

# STERNDRIVE MODELS GASOLINE ENGINE INSTALLATION MANUAL

## Models Covered

### Bravo

| Models Covered | Serial Number      |
|----------------|--------------------|
| 496 Mag        | 0W310000 and Above |
| 496 Mag DTS    |                    |
| 496 Mag HO     |                    |
| 496 Mag HO DTS |                    |

## Notice

| NOTICE                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------|
| After completing installation, these instructions should be placed with the product for the owner's future use. |
| NOTICE                                                                                                          |
| Predelivery preparation instructions must be performed before delivering boat to the product owner.             |

## Notice to Boat Manufacturer/Installer

Throughout this publication, Warnings and Cautions (accompanied by the International Hazard Symbol ) are used to alert the manufacturer or installer 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.

|  <b>WARNING</b>                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>WARNING</b> - indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.                                                                          |
|  <b>CAUTION</b>                                                                                                   |
| <b>CAUTION</b> - indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury or property damage. It may also be used to alert against unsafe practices. |

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**IMPORTANT:** Indicates information or instructions that are necessary for proper installation and/or operation.

**NOTE:** Refer to the appropriate Mercury MerCruiser Product Applications Manual for application recommendations.

This installation manual has been written and published by Mercury MerCruiser to aid the boat manufacturer (OEM) in the installation of the products described herein.

It is assumed that these personnel are familiar with marine product installation. Furthermore, it is assumed that they are familiar with, if not trained in, the recommended installation procedures of Mercury MerCruiser product.

We could not possibly know of or advise the marine trade of all conceivable installations and of the possible hazards and/or results of each installation. Therefore, the OEM is responsible for any installation that does not fulfil the requirements of this manual.

It is the responsibility of the boat manufacturer to select the appropriate engine/transom/drive package (including the correct gear ratio and propeller) for a given boat. Mercury MerCruiser recommends that any new or unique hull/power package combination be thoroughly water tested prior to sale, to verify that the boat performs as desired, and that the engine operates in the appropriate RPM range.

It is recommended that a Mercury MerCruiser Product Application Engineer (PAE) be contacted for assistance. For assistance outside the United States, contact the local Mercury Marine office or authorized distributor.

All information, illustrations and specifications contained in this manual are based on the latest product information available at time of publication. Mercury Marine reserves the right to make changes at any time without obligation. As required, revisions to this manual will be sent to all OEM boat companies.

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# Manual Outline

1 - Important Information

2 - Boat Construction

3 - Exhaust System

4 - Fuel System

5 - Cooling System

6 - Drive System and Engine Mounting

7 - Starting And Electrical

8 - Remote Controls

9 - Predelivery Preparation and Storage

Important Information

1

Boat Construction

2

Exhaust System

3

Fuel System

4

Cooling System

5

Drive System and Engine Mounting

6

Starting And Electrical

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Remote Controls

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Predelivery Preparation and  
Storage

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# SECTION 1 - IMPORTANT INFORMATION

1

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## Torque Specifications

**NOTE:** Securely tighten all fasteners not listed below.

**NOTE:** The propeller torque stated is a minimum torque value.

| Description                           | Nm                                                                 | lb. in. | lb. ft. |
|---------------------------------------|--------------------------------------------------------------------|---------|---------|
| Exhaust tube clamp                    | 4                                                                  | 35      |         |
| Exhaust pipe bolts                    | 34                                                                 |         | 25      |
| Exhaust block-off plate bolts         | 34                                                                 |         | 25      |
| Bravo One propeller nut               | 75                                                                 |         | 55      |
|                                       | Then align tabs with grooves                                       |         |         |
| Bravo Two propeller nut               | 81                                                                 |         | 60      |
|                                       | Then align tabs with grooves                                       |         |         |
| Bravo Three front propeller nut       | 136                                                                |         | 100     |
| Bravo Three rear propeller nut        | 81                                                                 |         | 60      |
| Rear engine mounting bolts            | 47                                                                 |         | 35      |
| Steering cable coupler nut            | 47                                                                 |         | 35      |
| Steering system pivot bolts           | 34                                                                 |         | 25      |
| Sterndrive unit fasteners             | 68                                                                 |         | 50      |
| Transom assembly fasteners            | 34                                                                 |         | 25      |
| Mounting clip screw                   | 12.2                                                               | 108     |         |
| Hose clamps                           | 3.4-6.8                                                            | 30-60   |         |
| Water inlet fitting bolts             | 5                                                                  | 45      |         |
| Water inlet block-off screw           | 5                                                                  | 45      |         |
| Fuel inlet fitting                    | Finger tight + 1-¾ to 2-¼ turns with a wrench. Do not overtighten. |         |         |
| Gen III Cool Fuel Module captured nut | 19                                                                 | 168     |         |
| Battery stud                          | 8-11                                                               | 71-91   |         |
| Propeller shaft anode screw           | 19                                                                 | 168     |         |

## Quicksilver Products

### Accessories

Quicksilver gauges, remote controls, steering systems, propellers, and other accessories are available for this product. Mercury MerCruiser recommends the use of Quicksilver parts on all applications. Refer to **Mercury Precision Parts Accessories Guide** for a complete listing.

This Guide is available from:

Attn: Parts Department

W6250 W. Pioneer Road

P.O. Box 1939

Fond du Lac, WI 54935-1939

Outside of U.S.A., order through Distribution Center or Distributor.

## Remote Controls And Instrumentation for DTS System

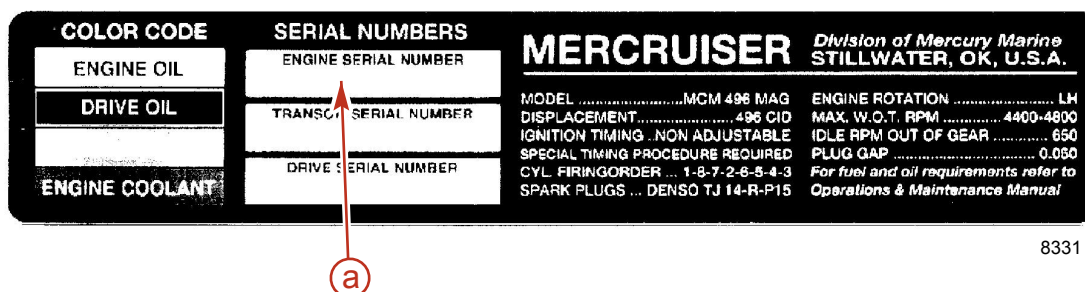
The Digital Throttle and Shift system (DTS) requires the use of specialized helm components, including a command module kit and electronic remote control. Refer to the **Mercury Precision Parts/Quicksilver Accessories Guide**.

## Serial Number Decal Placement

There are 3 sets of engine, transom assembly, and sterndrive serial number decal strips provided with each power package. One should be used for each of the following:

- Engine Specification Decal
- Warranty Registration Card
- Operation, Maintenance and Warranty Manual identification page

Affix engine serial number decal to specification / serial number decal.



**a** - Specification/serial number decal

## Bravo Three Notice: Trim-in Limit Insert (Non-DTS)

**NOTE:** *Bravo One, Two and Three Models are equipped with a trim-in limit insert.*

It has been brought to our attention that some boats (predominantly deep-Vee heavy boats) will roll up on their side under certain, specific, operating conditions. The roll can be either to port or starboard and may be experienced while moving straight ahead, or while making a turn. The roll occurs most frequently at or near maximum speed, with the sterndrive unit trimmed at or near full trim-in. While the boat will not roll completely over, the roll may be sufficient to unseat the operator or passengers, and thereby create an unsafe situation.

The roll is caused by stern-lift created from excessive sterndrive unit trim-in. Under these extreme stern-lift / bow-down conditions, instability can be created, which may cause the boat to roll. Weight distribution to the stern can reduce stern-lift and, in some circumstances, help to control the condition. Weight distribution in the bow, port or starboard, may worsen the condition.

The trim-in limit insert reduces stern-lift by preventing the sterndrive unit from reaching the last few degrees of full trim under. While this device should reduce the rolling tendency, it may not eliminate the tendency entirely. The need for this trim-in limit insert, and its effectiveness, can only be determined through boat testing and is ultimately the responsibility of the boat manufacturer.

### **⚠ WARNING**

It is recommended that only qualified personnel adjust the trim-in limit inserts. The boat must be water tested after adjusting the trim-in limit inserts to ensure that the modified trim-in range does not cause the boat to exhibit an undesirable boat handling characteristic if the sterndrive unit is trimmed in at higher speeds. Increased trim-in range may cause handling problems on some boats, which could result in personal injury.

## SmartCraft / DTS Models

The trim limit for DTS models is a function of the PCM. Refer to the DTS System Calibration Section for proper set-up procedures.

## Multiple Sterndrive Steering Tie Bar Arrangements

With multiple sterndrives you must select one of several possible steering systems.

**⚠ CAUTION**

Failure to observe the recommended Tie Bar Arrangements could result in serious damage to the steering and/or trim system components. This damage could adversely affect control of the boat. Observe the recommended Tie Bar Arrangements as presented in this section.

## Internal Power Steering With Internal Tie Bar Only

At the lower end of the performance spectrum, boats not capable of speeds in excess of 97 km/h. (60 MPH), the basic internal tie bar is recommended. It connects the slave sterndrive to the sterndrive that is directly connected to the factory power steering output. This internal tie bar is available in a variety of lengths from the sterndrive manufacturer.

## Internal Power Steering With Internal and External Tie Bar

As a boat moves into the moderate performance range of 97-113 km/h. (60-70 MPH) or for a reduction in steering backlash, an external tie bar should be added. External tie bars are usually designed to attach at the aft power trim cylinder bosses. This location is an excellent choice because of its proximity to the propeller. HOWEVER, because of the potential overstress that can occur if one sterndrive is trimmed much differently than the other, a dual trim control kit (Part Number 90362A3) should be installed to limit this potential tilt differential to about 20 degrees.

**IMPORTANT: Mercury Marine does not recommend the use of an external tie bar ONLY with no internal tie bar when using the internal power steering system. This can cause excessive loads on the steering components on the sterndrive connected to the internal power steering system. These increased loads can damage the steering components, resulting in increased play in the steering of the boat.**

## External Power Steering

When boat speeds move past 113 km/h (70 MPH) or if additional steering backlash reduction is desired, external power steering is recommended. This normally will include an external tie bar mounted at the same general location as the power steering cylinders, which are generally attached at the top of the sterndrive's drive shaft housing. With this steering system, no internal tie bar should be used. These steering cylinders can be attached either inboard (between) or outboard of the sterndrives.

## External Power Steering With Low External Tie Bar

For the fastest boats, over 129 km/h (80 MPH), or for the ultimate in steering backlash reduction, use external power steering, BUT (where mechanically possible) with the external tie bar mounted at the trim cylinder boss location (as previously described in "Internal Power Steering with Internal and External Tie Bar" statements). Again, this system does not use an internal tie bar.

## Corrosion Protection

Mercury MerCruiser power packages are equipped with anodes to help protect them from galvanic corrosion under moderate conditions. However, for severe conditions or if using a stainless steel propeller, it is recommended that a Quicksilver Anti-Corrosion Anode Kit and/or a MerCathode System with 2 additional transom mounted anode assemblies be installed (some models have a MerCathode System as standard equipment). A MerCathode Monitor also is available to allow the operator to check the operation of the MerCathode System with the push of a button. (Refer to **Mercury Precision Parts Accessories Guide** for part numbers.)

Boats that are connected to AC shore power require additional protection to prevent destructive low voltage galvanic currents from passing through the shore power ground wire. A Quicksilver Galvanic Isolator can be installed to block the passage of these currents while still providing a path to ground for dangerous fault (shock) currents. (Refer to **Mercury Precision Parts Accessories Guide** for part number.)

**IMPORTANT: If AC shore power is not isolated from boat ground, the MerCathode System and anodes may be unable to handle the increased galvanic corrosion potential.**

## Anti-fouling Paint

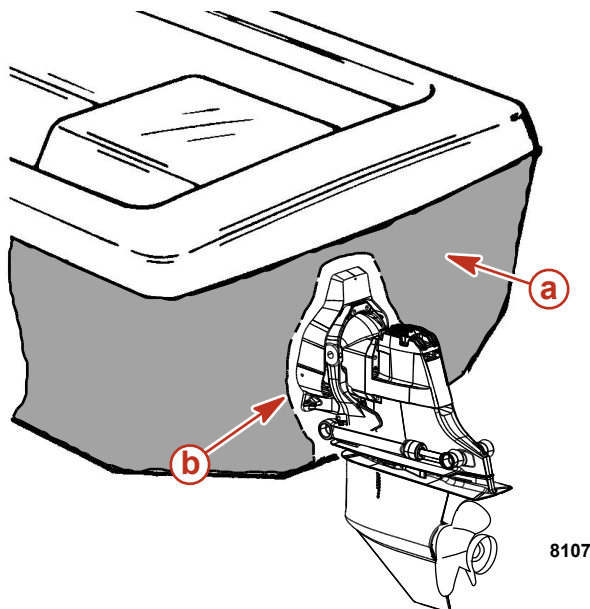
**IMPORTANT:** Corrosion damage that results from the improper application of anti-fouling paint will not be covered by the limited warranty.

**Painting Boat Hull or Boat Transom:** Anti-fouling paint may be applied to boat hull and boat transom but you must observe the following precautions:

**IMPORTANT:** Do not paint anodes or pressure wash anodes or MerCathode System reference electrode and anode, as this will render them ineffective as galvanic corrosion inhibitors.

**IMPORTANT:** If anti-fouling protection is required for boat hull or boat transom, copper base paint, if not prohibited by law, can be used. If using copper based anti-fouling paint, observe the following:

- Avoid an electrical interconnection between the Mercury MerCruiser Product, Anodic Blocks, or MerCathode System and the paint by allowing a minimum of 40 mm (1-1/2 in.) UNPAINTED area on transom of the boat around these items.



**a -** Painted boat transom

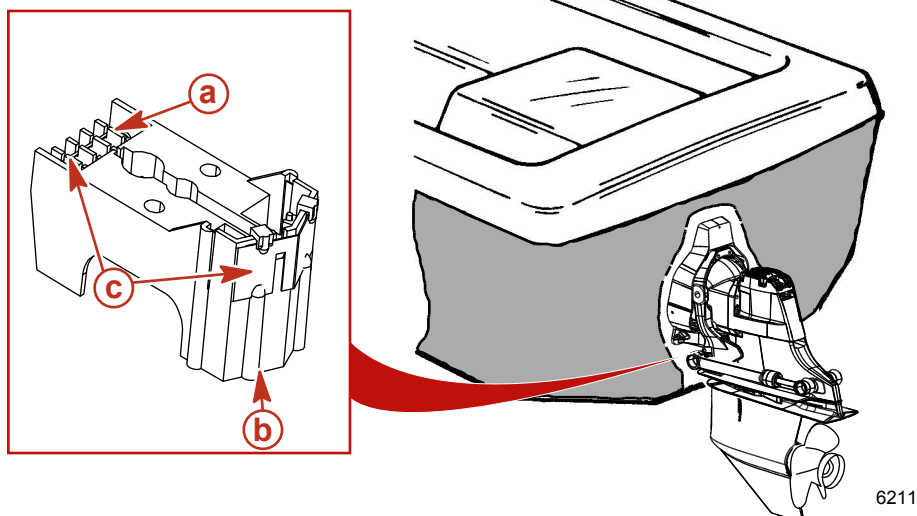
**b -** Minimum 40 mm (1-1/2 in.) unpainted area around transom assembly

**NOTE:** Sterndrive unit and transom assembly can be painted with a good quality marine paint or an anti-fouling paint that **DOES NOT** contain copper or any other material that could conduct electrical current. Do not paint drain holes, anodes, MerCathode system or items specified by boat manufacturer.

### ⚠ CAUTION

Improper boat cleaning procedures can cause product damage. Washing the MerCathode assembly, especially with a brush or high pressure washer, will damage the MerCathode assembly making it unable to inhibit galvanic corrosion. When cleaning the boat, do not use a brush or a high pressure washer to wash the MerCathode assembly found on the bottom of the transom assembly.

Do not wash the sterndrive unit with a power washer as this can damage the coating on the reference wire of the MerCathode assembly, if equipped, and increase corrosion.



**a** - MerCathode reference electrode

**b** - Do not paint

**c** - Do not pressure wash

## Emission Control Information Label

A tamper-resistant Emission Control Information label is affixed in a visible location to the engine at time of manufacture by Mercury MerCruiser. In addition to the required emissions statement, the label lists the engine serial number, family, FEL (emission level), date of manufacture (month, year), and the engine displacement. Please note that the low emissions certification will not affect the fit, function, or performance of the engines. Boatbuilders and dealers may not remove the label or the part it is affixed to before sale. If modifications are necessary, contact Mercury MerCruiser about the availability of replacement decals before proceeding.

|                                                                                                                                                                                |              |                                         |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------|-----------|
| <b>MERCURY</b><br><i>MerCruiser</i>                                                                                                                                            |              | <b>EMISSION CONTROL<br/>INFORMATION</b> |           |
| THIS ENGINE CONFORMS TO 2003 CALIFORNIA EMISSION<br>REGULATIONS FOR SPARK IGNITION MARINE ENGINES<br>REFER TO OWNER'S MANUAL FOR MAINTENANCE<br>SPECIFICATIONS AND ADJUSTMENTS |              |                                         |           |
| SERIAL#                                                                                                                                                                        | OMXXXXXXXX   | D.O.M                                   | JAN. 2003 |
| FAMILY                                                                                                                                                                         | XXXXX XXXXXX | DISP                                    | X.XL      |
| FEL.                                                                                                                                                                           | XX.X g/kW-hr |                                         |           |

11018

### Emission Control Label - Non CE Marked

"SERIAL#" - Engine Serial Number

"FAMILY" - Engine Family

"FEL." - Family Emission Limit

"D.O.M." - Date of Manufacture

"DISP" - Piston Displacement

|                                                                                                   |              |                                         |          |
|---------------------------------------------------------------------------------------------------|--------------|-----------------------------------------|----------|
| <b>MERCURY</b><br>MerCruiser                                                                      |              | <b>EMISSION CONTROL<br/>INFORMATION</b> |          |
| THIS ENGINE CONFORMS TO 2003 CALIFORNIA EMISSION<br>REGULATIONS FOR SPARK IGNITION MARINE ENGINES |              |                                         |          |
| REFER TO OWNER'S MANUAL FOR MAINTENANCE<br>SPECIFICATIONS AND ADJUSTMENTS                         |              |                                         |          |
| SERIAL#                                                                                           | OMXXXXXX     | D.O.M.                                  | Dec 2004 |
| FAMILY                                                                                            | XXXXX XXXXXX |                                         |          |
| FEL.                                                                                              | XX.X g/kW-hr | DISP.                                   | X.XL     |
|                                                                                                   |              |                                         | CE 0575  |

10652

### Emission Control Label - CE Marked

"SERIAL#" - Engine Serial Number

"FAMILY" - Engine Family

"FEL." - Family Emission Limit

"D.O.M." - Date of Manufacture

"DISP" - Piston Displacement

CE - When this mark is present in the lower right corner of the Emission Control Information Label, on the engine, the Declaration of Conformance applies. Refer to the front page of this Manual for further information.

## Owner Responsibility

The owner/operator is required to have routine engine maintenance performed to maintain emission levels within prescribed certification standards.

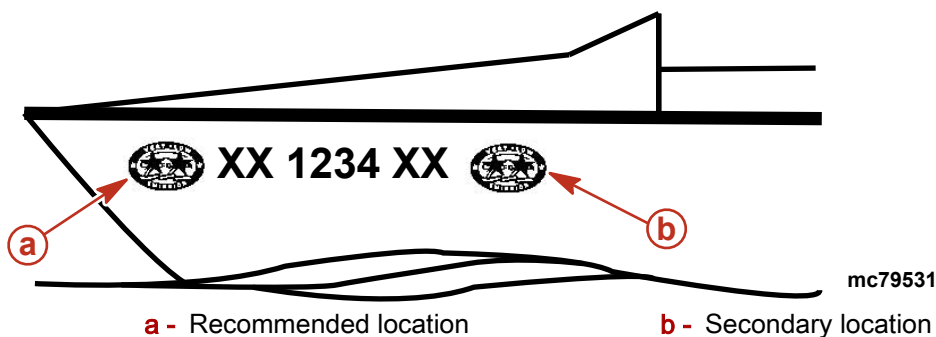
The owner/operator is not to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

## Star Label

Beginning January 1, 2003, one Three-Star label will be included with each factory-certified Mercury MerCruiser engine.

All Mercury MerCruiser engines (500 hp and below) will have a Three-Star Ultra Low Emission rating. The Three-Star label identifies that these engines meet the California Air Resources Board's Sterndrive and Inboard marine engine 2003 exhaust emission standards. Engines meeting these standards have 65% lower emissions than One-Star - Low Emissions engines.

The Three-Star label will be affixed on the left side of the hull as shown.





|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>One Star - Low emission</b>                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|   | <p>The one-star label identifies personal watercraft, outboard, sterndrive and inboard engines that meet the Air Resources Board's Personal Watercraft and Outboard marine engine 2001 exhaust emission standards. Engines meeting these standards have 75% lower emissions than conventional carbureted two-stroke engines. These engines are equivalent to the U.S. EPA's 2006 standards for marine engines.</p> |
| <b>Two Stars - Very Low emission</b>                                               |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|   | <p>The two-star label identifies personal watercraft, outboard, sterndrive and inboard engines that meet the Air Resources Board's Personal Watercraft and Outboard marine engine 2004 exhaust emission standards. Engines meeting these standards have 20% lower emissions than One Star - Low-Emission engines.</p>                                                                                              |
| <b>Three Stars - Ultra Low emission</b>                                            |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|   | <p>The three-star label identifies engines that meet the Air Resources Board's Personal Watercraft and Outboard marine engine 2008 exhaust emission standards or the Sterndrive and Inboard marine engine 2003 exhaust emission standards. Engines meeting these standards have 65% lower emissions than One Star - Low Emission engines.</p>                                                                      |
| <b>Four Stars - Super Ultra Low emission</b>                                       |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|  | <p>The Four Star label identifies engines that meet the Air Resources Board's Sterndrive and Inboard marine engine 2009 exhaust emission standards. Personal Watercraft and Outboard marine engines may also comply with these standards. Engines meeting these standards have 90% lower emissions than One Star - Low Emission engines.</p>                                                                       |

## Hang Tag

The Dealer must mark the appropriate box on one hang tag to match the Star label affixed to the boat. The dealer is responsible for displaying the hang tag in a visible location on the boat on display in California. Failure to properly display the hang tag could result in a citation and possible fine to the dealer from the California Air Resources Board.

If in California, the dealer must place the hang tag in a visible location in the boat prior to displaying the boat.

# SECTION 2 - BOAT CONSTRUCTION

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**2**

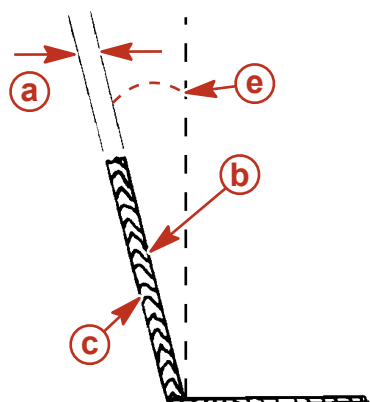


# Boat Construction

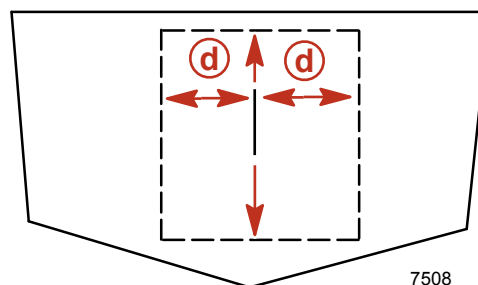
## Transom Thickness and Surface Plane

**IMPORTANT:** Transom thickness and surface plane (flatness) must be controlled where the sterndrive unit mounts.

| Transom Specifications |                                                                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thickness              | Between 51 - 57 mm (2 - 2-1/4 in.) for 203 mm (8 in.) to either side of the vertical center line                                                                                                             |
| Parallelism            | Inner and outer surfaces must be parallel within 3 mm (1/8 in.)                                                                                                                                              |
| Flatness               | Transom surfaces in area where transom assembly will be mounted (includes vertical as well as horizontal dimensions) :Inner Surface - Flat within 3 mm (1/8 in.) Outer Surface - Flat within 2 mm (1/16 in.) |
| Angle                  | 10 -16 degrees                                                                                                                                                                                               |



- a** - Transom thickness  
**b** - Inner surface  
**c** - Outer surface



7508

- d** - Transom plate coverage - 203 mm (8 in.) from center  
**e** - Transom angle

## Transom Cutout

Refer to **Section 6 - Drive System And Engine Mounting.**

## Checking Transom Thickness

Refer to **Section 6 - Drive System And Engine Mounting.**

## Engine Bed

| Description                                        | Measurement          |
|----------------------------------------------------|----------------------|
| Difference between starboard and port engine mount | 57.2 cm (22-1/2 in.) |
| Mount adjustment up and down (minimum)             | 6 mm (1/4 in.)       |

**NOTE:** Although the engine mounts allow some adjustment, it is a good practice to ensure that the front and rear mount locations in the vessel are parallel and in the same plane. This may be checked by tying a string from the left front mount location to the right rear mount location and another from right front to left rear. The strings should touch where they cross.

## 496 Mag And 496 Mag HO Boat Type Recommendation

The 496 Mag and 496 Mag HO models are recommended for use in most sport boat applications with the exception of the following:

- Bravo applications that require that the sterndrive unit be mounted more than 76 mm (3 in.) above the standard X-dimension (i.e., catamarans, certain stepped bottom boats). For those applications, we recommend our Performance Product models with a Super Speedmaster sterndrive unit which are designed specifically for surfaced propeller operation.

- Applications that require other than standard Quicksilver propellers to get the boat up on plane or to keep the propeller from ventilating when up on plane.
- Boats that require that the engine be run above 3200 RPM to keep them on plane.
- Racing applications or other highly abusive applications where the boat and the sterndrive units will come out of the water frequently. These, again, are applications where we recommend our Performance Product models with Super Speedmaster sterndrive units.

## SECTION 3 - EXHAUST SYSTEM

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# Exhaust System

## Exhaust System Caution

### CAUTION

It is the responsibility of the boat manufacturer or installing dealer to properly locate the engine and install the exhaust system. Improper installation may allow water to enter the exhaust manifolds and combustion chambers and severely damage the engine. Damage caused by water in the engine will not be covered by Mercury MerCruiser Warranty, unless this damage is the result of defective parts.

## Exhaust Emissions

**IMPORTANT:** Mercury MerCruiser declares that our sterndrive or inboard engines without integral exhaust, when installed in a recreational craft, in accordance with the manufacturers supplied instructions, will meet the exhaust emissions requirements of the directive mentioned in the appropriate Mercury MerCruiser Operation, Maintenance & Warranty Manual. The engine must not be put into service until the recreational craft in which it is to be installed has been declared in conformity, if so required, with the relevant provision of the Directive.

## Preferred Exhaust System

Most Mercury MerCruiser sterndrive engines were developed and tested for Y-pipe or through the propeller exhaust systems. The only exception to this is the 496 Mag engine. By using the Y-pipe system, you limit the potential for water intrusion due to the exhaust system design.

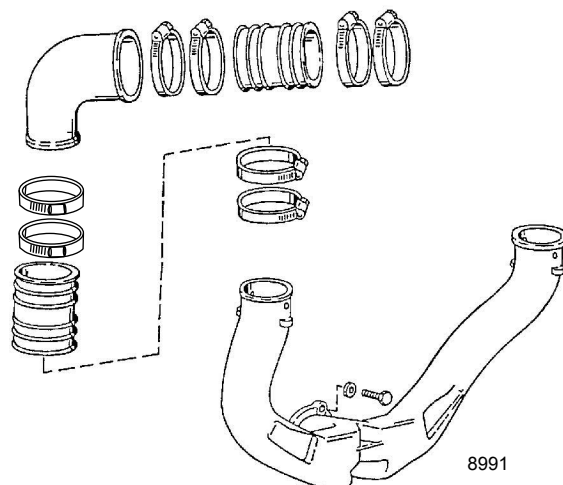
## Magnum Bravo Model Exhaust Recommendation

**IMPORTANT:** To get maximum performance from Magnum Bravo Models, through the transom exhaust is required. It is recommended that the exhaust bellows on the transom assembly be removed. This is necessary to avoid creating a vacuum at the exhaust outlet in the propeller at higher boat speeds. This vacuum could degrade propeller performance on some boats.

**NOTE:** If noise regulations do not allow the use of through the transom exhaust, an Exhaust Pipe Kit (807130A20) and intermediate elbow kit (44267A1) must be installed for through the prop exhaust. This kit also contains an exhaust tube that is used in place of the exhaust bellows.

**NOTE:** No internal shutters are provided with this kit.

**IMPORTANT:** To comply with the EU (European Union) Noise Emission Standard under Mercury's EU Noise Certification, the 496 Mag and 496 Mag HO sterndrive engines must install and use the exhaust pipe kit (807130A20) and the intermediate elbow kit (44267A1). Installation and use of any other exhaust components will require individual certification of installation with governing authority.



Exhaust pipe kit and intermediate exhaust elbow kit

## Through The Transom And Through The Hull Exhaust System Design

These engines are equipped with a wet exhaust system in which exhaust is mixed with water in the exhaust elbows. This cools the exhaust and allows the use of heat resistant rubber hose on the outlet side of the system. These specifications must be observed by the OEM and muffler manufacturer when designing and installing the exhaust system:

- Through the prop exhaust utilizing the y-pipe is the desired system on all models except the 496 Mag.
- Heat resistant exhaust hose that complies with specifications SAE J2006 or UL 1129 should be used (ABYC standard).
- Exhaust hoses should be no smaller than the minimum sizes. Larger hoses should be used on applications with long hose runs.

| Minimum Exhaust Hose Size |                    |                      |                     |
|---------------------------|--------------------|----------------------|---------------------|
| Model                     | Dual Outlet System | Single Outlet System |                     |
|                           |                    | Dual Hose Portion    | Single Hose Portion |
| 496 Mag Bravo             | 102 mm (4 in.)     | 102 cm (4 in.)       | 127 mm (5 in.)      |

- Sharp bends in exhaust hoses should be avoided.
- Exhaust hoses can be installed at up to a 5° angle relative to the exhaust elbow outlets. Refer to Exhaust Hose Connections.
- Exhaust elbows must be the prescribed distance above the water line. Install risers if needed. See Measuring Exhaust Elbow Height.
- The exhaust hose attached to exhaust elbow must have a minimum of 10 degrees downward slope. On longer hose applications, slope can be reduced to 3 degrees in the portion of exhaust system that is more than 46 cm (18 in.) away from elbow.

**NOTE:** Mercury MerCruiser's recommendations is more stringent than ABYC recommendation of a minimum drop in the exhaust system of 1/2 in. per foot with an overall drop of not less than 10.2 cm (4 in.) between the exhaust elbow outlets and the boat outlets.

| Slope Conversion |                  |              |                     |
|------------------|------------------|--------------|---------------------|
| Degrees          | Drop vs. Run     |              | Distance from Elbow |
| 3                | 5/8 in. / ft     | 52 mm / m    | < 18 in.            |
| 6                | 1-1/4 in. / ft   | 105 mm / m   | < 18 in.            |
| 7                | 1-7/16 in. / ft  | 122 mm / m   | < 18 in.            |
| 10               | 2-1/8 in. / ft   | 176 mm / m   | < 18 in.            |
| 12               | 2-1/2 in. / ft   | 212.5 mm / m | < 18 in.            |
| 14               | 2-15/16 in. / ft | 249 mm / m   | < 18 in.            |
| 19               | 4-1/8 in. / ft   | 344 mm / m   | < 18 in.            |

- The drop in the exhaust hose must be continuously sloping downward so that a low spot does not exist at any point.
- Through the hull exhaust fittings (flanges, outlets) must be equipped with internal shutters and external flappers to prevent the reverse flow of water into the engine. Refer to Exhaust Through The Hull Fittings.
- Exhaust outlets must be above the water line with boat at rest in the water and a full load aboard, as well as while underway. This is necessary to minimize engine back pressure.
- Every exhaust hose connection should be secured with at least 2 hose clamps. The clamps should be stainless steel and at least 13 mm (1/2 in.) wide. Clamps which rely solely on spring tension should not be used. (ABYC Standard).
- The exhaust system must be adequately supported for proper orientation and to prevent overstressing the exhaust manifolds and elbows. The support requirements will vary with exhaust system design and the amount of G-forces to be encountered.
- The through transom exhaust system must meet the exhaust back pressure specification.
- Straight through transom exhaust or silent choice exhaust must have an exhaust hose of at least 31 cm (12 in.), have an adequately muffled tip, and meet all aforementioned specifications.
- The system must have the capability to be serviced, reassembled, and replaced while maintaining all of the specifications. The boat builder must provide documentation, such as manuals, drawings, or orientation marks on production assemblies.
- If a waterlift/collector system is used, the waterline is defined as the waterline inside the collector. All measurements must be taken from that waterline to measure exhaust elbow weight.
- in-line mufflers, collectors, and hoses must self drain after engine shut-down. See muffler/collector section.

## Measuring Exhaust Elbow Height

The height of the exhaust elbows and the slope of the exhaust hoses must be within the dimensions specified to prevent water intrusion problems. Exhaust elbow risers must be installed, if needed, to obtain the proper height and/or slope. Measurement must be taken with the boat in the water. It is important that the boat be loaded as outlined following to simulate the maximum loading conditions likely to be encountered in normal operation.

**IMPORTANT:** Load distribution recommendations are the responsibility of the boat manufacturer. Any load distribution conditions that will affect the exhaust system height and slope compliance must be clearly communicated to the operator in the owner's manual. For example, the number of people that can be located on the swim platform simultaneously should be included in the manual, if this could pose a problem.

1. Fill fuel, water, waste water and heater tanks to maximum capacity. People or weights can be used to simulate these loads if desired. Refer to conversions:
  - 1 U.S. gallon of water = 8.3 lb
  - 1 liter of water = 1 kg

- 1 U.S. gallon of gasoline = 6 lb
  - 1 liter of gasoline = 0.72 kg
2. Add maximum allowable cargo weight to boat in areas where it will be stowed, including refrigerator and lockers. Do not forget the PWC, if applicable.
  3. Add average passenger weight in all locations where each passenger will sit during normal operation.
  4. Allow for a minimum of 2 people on the swim platform for docked conditions. Seat people starting at the rear of the boat.

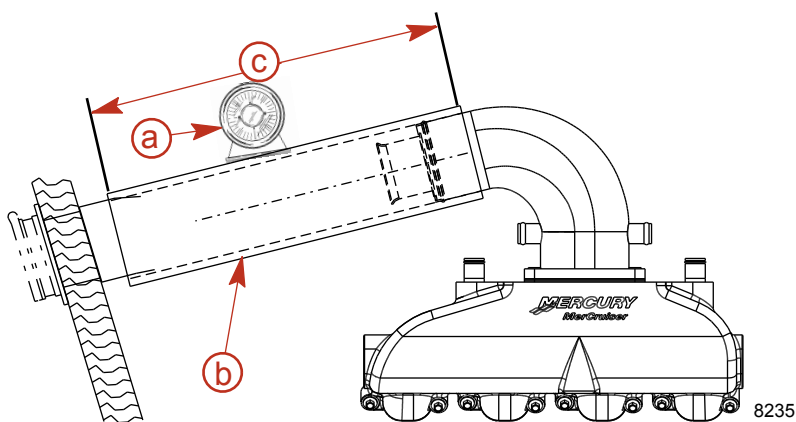
**NOTE:** ABYC specifies an average passenger weight of 64 kg (141 lb) for boat loading calculations. This should be used as a minimum. An average passenger weight of 86 kg (190 lb) is desirable.

5. Measure exhaust elbow height as outlined under Methods For Measuring Exhaust Elbow Height.
6. Measure exhaust system slope as specified following.
7. Leave fluid and cargo weights where they are, but remove passenger weights from boat. Beginning at the bow, reload passenger weight (the equivalent of one person at a time) while retaking readings. Use all of the available seating areas in the bow first. Continue adding passenger weight (and taking readings), moving from the bow to the stern until the maximum people weight has been added back on board.
8. Repeat Step 7, but this time start at stern of boat and work toward bow.
9. Measurements under all loading conditions should be within these specifications:

**NOTE:** Exhaust elbow height is measured to the waterline in the water lift muffler (instead of the water line) on applications so equipped. Refer to the appropriate Mercury MerCruiser Product Applications Manual for more information.

| Minimum Exhaust Elbow Height |                 |
|------------------------------|-----------------|
| Model                        | Specification   |
| 496 Mag Bravo                | 381 mm (15 in.) |

**NOTE:** Through transom exhaust applications must have an exhaust hose length of 305 mm (12 in.).



**Using a universal protractor (inclinometer) to measure slope**

- a** - Protractor/Inclinometer  
**b** - Exhaust hose or tube

**c** - Minimum 305 mm (12 in.).

| Minimum Exhaust Hose Slope |                                   |                                     |
|----------------------------|-----------------------------------|-------------------------------------|
| Model                      | Specification                     |                                     |
|                            | Within 457 mm. (18 in.) of engine | Remainder of system (if applicable) |
| All models                 | 10 degrees                        | 3 degrees                           |

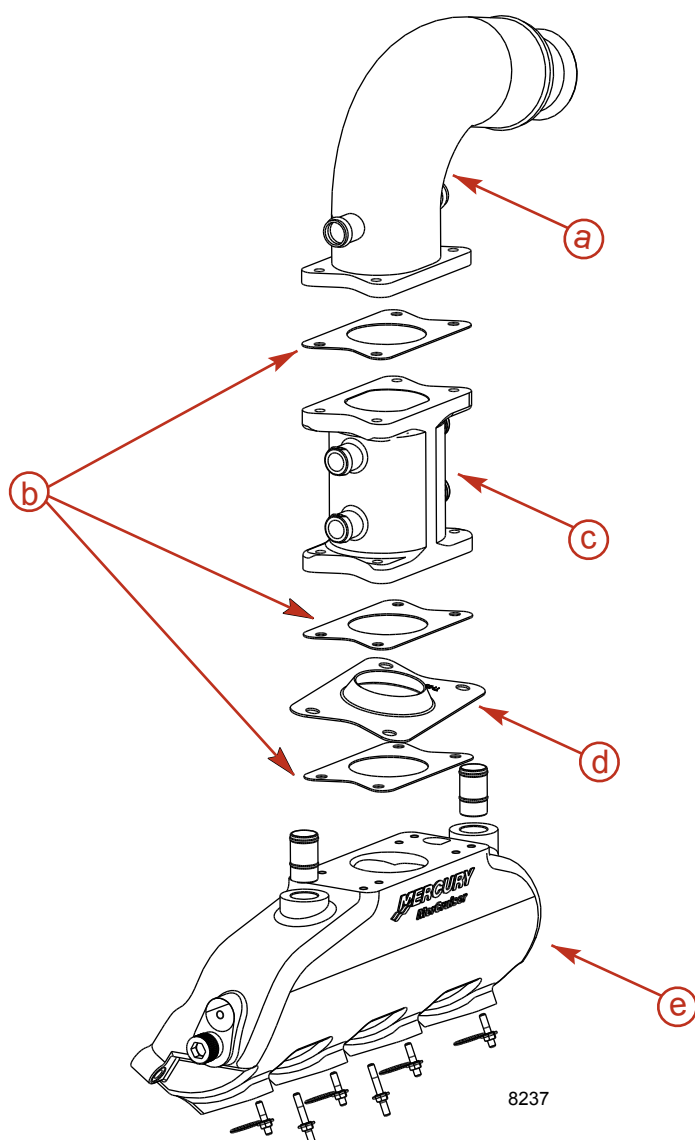
10. Install risers if height is insufficient. Modify exhaust system and/or install risers, if slope is insufficient. Refer to the **Mercury Precision Parts / Quicksilver Accessory Guide** for part numbers.

| Model         | Riser Options |                |                |
|---------------|---------------|----------------|----------------|
| 496 mag Bravo | 51 mm (2 in.) | 152 mm (6 in.) | 203 mm (8 in.) |

**NOTE:** High rise option, 203 mm (8 in.), is obtained by using the 51 mm (2 in.) and 152 mm (6 in.) riser kits together. This is the maximum height that Mercury MerCruiser recommends.



11. If measurements are less than specified, exhaust elbow risers must be installed to achieve proper dimension.



Typical riser installation

- |                   |                      |
|-------------------|----------------------|
| a - Exhaust elbow | d - Turbulator       |
| b - Gasket        | e - Exhaust manifold |
| c - Riser         |                      |

**NOTE:** Up to a maximum of 203 mm (8 in.) of riser height can be added.

12. **Applications With Through The Propeller Exhaust:** Recheck exhaust elbow height.

13. **Applications With Through The Hull Or Through The Transom Exhaust:**

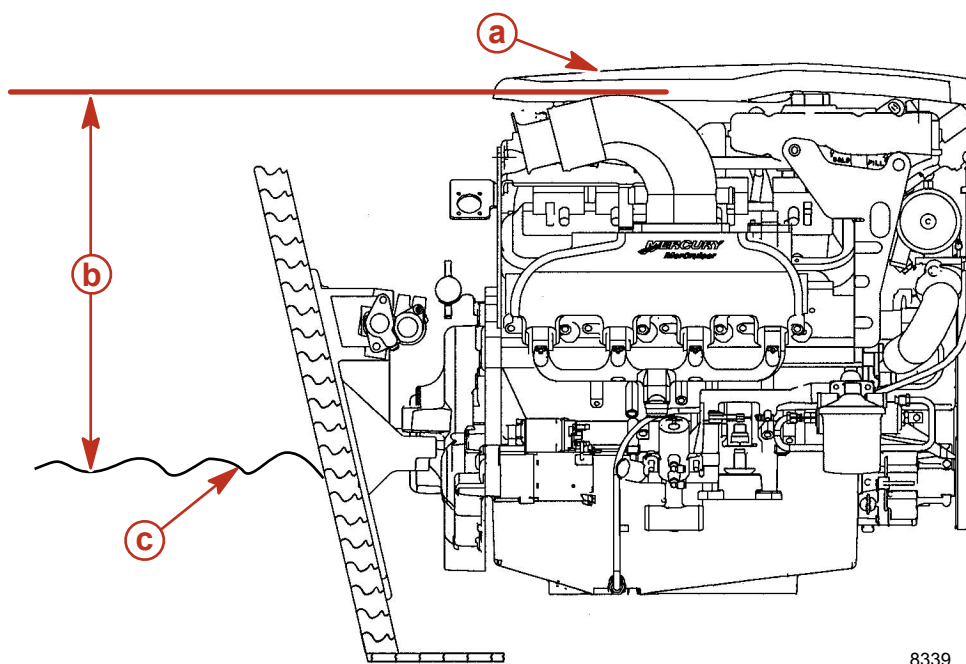
- Move load weight to bow to simulate greatest bow-down attitude the boat will encounter in normal operation.
- Recheck exhaust system slope.

14. Move load weight and cargo weight to stern of boat to stimulate greatest stern-down attitude the boat will encounter such as when loading.

**IMPORTANT:** Be sure to consider swim platform loading and personal watercraft.

15. Recheck exhaust system measurements.

| Minimum Exhaust Elbow Height From Top of Elbow to Waterline |                 |
|-------------------------------------------------------------|-----------------|
| Model                                                       | Measurement     |
| 496 Mag / 496 Mag HO                                        | 381 mm (15 in.) |



8339

**a** - Highest point on exhaust elbow**c** - Waterline**b** - Measurement

**NOTE:** Additional requirements for through the hull or transom exhaust system applications:

| Continuous Downward Slope From Horizontal |                           |            |                                       |            |                                        |
|-------------------------------------------|---------------------------|------------|---------------------------------------|------------|----------------------------------------|
| Model                                     | Engine Installation Angle | Minimum    |                                       | Maximum    |                                        |
| Sterndrive                                | 0 degrees                 | 10 degrees | 48 mm (1-7/8 in.) per 305 mm (12 in.) | 19 degrees | 105 mm (4-1/8 in.) per 305 mm (12 in.) |

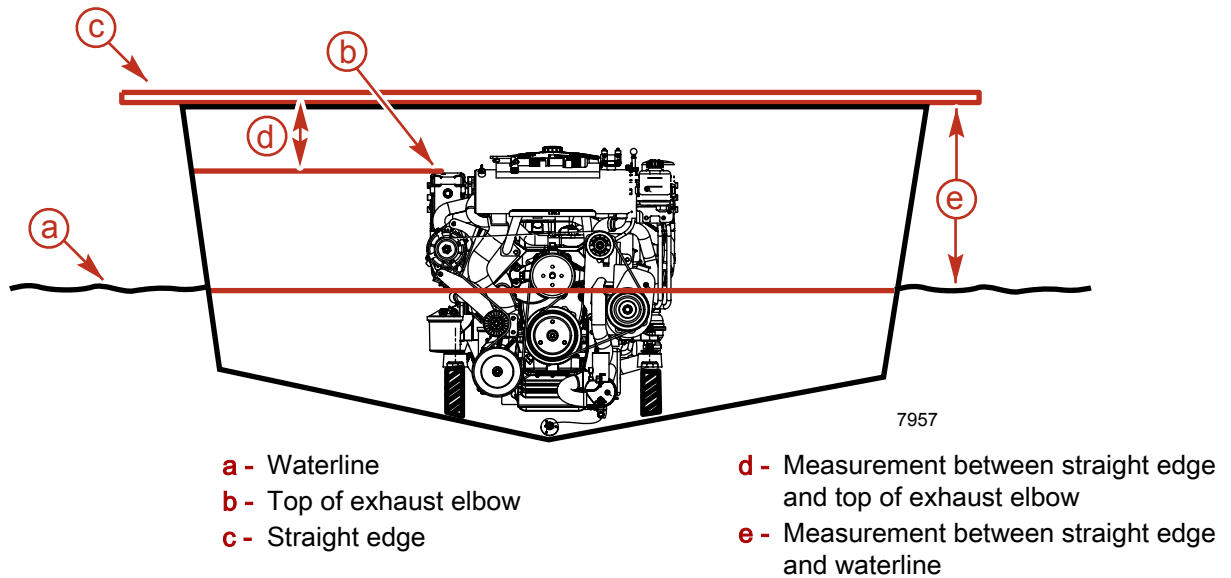
## Methods For Measuring Exhaust Elbow Height

**IMPORTANT:** Refer to Measuring Exhaust Elbow Height for instructions on proper loading of boat and complete measurement instructions.

### STRAIGHT EDGE METHOD

1. Place a straight edge across boat.
2. With the straight edge above the engine as shown, measure the distance between the straight edge and the top of the exhaust elbow.
3. Ensure that the boat is level from side-to-side, using a level or inclinometer. Then, measure the distance between the straight edge and the outside waterline.

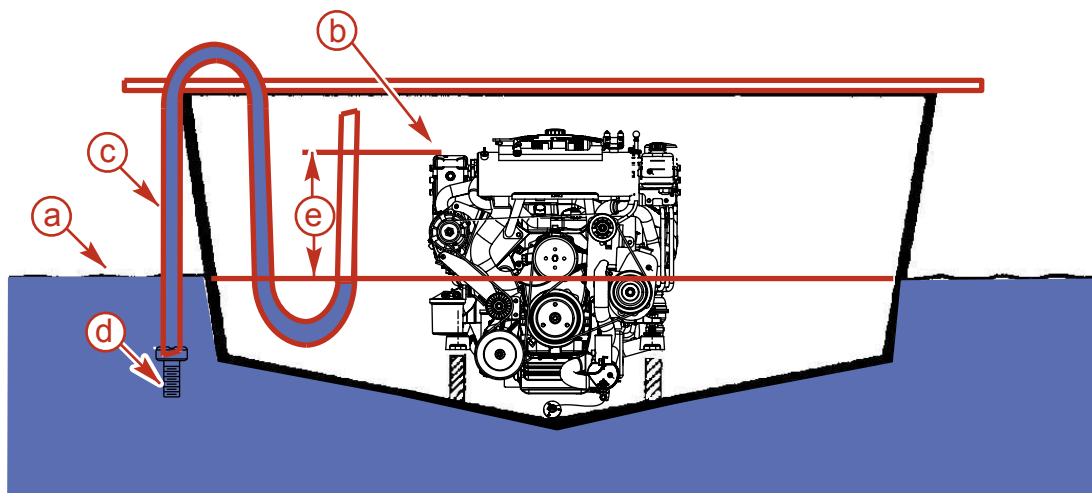
4. The difference between these two measurements is the exhaust elbow height above the waterline. Refer to Measuring Procedures and compare measurement to specifications.



### Clear Hose Method for Measuring Exhaust Elbow Height

1. Obtain a 8-10 mm (5/16 - 3/8 in.) diameter hose approximately 4.5 m (15 ft) long. Put a metal fitting or a weight on one end of the hose to keep that end of the hose below the waterline.
2. Put the weighted end of the hose over the port or starboard side of the boat, keeping it in line with the engine's exhaust elbow.
3. Route the remainder of the hose toward the engine's exhaust manifold and elbow. Ensure that this open end section of the hose is as vertical as possible from the boat's bilge to the top of the exhaust elbow.
4. Coil excess hose in bilge of boat, keeping it below the water line.
5. Lower open end of hose and siphon water until it starts to come out of the hose. Put a finger over the hose and lift open end until it is at the top of the exhaust elbow.
6. Slowly take finger off end of hose to let the water level stabilize. The water will seek the level of the water outside the boat. Keep hose close to exhaust elbow and as vertical as possible.
7. Make sure that the boat is level (side-to-side) using a level or inclinometer.

8. The measurement between water in hose and top of exhaust elbow is the exhaust elbow height.



a - Waterline  
b - Top of exhaust elbow  
c - Clear plastic hose

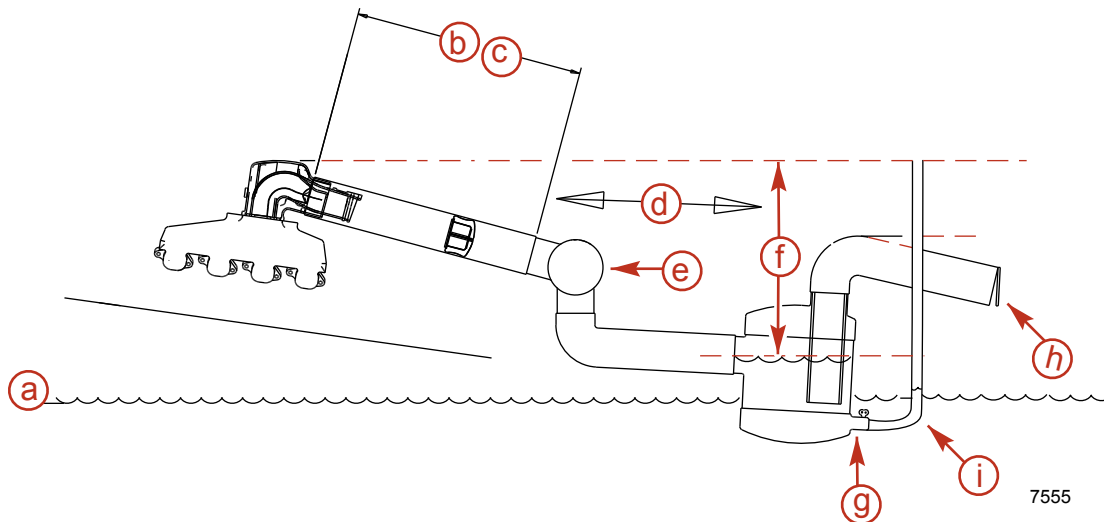
d - Weight  
e - Measurement - waterline to top of exhaust elbow

## COLLECTOR AND WATER LIFT MUFFLER EQUIPPED

**IMPORTANT:** Engine must have been operated previously to fill muffler with water.

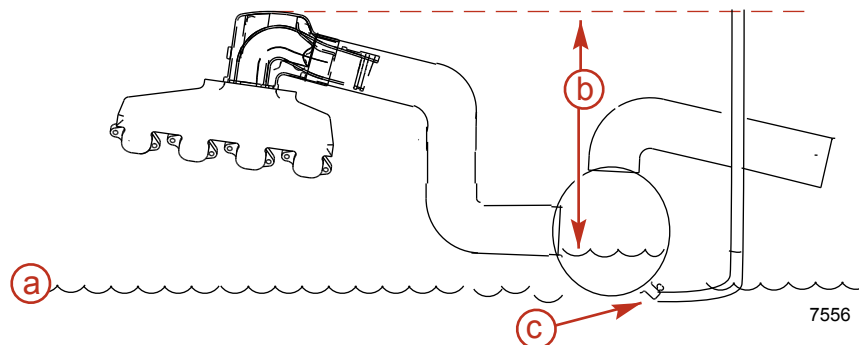
1. Attach a clear hose to the muffler drain plug or drain valve.
2. If the clear hose is attached to a drain valve, open the drain valve.
3. Start the engine to fill the muffler and clear hose.
4. Route the remainder of the clear hose toward the engine's exhaust manifold and elbow. Ensure that this open end section of the clear hose is as vertical as possible from the boat's bilge to the top of the exhaust elbow.
5. Coil excess clear hose in bilge of boat, keeping it below the waterline.
6. Lower open end of clear hose and siphon water until it starts to come out of the clear hose. Put a finger over the clear hose and lift the open end until it is level with the top of the exhaust elbow.
7. Slowly take finger off the end of the clear hose to let the water level stabilize. The water will seek the level of the water inside the water lift muffler. Keep the clear hose close to exhaust elbow and as vertical as possible.
8. Make sure that the boat is level (side-to-side) using a level or inclinometer.

9. The measurement between the water in the clear hose and the top of the exhaust elbow is the exhaust elbow height above the water line.



Typical

- |                                                                         |                                                           |
|-------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>a</b> - Water line                                                   | <b>f</b> - Minimum exhaust elbow height with maximum load |
| <b>b</b> - 457 mm. (18 in.) minimum between exhaust elbow and collector | <b>g</b> - Drain plug or drain valve                      |
| <b>c</b> - 10 degree downward slope minimum                             | <b>h</b> - External flappers                              |
| <b>d</b> - 3 degree downward slope minimum                              | <b>i</b> - Clear hose                                     |
| <b>e</b> - Collector                                                    |                                                           |



Typical S-pipe Used With Water Lift Muffler

- |                                                           |                                      |
|-----------------------------------------------------------|--------------------------------------|
| <b>a</b> - Water line                                     | <b>c</b> - Drain plug or drain valve |
| <b>b</b> - Minimum exhaust elbow height with maximum load |                                      |

## Exhaust Resonator Guidelines

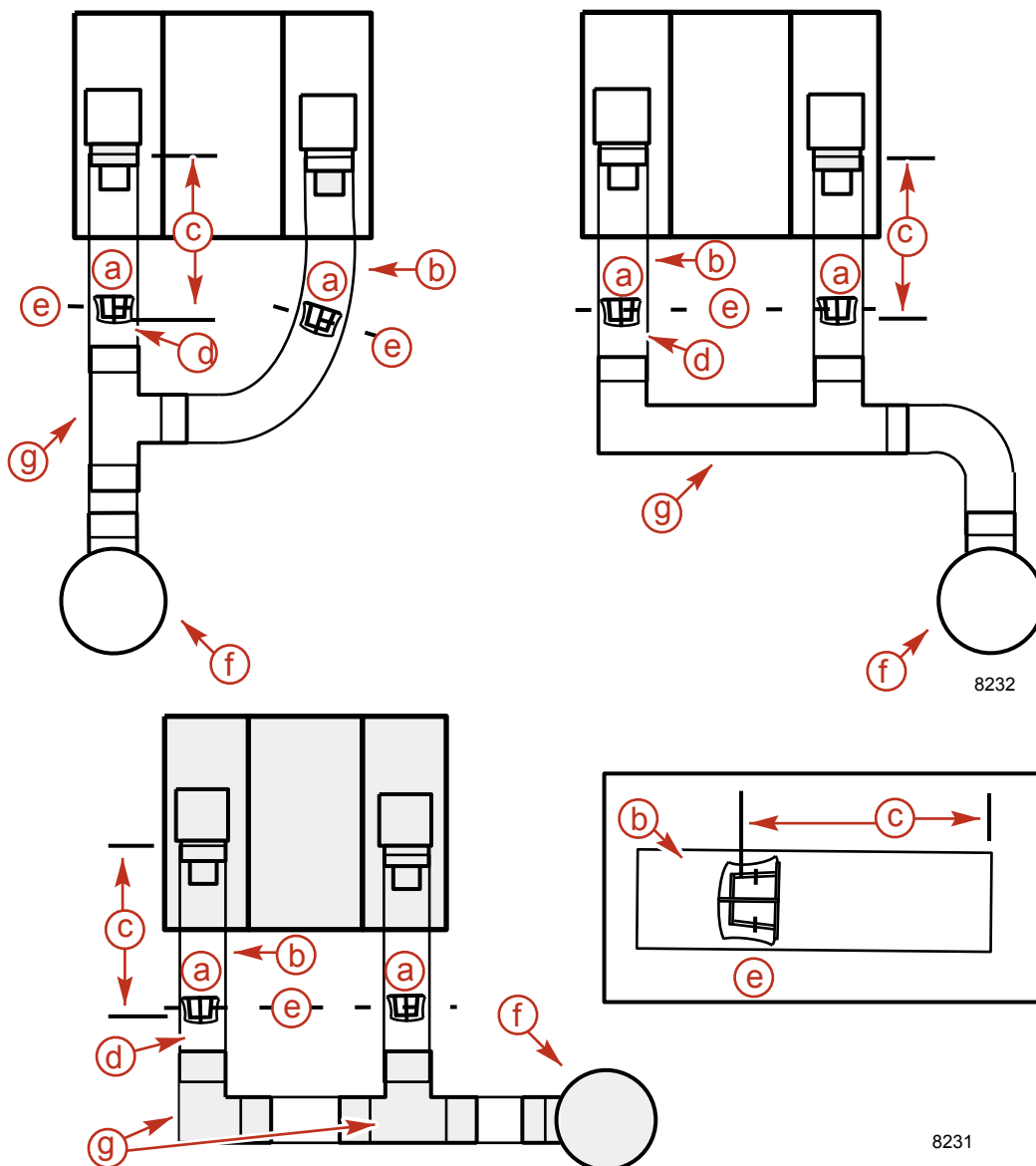
### ⚠ CAUTION

Avoid severe engine damage. Water ingestion may occur in some instances without the use of specially designed exhaust resonators. Install exhaust resonators in the exhaust system when specified.

**IMPORTANT:** MerCruiser strongly recommends exhaust resonators on all models with through the transom exhaust.

On sterndrive engines using through the transom or through the hull exhaust systems, special care must be exercised in system design and construction to prevent an adverse tuning effect on engine exhaust output.

- The exhaust resonator is positioned with the inside flat surface at the preferred distance of 432 mm (17 in.) from the front edge of the exhaust hose but no closer than 51 mm (2 in.) to the exhaust outlet on sterndrives. The 432 mm (17 in.) dimension can be reduced, if necessary, to a MINIMUM of 330 mm (13 in.). This dimension must be the same on both exhaust outlets.



- a** - Exhaust resonator
- b** - Exhaust hose
- c** - Dimension to inside flat surface of resonator approximately 432 mm (17 in.)
- d** - No less than 51 mm (2 in.) between collector and resonator

- e** - Clamp - positioned around center of resonator
- f** - Exhaust muffler
- g** - Collector

Exhaust system tuning can be affected by various factors that are beyond the control of Mercury MerCruiser. Following are several factors that can affect exhaust system tuning:

- Type and configuration of exhaust outlet.

- Length of exhaust hose.
- Amount of back-pressure in exhaust system. Refer to the appropriate **Mercury MerCruiser Product Applications Manual**.

Exhaust Resonator Kit use on Sterndrive Models:

| CAN Be Used With:                                                                | CANNOT Be Used With:                                      |
|----------------------------------------------------------------------------------|-----------------------------------------------------------|
| Transom mounted muffler tips                                                     | Silent Choice Exhaust System                              |
| Waterlift mufflers or other mufflers that are mounted outboard of exhaust elbows | Below swim platform exhaust                               |
| Open exhaust                                                                     | Mufflers that mount between exhaust elbow and exhaust tip |

# SECTION 4 - FUEL SYSTEM

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## Fuel Delivery System

The fuel delivery system must be designed to deliver the fuel to the engine with minimal restriction and at the lowest temperature. Gasoline is extremely sensitive to vaporizing if placed under a vacuum (low pressure) and exposed to moderate or high temperatures. This is particularly true if winter blend fuels with a high RVP (Reid Vapor Pressure) are encountered in warmer temperature areas. Excessive restriction in the fuel delivery system may cause a condition known as vapor locking. This typically occurs after the engine has been operated at high RPM and then shut off and allowed to sit for 15 minutes to 2 hours. During this time the engine heat soaks, causing the temperature of the fuel system to increase. Upon restart, the combination of heat and vacuum in the fuel system causes the fuel to vaporize. The fuel system cannot handle this vapor and therefore, fuel starvation results when the boater attempts to resume operation. Depending upon the degree of vapor locking, this can range from a hesitation or bog when accelerating to a complete stalling of the engine. To minimize the potential for this problem, the guidelines should be observed to limit fuel delivery restriction to 6.9 kPa (2 in. Hg) or less and fuel inlet temperature to 44 C (110 F) or less.

The fuel delivery system is an integral part of the boat. Mercury MerCruiser makes no attempt in this manual to cover all aspects of design and integration of the fuel delivery system, due to a broad range of possible configurations and the numerous regulations and standards that cover this area. The applicable standards and regulations for the markets where your product will be sold should be observed, along with any information from the fuel system component manufacturers. The following general guidelines are provided:

### WARNING

**Avoid serious injury or death and property damage due to improper boat design and construction. Always adhere to all applicable Marine Regulations (United States Coast Guard [USCG], European Union - Recreational Craft Directive [EU-RCD], and so on) and the standards they reference (American Boat and Yacht Council [ABYC], Society of Automotive Engineers [SAE], International Standards Organization [ISO], and so on) when designing and constructing the boat and the boat components, such as the engine compartment, fuel delivery system and exhaust system.**

The main concern of a boat's fuel system is safety; this must be achieved through a technically sound installation and constant inspection.

The fuel system, from the filler pipe to the fuel pump, is the same in principle for all boats.

The fuel tank is an integrated component of the boat. Refer to the special information on service and maintenance, which you have received from the tank manufacturer.

Only a few points related to function and safety are listed here [Refer to boating standards (NMMA, ABYC, etc.) and Coast Guard regulations for complete guidelines]:

- All connections should be on the upper side of the tank.
- The drain plug at the lowest point on the tank serves to permit the removal of water and sediment.
- The tank breather pipe must have an inner diameter of at least 13 mm (1/2 in.) and must be fitted with a swan neck to prevent water from entering the tank.

It is recommended that the exact route and length of the fuel lines be established at the first installation of the engine to prevent problems later in connecting them to the engine.

All fuel lines must be well secured. The holes where the lines run through the bulkheads should be carefully rounded off or protected with rubber grommets. This prevents damage to the lines from abrasion.

The following, but not limited to the following, additional fuel connection related points, applying to all engines unless otherwise stated, must be considered [Refer to boating standards (NMMA, ABYC, etc.) and Coast Guard regulations for complete guidelines]:

1. Fuel pickup should be at least 25 mm (1 in.) from the bottom of fuel tank to prevent picking up impurities.

2. The maximum measured vacuum at the engine's fuel inlet must not exceed 6.9 kPa (2 in. Hg) through out engine operating range.

**IMPORTANT: Vacuum reading higher than specified can cause vapor locking with some of today's fuels. It can also cause poor engine performance because of fuel starvation.**

3. Fuel lines used must be Coast Guard approved (USCG Type A1).

| Description                | Specification           |
|----------------------------|-------------------------|
| Minimum Fuel Line Diameter | 10 mm (3/8 in.) minimum |

4. **On Multi-Engine Gasoline Installations:** It is best to use a fuel pickup and supply line for each engine. If a single pickup and line is used, line must be 13 mm (1/2 in.) ID or larger.
5. **On installations that require long lines or numerous fittings:** The fuel lines and fittings ID must be greater than 10 mm (3/8 in.).
6. Fuel lines should be installed free of stress and firmly secured to prevent vibration and/or chafing.
7. Sharp bends in fuel lines must be avoided.
8. A flexible fuel line must be used to connect fuel supply line to fuel inlet fitting on engine to absorb deflection when engine is running.

# SECTION 5 - COOLING SYSTEM

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| Hot Water Heater Installation.....              | 5 |
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# Seawater Connections - General Information

## Specifications

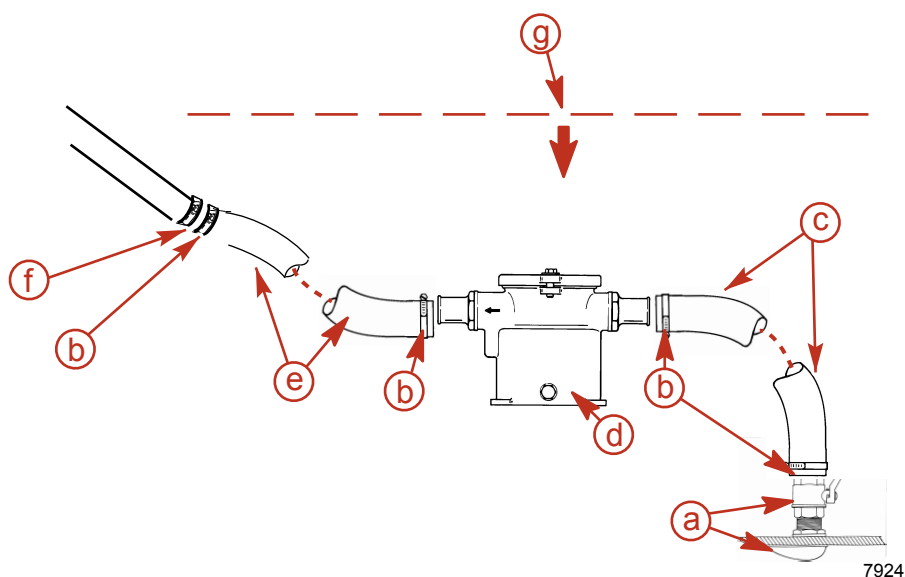
| Description       | Specification                        |
|-------------------|--------------------------------------|
| Water pickup      | 32 mm (1-1/4 in.) ID wire reinforced |
| Water inlet hose  | 32 mm (1-1/4 in.) connections        |
| Seacock           |                                      |
| Seawater strainer |                                      |

## Seawater Pickup

This section covers through the hull and through the transom water inlets only. For information on sterndrive water inlet connections, refer to the appropriate section after engine installation.

## Seawater Pickup Requirements

**IMPORTANT:** Seawater hose used must be wire reinforced to avoid collapsing hose when suction is created by seawater pump impeller.



Typical installation shown with a through the hull water pick up

- a** - Quicksilver seawater pickup and seacock
- b** - Hose clamp
- c** - Seawater hose to seawater strainer
- d** - Quicksilver seawater strainer
- e** - Seawater hose to engine
- f** - Seawater pump hose connector (if equipped)
- g** - Below seawater pump level

**IMPORTANT:** Do not install the water pickup directly in line with the propeller, as the pickup may create turbulence and allow air to flow into the propeller slipstream. This will cause propeller ventilation and will adversely affect boat performance.

**IMPORTANT:** Make gradual bends in the seawater hoses to avoid kinks. Hoses must not come in contact with steering system components, engine coupler, or drive shaft.

- The seawater pickup must be large enough to permit sufficient water flow to engine seawater pickup pump for adequate engine cooling.
- The seawater pickup also must supply a positive head while underway.

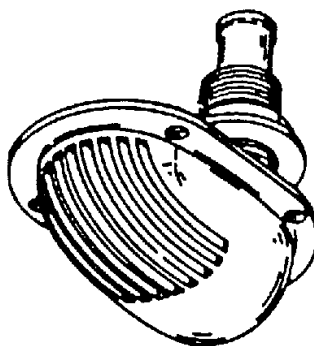
- The seawater pickup should be located as close to the seawater pump inlet as possible and in an area where an uninterrupted, solid stream of water will flow past when the boat is underway.
- Refer to appropriate **Mercury MerCruiser Product Applications Manual**.

## Seawater Pickup - General Information

A transom seawater pick up or a through the hull seawater pickup can be used.

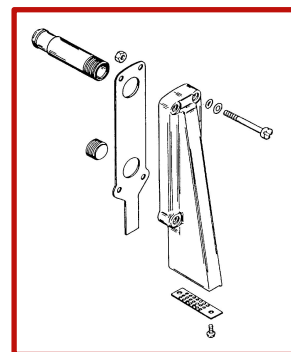
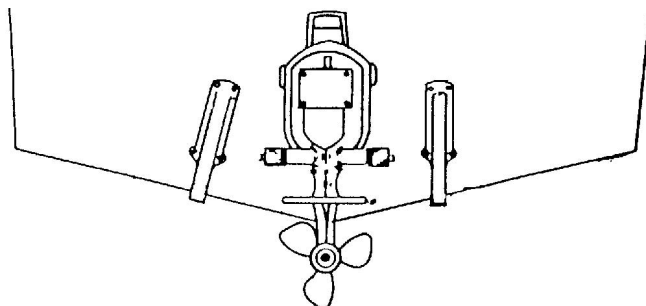
**IMPORTANT:** Seawater pickup must have an integral seacock.

**IMPORTANT:** Follow seawater pickup manufacturer's installation instructions.



7542

**Typical through hull seawater pickup with seacock**



8619

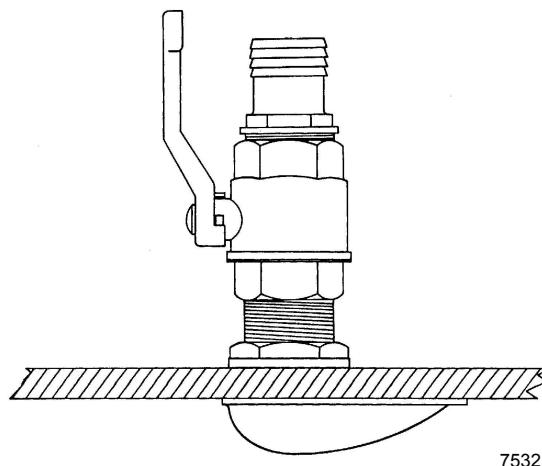
**Typical transom seawater pickup installed on boat transom**

- Pickup location should be selected to minimize water inlet hose length, while providing an optimum location for water pickup.
- Location should be in an area that will provide a solid, air-free flow of water under all operating conditions.
- Avoid areas with a disturbed water flow, such as those behind, or in close proximity to, the propeller.
- Locations that are too far forward or outboard should also be avoided as these are prone to aeration problems at high boat trim angles and in turns.
- Check for aeration as outlined under Water Supply Test.
- Provisions should be made to minimize galvanic corrosion, given the hull material being used and the composition of the surrounding components. Some industry standards and regulations also require that the pickup be connected into the boat's bonding system to minimize stray current corrosion. Refer to applicable standards and regulations for more details.
- Refer to appropriate Mercury MerCruiser Product Applications Manual.

## Seacock - General Information

The ABYC and other industry standards / regulations require the use of a seacock on certain types of applications to stop the entry of water in the event of a leak in the cooling system.

**IMPORTANT:** Follow seacock manufacturer's installation instructions.



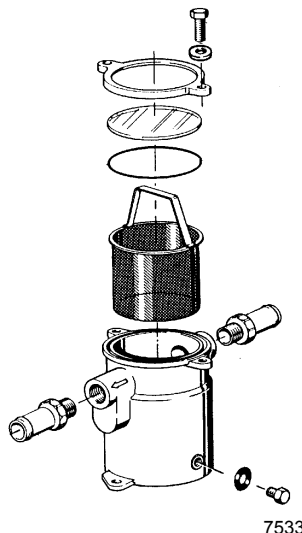
**Typical seacock shown with a through the hull water pick up**

- Refer to applicable standards / regulations for specific requirements. The seacock also allows the water to be shut off when servicing the engine.
- Seacock must provide minimum restriction to water flow (refer to Specifications).
- A ball or gate valve is recommended.
- The ball valve is most common and is typically equipped with a lever type handle that operates in a 90 degree arc. This design gives a clear indication of whether the valve is open or shut.
- Industry standards / requirements typically require that the seacock be rigidly attached to the hull at the water pickup.
- Seacock location should be readily accessible for quick, easy operation.
- Refer to appropriate **Mercury MerCruiser Product Applications Manual**.

## Sea Strainer - General Information

A sea strainer is recommended if the boat is to be operated in an area with a high debris content.

**IMPORTANT:** Follow sea strainer manufacturer's installation instructions.



**Typical sea strainer**

- Sea strainer must be sized to minimize restriction (Refer to Specifications) and to provide a reasonable service interval.
- Locate strainer in an area that will be easily accessible for servicing.
- If boat is not equipped with a seacock, strainer should be located above the waterline to prevent water entry into boat when servicing.
- Strainer must have provision to allow draining in freezing temperature periods.
- Refer to appropriate **Mercury MerCruiser Product Applications Manual**.

## Hot Water Heater Installation

**IMPORTANT:** When connecting a cabin heater or hot water heater:

- Supply hose (from engine to heater) and return hose (from heater to engine) Must Not Exceed 16 mm (5/8 in.) inside diameter (ID).
- Make heater connections Only at locations shown.
- Refer to manufacturers' instructions for complete installation information and procedures.
- Do not reposition the engine temperature switch; it must remain where installed by factory.

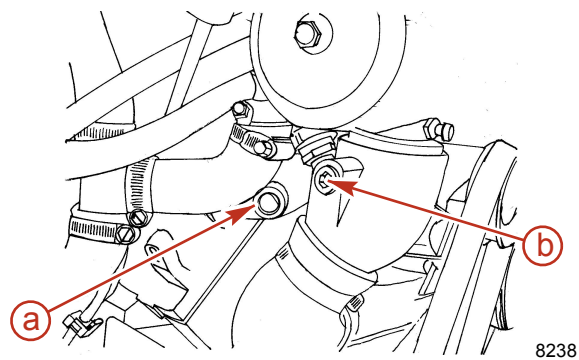
### **⚠ CAUTION**

Avoid a performance loss and/or possible engine damage. Engine coolant must flow continuously from the engine intake manifold to the engine water circulating pump. Never close off or block the engine coolant flow to or from a hot water heater using coolant supplied by the engine intake manifold and returned to the engine water circulating pump.

### **⚠ CAUTION**

Avoid engine overheating which could result in engine damage. On models equipped with Closed Cooling, an air pocket may form in the closed cooling system if some coolant is lost from the system and the cabin heater or hot water is mounted higher than the fill cap on the heat exchanger. Heater must be mounted lower than the fill cap of the heat exchanger on models so equipped.

## Hose Connection



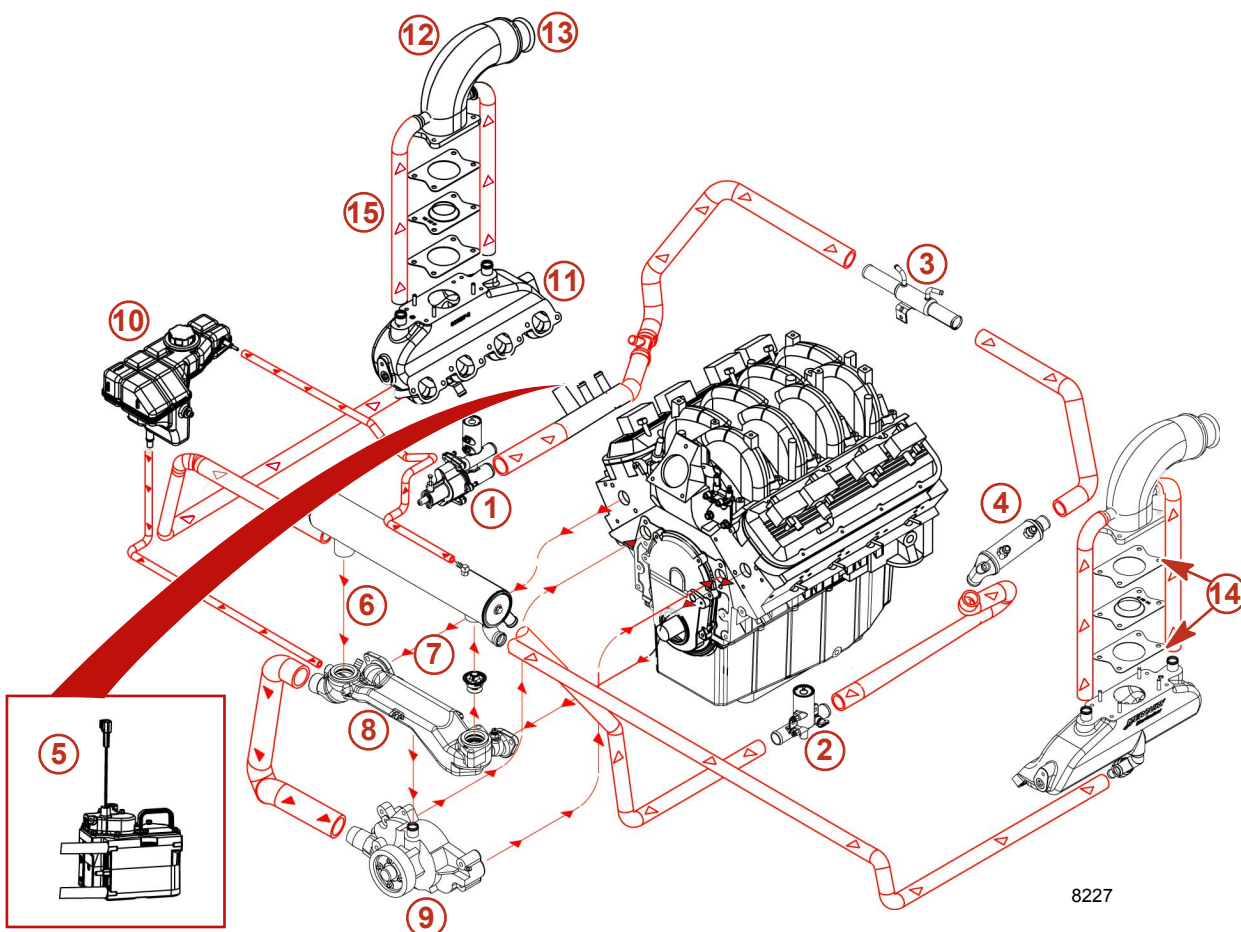
**a** - Supply hose connection

**b** - Return hose connection



# Water Flow Diagram 496 MAG Bravo

**NOTE:** Certain components in the following diagram may look different than on your particular power package, but the water and coolant flow paths remain similar on all engines.



8227

- |                                |                               |
|--------------------------------|-------------------------------|
| 1 - Seawater pump/Air actuator | 9 - Water circulating pump    |
| 2 - Air actuator               | 10 - Coolant reservoir        |
| 3 - Power steering cooler      | 11 - Exhaust manifold         |
| 4 - Oil cooler                 | 12 - Elbow                    |
| 5 - Gen III Cool Fuel Module   | 13 - Water and exhaust outlet |
| 6 - Heat exchanger             | 14 - Gasket (2 per side)      |
| 7 - Thermostat                 | 15 - Turbulator (1 per side)  |
| 8 - Crossover                  |                               |

# SECTION 6 - DRIVE SYSTEM AND ENGINE MOUNTING

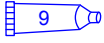
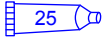
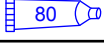
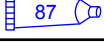
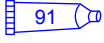
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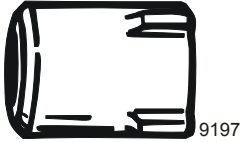
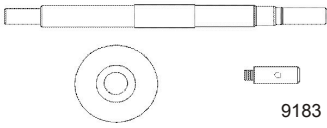
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## Lubricant, Sealant, Adhesives

| Tube Ref No.                                                                         | Description                        | Where Used                                                                                     | Part No.       |
|--------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------|----------------|
|  9  | Loctite 567 PST Pipe Sealant       | Fuel inlet fitting                                                                             | 92-809822      |
|  25 | Liquid Neoprene                    | Battery terminals<br>All electrical connections<br>MerCathode connections<br>Battery Terminals | 92-25711-3     |
|  34 | Special Lubricant 101              | Power steering bushings<br>Upper and lower pivot bolts<br>Clevis pin<br>Steering cable end     | 92-802865A1    |
|  80 | SAE Engine Oil 30W                 | Shift cable pivot points                                                                       | Obtain Locally |
|  87 | High Performance Gear Lubricant    | Gear Lube Monitor                                                                              | 92-802854A1    |
|  91 | Engine Coupler Spline Grease       | Coupler splines<br>U-joint O-rings<br>Drive shaft splines                                      | 92-802869A1    |
|  95 | 2-4-C Marine Lubricant with Teflon | Bell Housing Studs<br>O-ring seals<br>Trim cylinder hardware                                   | 92-802859A1    |

## Special Tools

|                                                                                          |                                                                             |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Tapered Insert Tool                                                                      | 91-43579                                                                    |
|  9197  | Removes and installs the tapered insert retainer into the water inlet hose. |
| Alignment Tool Assembly                                                                  | 91-805475A 1                                                                |
|  9183 | Aligns the engine and the sterndrive unit during installation.              |

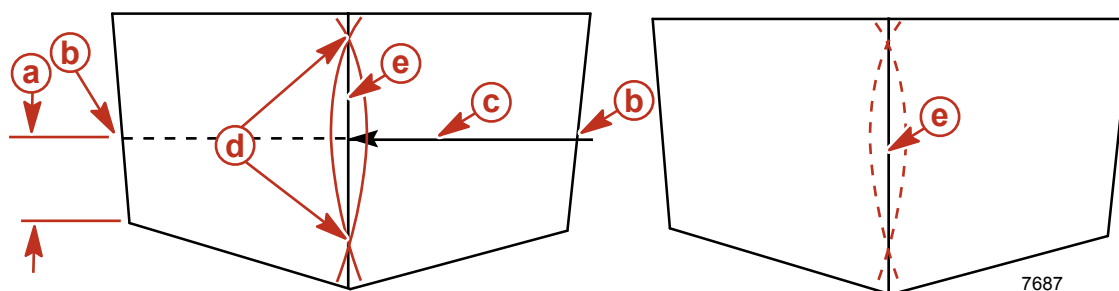
## Transom Cutout

### Finding The Crankshaft Vertical Center Line

#### SINGLE ENGINE

1. Locate and mark the vertical center line on the transom, if known. This is also the crankshaft vertical center line.
2. If unknown, a compass can be used to locate the vertical center line:
  - a. Mark identical locations on each side of the boat 29.4 cm (12 in.) from the bottom of the hull.
  - b. Position the fixed end of a compass at the marks and draw arcs on the transom.

- c. Draw the crankshaft vertical center line through the intersection points of the 2 arcs.



**Single engine installation**

- a** - 29.4 cm (12 in.)  
**b** - Identical side marks  
**c** - Compass arc

- d** - Arc intersection points  
**e** - Crankshaft vertical center line

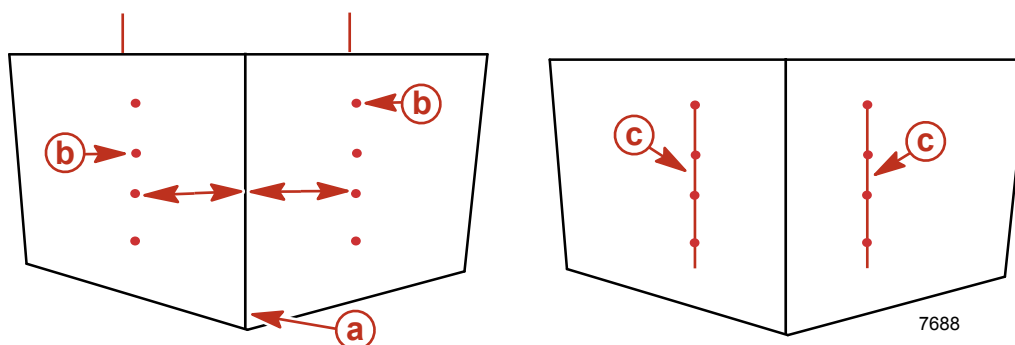
## DUAL ENGINE

1. Locate and mark the vertical center line on the transom. Refer to Single Engine procedure.
2. Make a set of marks equal to 1/2 the minimum distance between crankshaft vertical center lines on either side of the vertical center line.

| Minimum Distance Between Crankshaft Vertical Center lines (Dual Side-By-Side) |                    |
|-------------------------------------------------------------------------------|--------------------|
| Model                                                                         | Measurement        |
| 8.1 liter (496 cid)                                                           | 97.8 cm (38-½ in.) |

**IMPORTANT:** Crankshaft vertical center lines must be an equal distance from boat vertical center line.

3. Draw the 2 crankshaft vertical center lines through the intersection of the marks.



**Dual installation**

- a** - Vertical center line  
**b** - 1/2 minimum distance between crankshaft center line marks

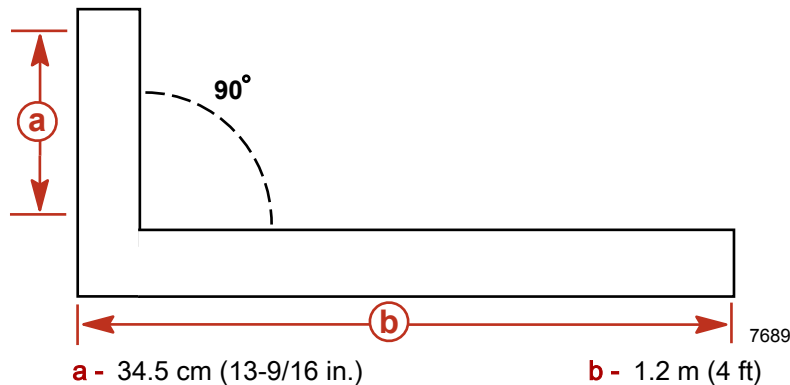
- c** - Crankshaft vertical center lines

## Finding Crankshaft Horizontal Center Line (X-dimension)

X-dimension can be measured by the 90 Degree Tool Method or by the Tape Measure Method.

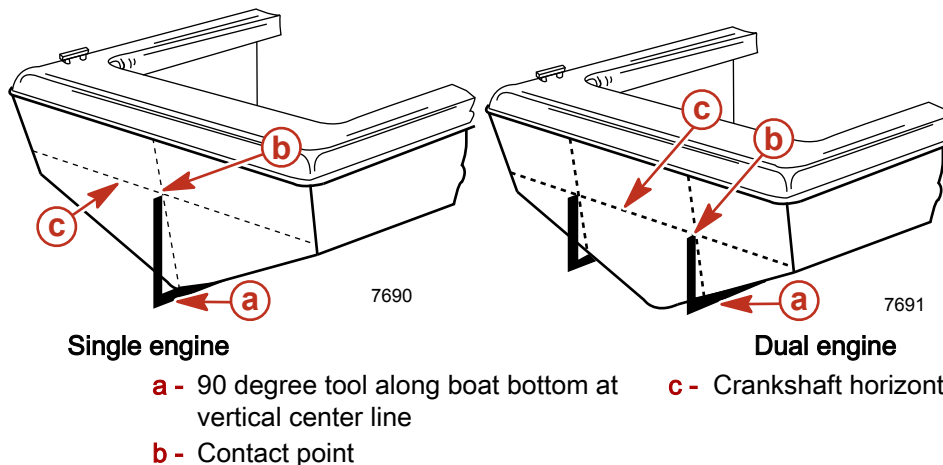
## 90 DEGREE TOOL METHOD

1. Construct the 90 degree tool.



**IMPORTANT:** The 34.5 cm (13-9/16 in.) dimension should only be raised or lowered after proper testing.

- -To lower drive unit - Subtract from dimension "a".
  - To raise drive unit - Add to dimension "a".
2. Place the 90 degree tool along the boat bottom at the vertical center line.
  3. Locate the point at which top of the 90 degree tool contacts the transom on the vertical center line. This is the crankshaft horizontal center line or X-dimension.
  4. Draw a line perpendicular to the vertical center line at the crankshaft horizontal center line.



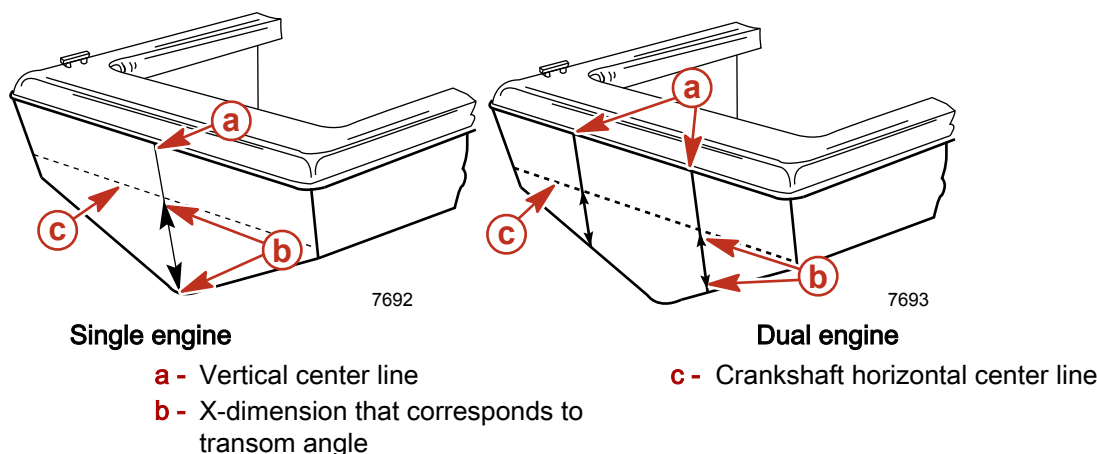
## TAPE MEASURE METHOD

1. Determine the X-dimension from the following chart.

**IMPORTANT:** This dimension should only be raised or lowered after proper testing.

| Transom Angle (degrees) | X-dimension            |
|-------------------------|------------------------|
| 16                      | 36.4 cm (14-5/16 in.)  |
| 15                      | 36.2 cm (14-1/4 in.)   |
| 14                      | 36.0 cm (14-3/16 in.)  |
| 13                      | 35.9 cm (14-1/8 in.)   |
| 12                      | 35.7 cm (14-1/16 in.)  |
| 11                      | 35.6 cm (14 in.)       |
| 10                      | 35.4 cm (13-15/16 in.) |

2. On the vertical crankshaft center line, measure up from the bottom of the transom to the X-dimension selected previously. This is the crankshaft horizontal center line at the X-dimension.
3. Draw a line perpendicular to the vertical center line at the crankshaft horizontal center line.



## Cutting Out The Transom

**IMPORTANT:** The following instructions will provide a sterndrive unit mounting location that is suitable for most boats. Best mounting location for a particular boat, however, can be determined only by testing.

1. **Below 40 km/h (25 mph):** Subtract 13 mm (1/2 in.) from X-Dimension.
2. **Heavy duty applications:** Subtract 25 mm (1 in.) from X-Dimension.
3. **Above 40 km/h (25 mph):** Use X-Dimension shown.
4. **Above 80 km/h (50 mph):** The X-Dimension can be increased to improve performance in some applications. However, pulling power for skiing will decrease. During testing, X-Dimension should be increased 13 mm (1/2 in.) at a time until desired performance is achieved but **in no case should it ever be increased by more than:**

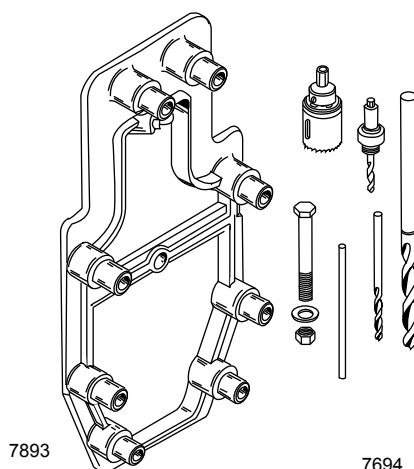
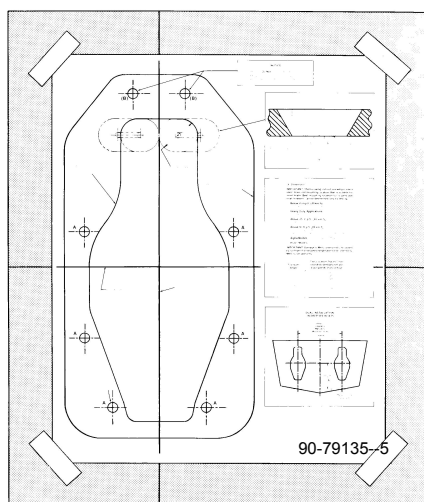
| Maximum Increase In X-Dimension |               |
|---------------------------------|---------------|
| Bravo One and Three             | 76 mm (3 in.) |
| Bravo Two                       | 25 mm (1 in.) |

Extreme care should be taken when raising drive unit to ensure that water supply does not become aerated. Use clear water inlet hose to monitor incoming water and monitor engine temperature gauge to ensure engine does not overheat.

In applications where cooling water to the engine is supplied by a through the hull or through the transom fitting, the sterndrive height will not cause cooling water aeration.

**IMPORTANT:** Damage to Mercury MerCruiser products caused by too high of an installed height will not be covered by Mercury MerCruiser warranty.

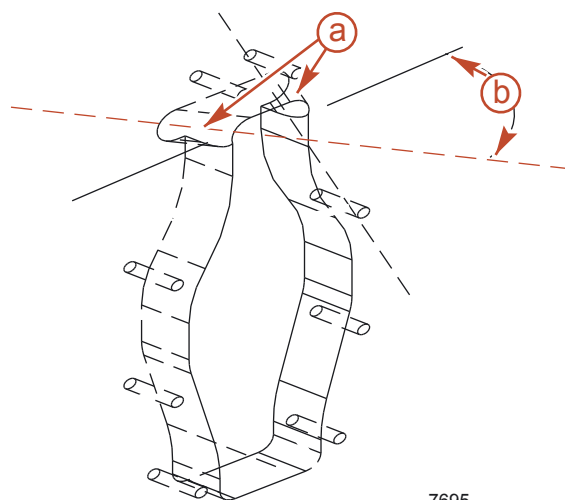
1. Cut out transom using the Template or the Transom Drilling Fixture Kit (purchased separately).



#### Transom cutout template

#### Transom drilling fixture kit

2. Follow instructions indicated on template or provided with drilling fixture.
3. Ensure that centerline on either the template or transom drilling fixture align with lines previously marked on transom.
4. Drill two 6 mm (1/4 in.) pilot holes at a 60 degree angle for hole saw guides.
5. Using a hole saw cut the two 51 mm (2 in.) holes for the steering lever cutout. If the hole saw cutout is made incorrectly, drive unit steering lever may contact transom causing limited steering travel.



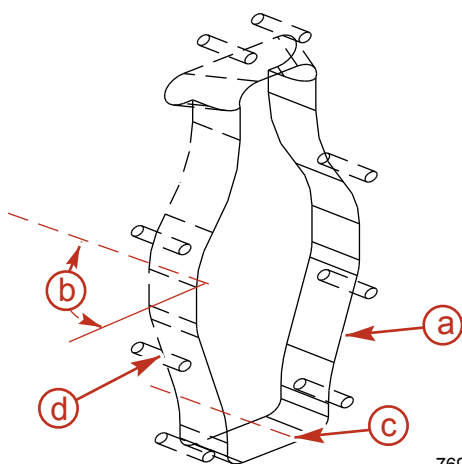
**a** - 51 mm (2 in.) hole saw holes  
(steering lever cutout)

**b** - 60 degrees versus transom angle

6. Cut the transom on the cut line at a 90 degree angle. If the transom cutout is made incorrectly the gimbal housing or exhaust system may improperly contact the boat transom causing transom mounting problems.



- Seal the inside edge of the transom cutout opening with a suitable sealant to prevent water absorption and deterioration of the transom.



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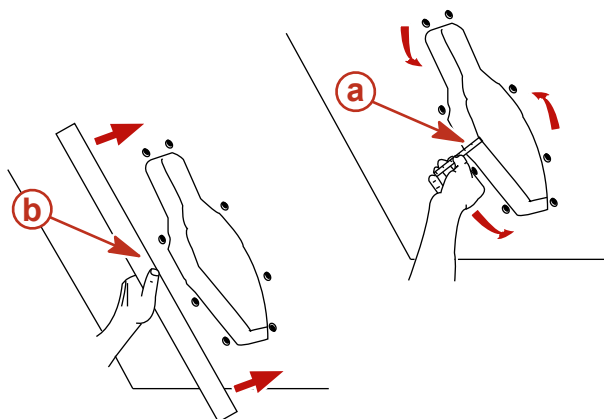
- a** - Cut line  
**b** - 90 degrees to transom  
**c** - Exhaust pipe area  
**d** - Mounting holes perpendicular to transom (8)

## Checking The Transom Thickness

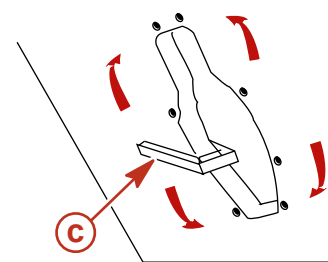
**IMPORTANT:** Transom thickness and surface plane (flatness) must be controlled where the sterndrive unit mounts.

- Ensure that transom thickness and surface conform to specifications.

| Transom Specifications |                                                                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thickness              | Between 51 - 57 mm (2 - 2-1/4 in.) for 203 mm (8 in.) to either side of the vertical center line                                                                                                             |
| Parallelism            | Inner and outer surfaces must be parallel within 3 mm (1/8 in.)                                                                                                                                              |
| Flatness               | Transom surfaces in area where transom assembly will be mounted (includes vertical as well as horizontal dimensions) :Inner Surface - Flat within 3 mm (1/8 in.) Outer Surface - Flat within 2 mm (1/16 in.) |
| Angle                  | 10 -16 degrees                                                                                                                                                                                               |



- a** - Measuring thickness  
**b** - Measuring flatness



7697

- c** - Suitable mandrel to check for uniform transom thickness

## Preliminary Connections

### Drive Shaft Extension Models

If your power package is equipped with a drive shaft extension, refer to the **Drive Shaft Extension Installation Instructions** (90-866039) included with your engine package.

You will also need to order extensions for the gear lube monitor and MerCathode quick connects. Refer to your parts catalog for current part numbers.

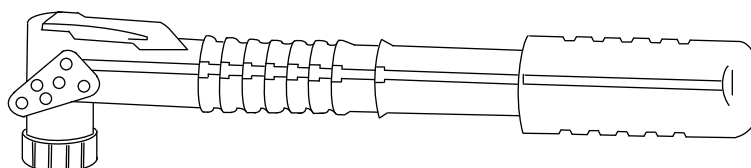
### Engine Mounts

**NOTE:** On offshore boats or boats which will be used in rough water areas, Mercury MerCruiser recommends the use of a solid plate engine mount.

### Air Pump

**NOTE:** Some models have air pump mounted on the engine and other models have the air pump in a parts bag.

1. Select an easily accessible mounting location for the air pump.
2. Mount the air pump.



8992

### Power Trim Pump

1. Select an appropriate mounting location (floor or transom) for the trim pump that:
  - Is within length limits of BLACK and GRAY hydraulic hoses coming from gimbal housing assembly.
  - Is close to the battery so that trim pump battery leads can be connected.
  - Allows easy access to trim pump oil fill and vent locations.
  - Is in an area where pump will not be exposed to water.
  - Prevents the power steering booster cylinder from coming in contact with the trim pump when the steering wheel is turned in either direction (right or left).

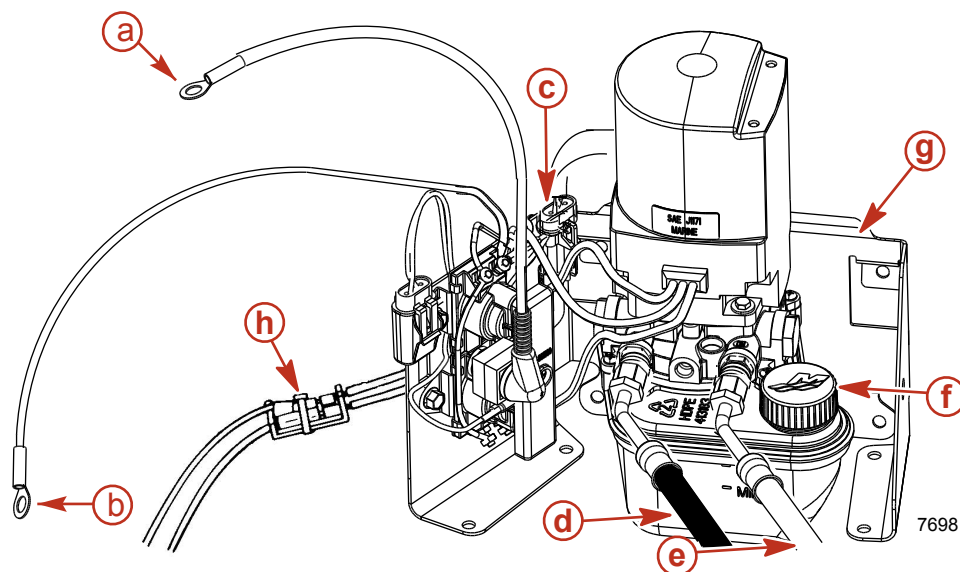
**NOTE:** Template 90-863152 provides mounting hole location for floor or transom mounting.

2. Mount the pump in the desired location.

### Power Trim Pump Connections and Filling

**IMPORTANT:** Make hydraulic connections as quickly as possible to prevent oil from leaking out of system.

1. Connect hydraulic hoses to trim pump. Ensure that the quick connect fitting completely seat when connecting the hoses.



**a** - Positive battery lead

**b** - Negative battery lead

**c** - Harness connector

**d** - BLACK hydraulic hose (UP hose)

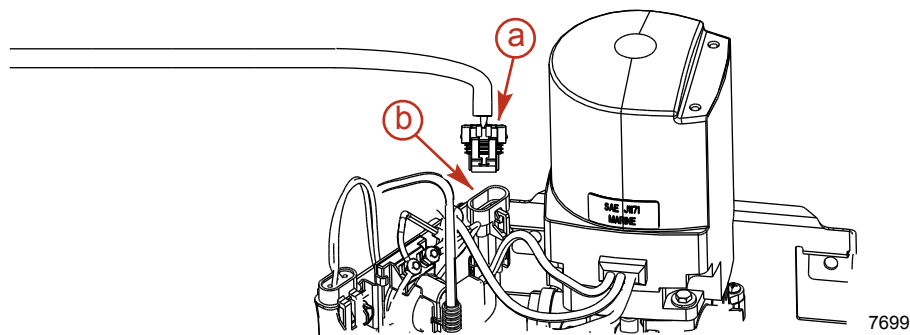
**e** - GRAY hydraulic hose (DOWN hose)

**f** - Fill/vent cap

**g** - Dual mount trim pump bracket

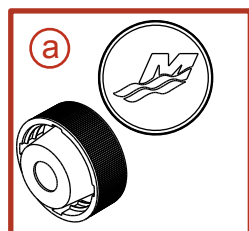
**h** - Trim limit switch connected and secured

2. Connect power trim pump control harness to trim pump.

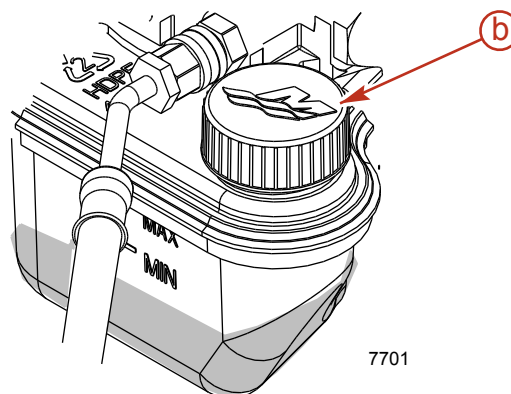


**a** - Control harness

**b** - Trim pump connector



**a** - Fill cap assembly (top and underneath side views)

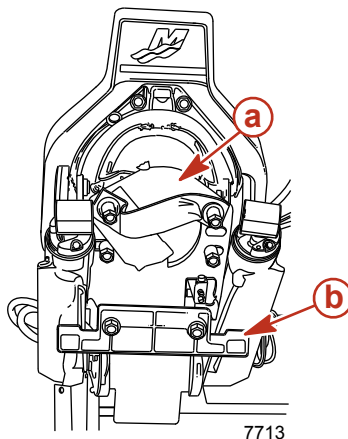


**b** - Fill cap on trim pump reservoir

## Transom Connections

### Installing Gimbal Housing Assembly

1. Carefully remove transom assembly from shipping carton.
2. Remove and read all tags attached to transom assembly.



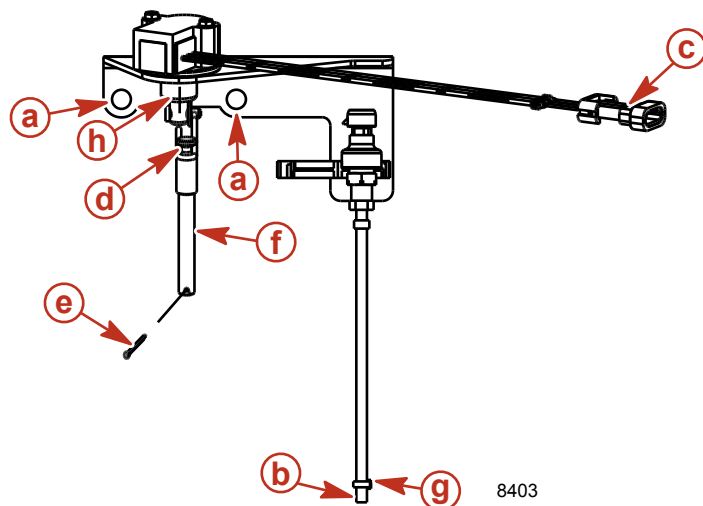
**a** - Shipping hardware

**b** - Trim cylinder support

3. Remove the shipping hardware.
4. Remove the dust cover if boat will be shipped with drive installed.
5. Do not remove the Shift Slide Installation Tool.
6. Retain the serial number envelope.

### Sensor Steering Assembly

1. Remove nuts from upper 2 transom studs.
2. Remove cotter pin and clevis pin from steering lever.
3. Install new clevis pin and secure with existing cotter pin.



**a** - Transom stud holes  
**b** - Pitot tube connection  
**c** - Plug  
**d** - Guide

**e** - Cotter pin  
**f** - Clevis pin  
**g** - Tie strap  
**h** - Alignment mark

4. Slide guide onto the groove in the clevis pin.
5. Bolt the steering assembly to the transom.

6. Remove the brass plug from the transom.
7. Install pitot barbed fitting.
8. Attach pitot tube to barbed fitting and secure with a tie strap.
9. Plug sensor into transom harness.

## Installing Inner Bravo Transom Plate

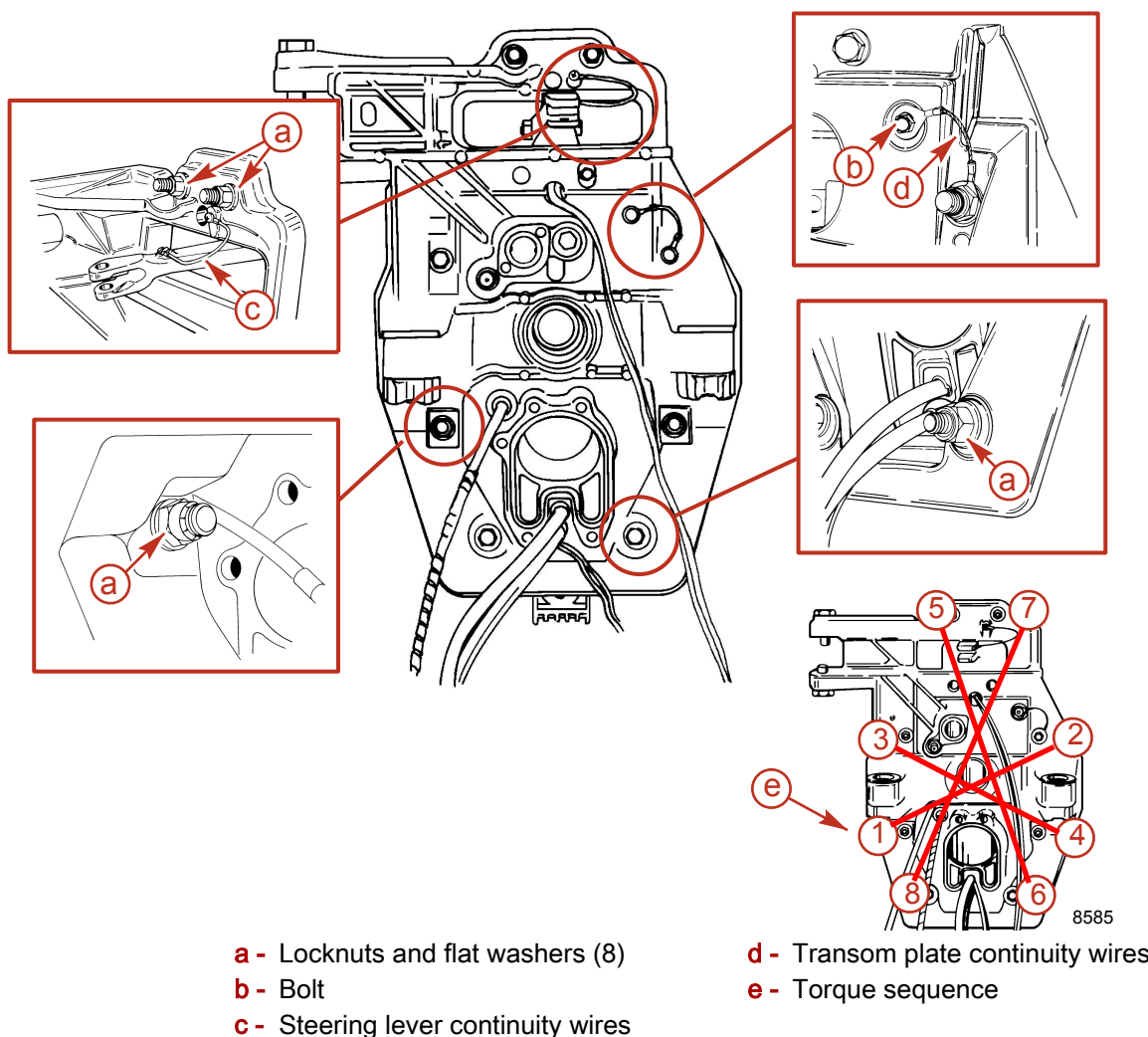
1. Insert wires, hoses, and shift cable through appropriate openings in inner transom plate.
2. Position gimbal housing on transom and hold in place.

**IMPORTANT:** Tighten the transom assembly fasteners using an X-pattern torque sequence, starting from the middle fasteners. Tighten in small increments and go around the pattern several times until the proper torque is achieved.

3. Secure transom assembly with fasteners. Torque the fasteners.

| Description               | Nm | lb. in. | lb. ft. |
|---------------------------|----|---------|---------|
| Transom assembly hardware | 34 |         | 25      |

**IMPORTANT:** Steering lever continuity circuit wire must be positioned as shown to avoid stressing wire when steering lever moves.

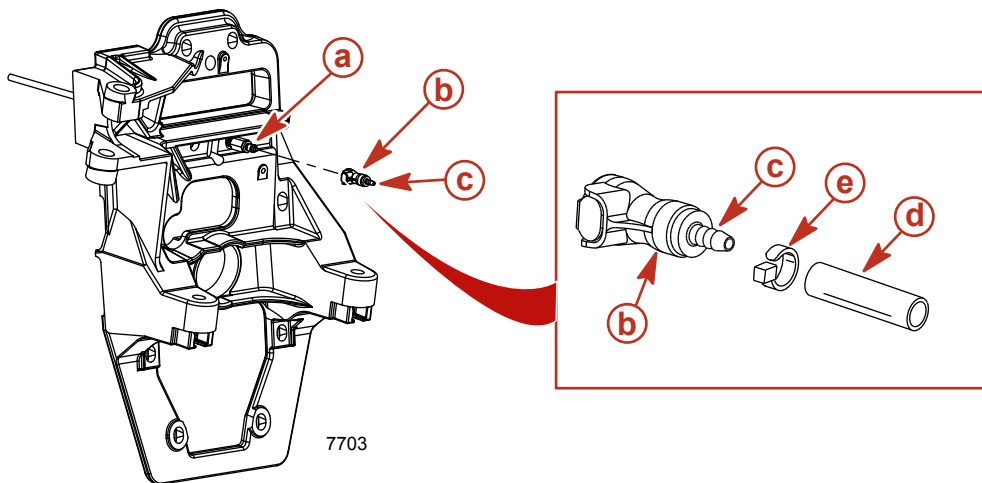


## Connecting Speedometer Pickup

### ⚠ CAUTION

Excess water in bilge can damage engine or cause boat to sink. Do not remove plug from speedometer pickup tube fitting unless connection is to be utilized.

1. Remove the protective cap from the male quick connect.
2. Connect a 4 mm (5/32 in.) speedometer hose (not provided) from speedometer to barb fitting. Secure hose with tie strap.



Typical

a - Male quick connect

b - Female quick connect

c - Barbed fitting

d - Hose

e - Tie strap

### ⚠ CAUTION

Avoid water leaking into boat. Speedometer hose is filled with water, especially during boat operation. Hose contact with moving or rotating engine parts could cause damage to the hose resulting in water leaking into boat. Do not let speedometer hose contact steering system components, engine coupler or drive shaft.

3. Secure the hose to the transom with the hose clip and screw that are provided in the parts bag. Ensure that the hose does not contact the steering system components or the engine coupler and drive shaft.

## Models With Bravo Sterndrive and Alternative Water pickups

### Alternative Water Pickups

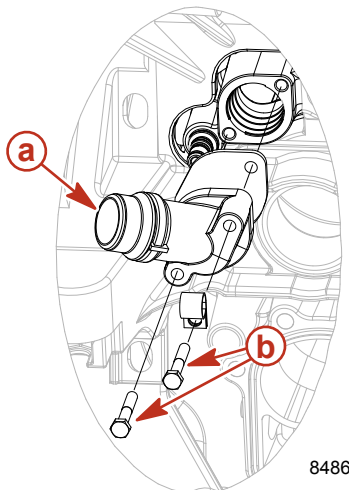
A water inlet block-off kit must be used if the sterndrive unit water pickup will not be used to supply water to the engine. When installing the block-off plate, it is necessary to cut the water hose that is located between the bell housing and the gimbal housing. This allows water to continue to circulate through the sterndrive unit for cooling.

### ⚠ CAUTION

Avoid overheating the sterndrive. The seawater inlet holes must be allowed to flow water without being obstructed or damage to the sterndrive will result. Do not dead-end the seawater hose from bell housing. Cut hose as recommended in procedures.

## Bravo Models

1. Remove the existing water fitting and gasket. Discard the screws and washers.

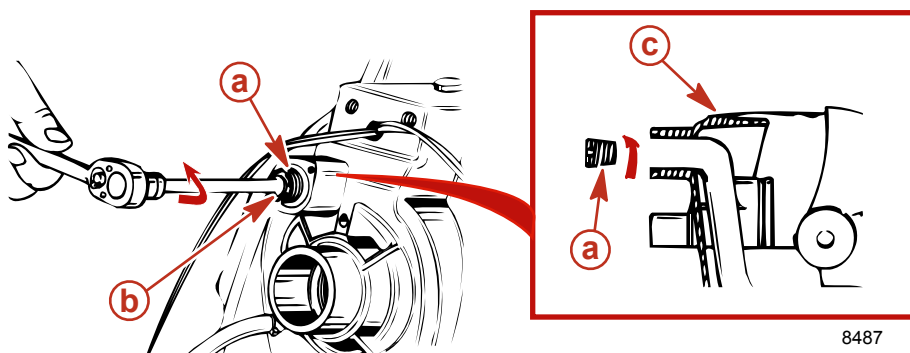


**Bravo shown**

**a -** Water inlet fitting

**b -** Screws and lockwashers

2. Remove the tapered insert in the gimbal housing using the Tapered Insert Tool. Discard the insert.



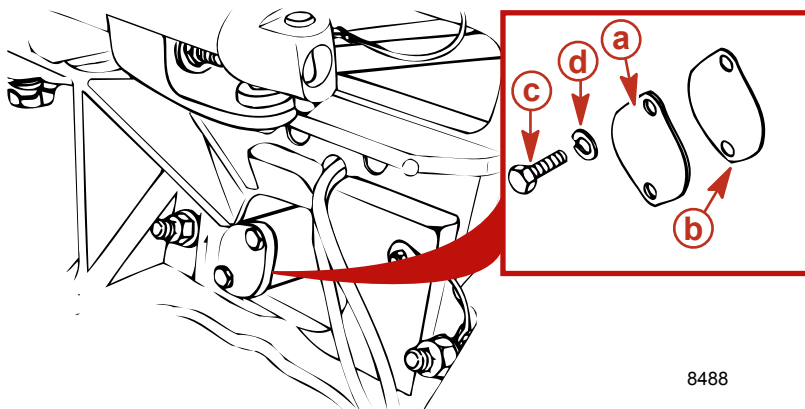
**a -** Tapered insert

**b -** Tapered Insert Tool

**c -** Gimbal housing cross-sectional view

|                     |          |
|---------------------|----------|
| Tapered Insert Tool | 91-43579 |
|---------------------|----------|

3. Install the block-off plate with new gasket. Secure with screws and lockwashers. Torque the screws.

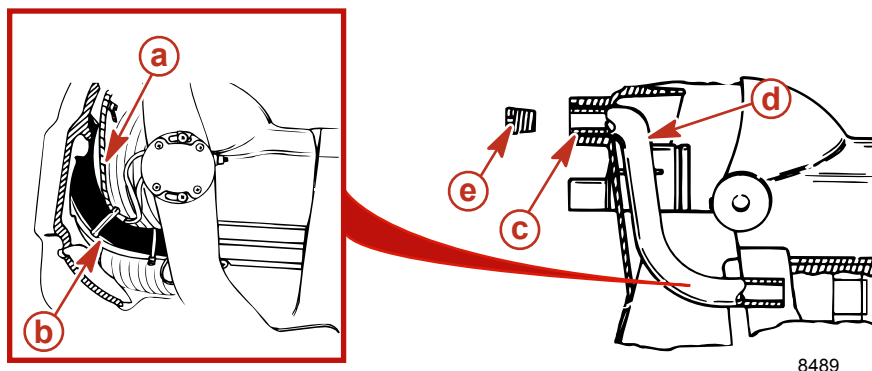


a - Block-off plate  
b - Gasket

c - Screw  
d - Lockwasher

| Description                 | Nm | lb. in. | lb. ft. |
|-----------------------------|----|---------|---------|
| Water inlet block off screw | 5  | 45      |         |

4. Move the trim limit switch wires and speedometer hose aside. Reach between the gimbal housing and the bell housing and detach the water hose from the gimbal housing where the tapered insert was removed in Step 2.



a - Trim limit switch wires  
b - Speedometer hose  
c - Gimbal housing

d - Water hose  
e - Tapered insert

### ⚠ WARNING

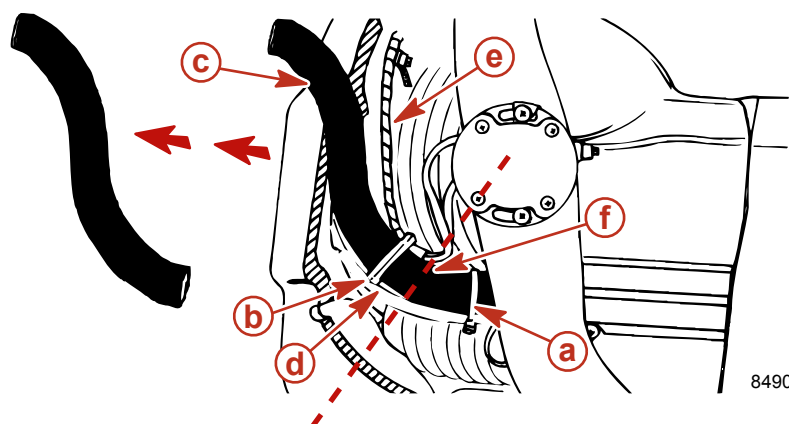
Avoid water leakage into the boat. If the U-joint bellows is damaged, water will enter the boat. Be careful not to damage the U-joint bellows when removing the section of the water hose attached between the gimbal housing and the bell housing.

**NOTE:** Move the trim limit switch wires and speedometer hose to avoid damaging them when cutting the water hose. The existing tie strap and clip can be reused if they are moved and repositioned after the hose is cut.

5. Cut completely through the water hose 127 mm (5 in.) in front of the aft end of the hose where it is fitted into the bell housing in the area shown. Do not damage the U-joint bellows.
6. Discard loose hose piece.



7. Secure the trim limit switch wires and speedometer hose to the remaining section of water hose using existing tie strap and clip.



- |                      |                             |
|----------------------|-----------------------------|
| a - Tie strap        | d - Speedometer hose        |
| b - Clip             | e - Trim limit wire harness |
| c - Water inlet hose | f - Cutting area            |

8. Install a through the hull or through the transom seawater pickup, seawater strainer, and seacock.
9. Connect the seawater inlet hose between seawater pump and seawater strainer.
10. Secure all hoses with hose clamps.

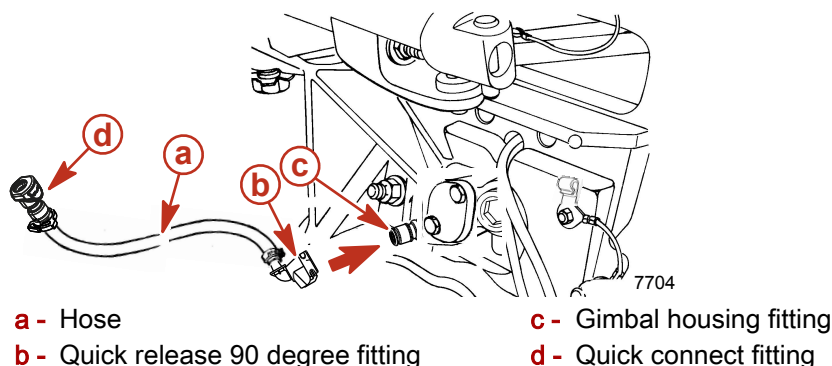
## Gear Lube Monitor Connection At Gimbal Housing

### ⚠ CAUTION

Avoid sterndrive unit damage. The quick release button on the gear lube monitor 90 degree hose fitting may not lock on the gimbal housing fitting if touching or depressed by the water inlet fitting, or block-off plate if equipped. Failure to lock the 90 degree hose fitting on the gimbal housing fitting could result in a loose 90 degree hose fitting causing a loss of gear lube and damage to the sterndrive unit. Ensure the 90 degree hose fitting is locked on the gimbal housing fitting.

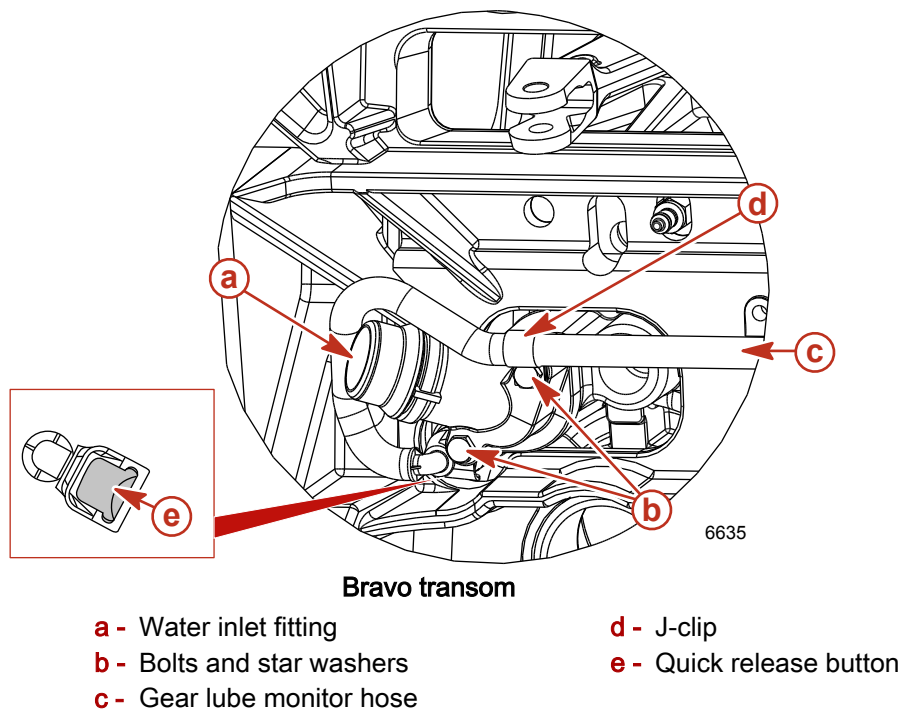
**NOTE:** The gear lube monitor hose is now in the parts bag on the engine.

1. Connect the quick release 90 degree fitting of the gear lube monitor hose to the gimbal housing.



**NOTE:** The quick release button on hose fitting must be positioned away from water inlet fitting, or block-off plate if equipped. Release button must not contact water fitting or block-off plate, if equipped.

- 2. Position quick release button on hose fitting away from water inlet fitting. Release button must not contact water fitting.



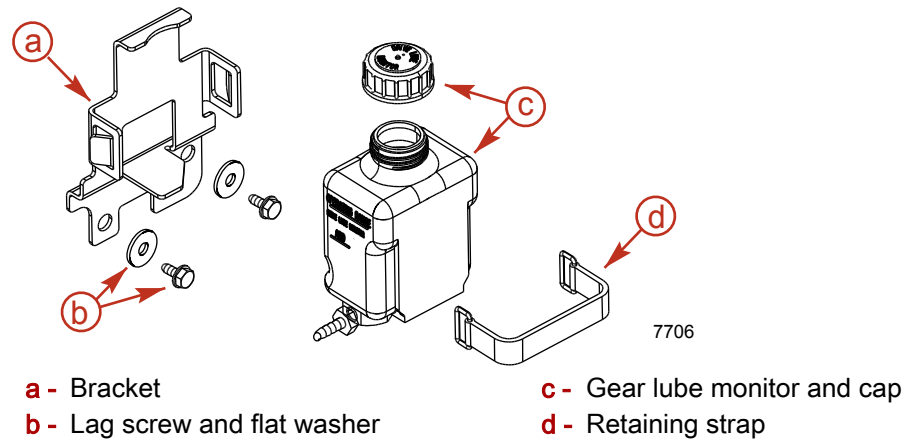
| Description               | Nm | lb. in. | lb. ft. |
|---------------------------|----|---------|---------|
| Water inlet fitting bolts | 5  | 45      |         |

**NOTE:** The hose must not come into contact with the steering system components or the engine coupler and drive shaft.

## Alternative Mounting Of Gear Lube Monitor On Transom

**IMPORTANT:** The mounting location specified must be above the steering lever on the transom assembly. Hose must be positioned to avoid moving parts (steering system, engine coupler).

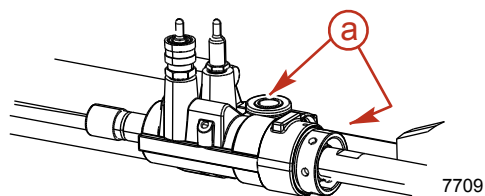
- 1. Install the gear lube monitor bracket in the specified location and secure with lag screws and flat washers.
- 2. Install the gear lube monitor in the bracket. Secure the monitor with the retaining strap.



## Installing Steering System

**NOTE:** For dual installations, power steering unit can be mounted on port or starboard transom assembly. Measure exact distance between power package center lines. Select a tie bar from Mercury Precision Parts / Quicksilver Accessory Guide. Refer to tie bar installation instructions before proceeding.

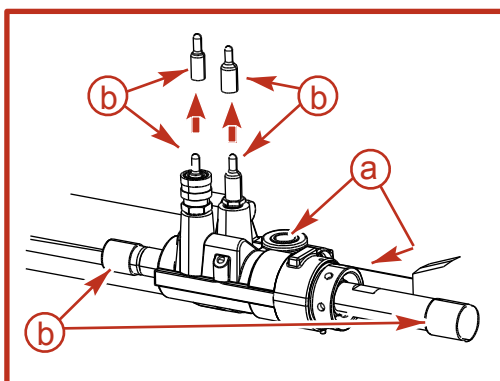
1. Inspect the bushings for debris. Lubricate the power steering bushings.



**a - Bushings**

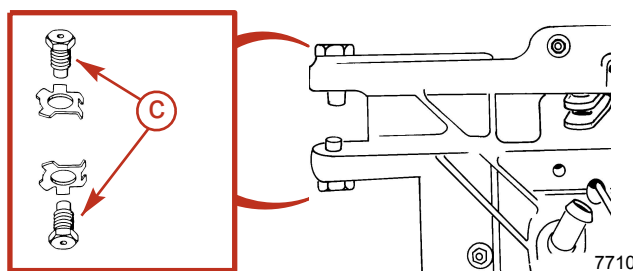
| Tube Ref No.                                                                         | Description           | Where Used              | Part No.    |
|--------------------------------------------------------------------------------------|-----------------------|-------------------------|-------------|
|  34 | Special Lubricant 101 | Power steering bushings | 92-802865A1 |

2. Remove the protective shipping caps.
3. Remove the upper and lower pivot bolts and ensure that the threads are well lubricated.



**a - Bushing**

**b - Protective shipping caps**

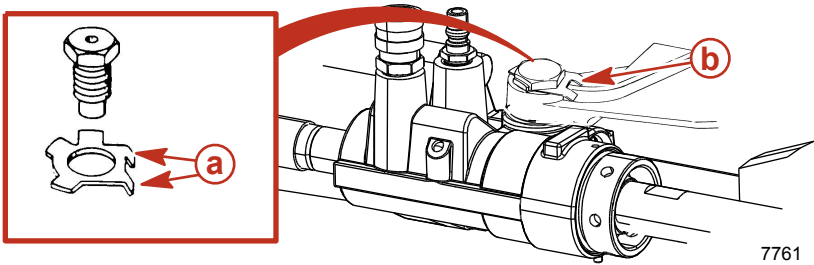


**c - Upper and lower pivot bolt**

| Tube Ref No.                                                                           | Description           | Where Used                  | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|-----------------------------|-------------|
|  34 | Special Lubricant 101 | Upper and lower pivot bolts | 92-802865A1 |

4. Position the steering assembly so that the pivot bolts will enter the bushings in the power steering control valve.

5. Install the upper and lower pivot bolts along with tab washers. Ensure that the tab washer tangs straddle the ridge on the inner transom plate.



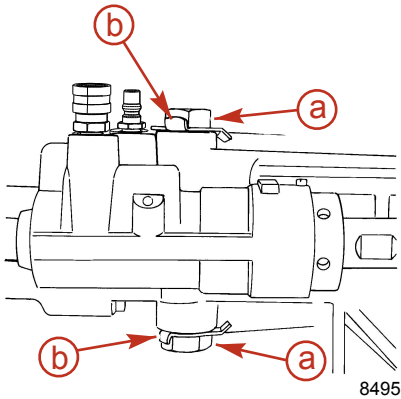
Upper Pivot Bolt And Tab Washer Shown (Lower Similar)

a - Tab washer tang

b - Ridge

6. Turn the pivot bolts all the way in, **by hand**, to ensure proper steering assembly alignment.
7. Ensure that the steering assembly pivots freely.
8. Torque the pivot bolts. **Bend the tab washer tabs against the corresponding flats on the bolt heads.**

**NOTE:** It may be necessary to tighten the pivot bolts further to align the flats on bolt head with the tabs on the washer.



a - Pivot bolt

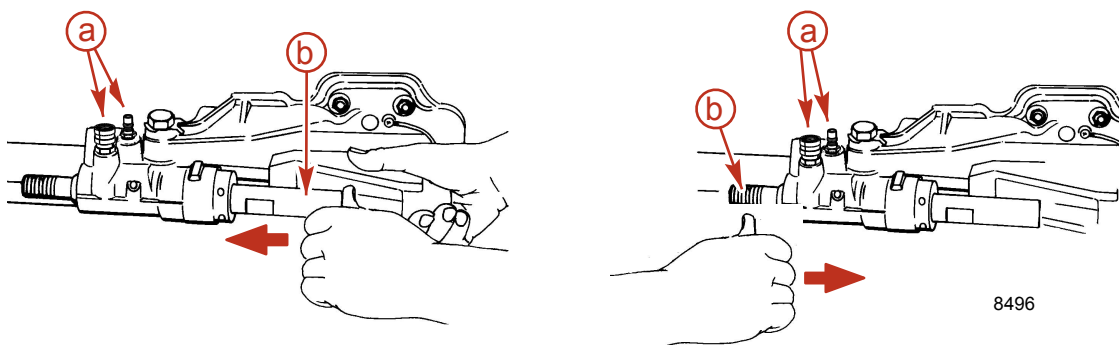
b - Bent tab

| Description                | Nm | lb. in. | lb. ft. |
|----------------------------|----|---------|---------|
| Upper and lower pivot bolt | 34 |         | 25      |

**⚠ CAUTION**

**MOVING THE CONTROL VALVE RAM** with the hoses disconnected will expel fluid from the control valve ports. Wear eye protection.

9. While wearing eye protection, to avoid expelled fluid, move the control valve cable guide tube in the directions shown, so that it will be less difficult to pull it out or push it in during connection.

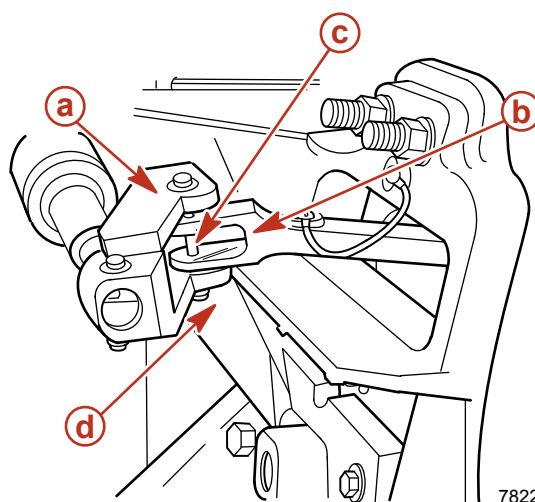


**a** - Port

**b** - Control valve cable guide tube

10. Connect the clevis to the steering lever. Lubricate the clevis pin. **Be sure to spread both ends of the cotter pin.**

**NOTE:** Insert the clevis pin from the top to ensure that the cotter pin hole is as shown in the diagram.



**a** - Clevis

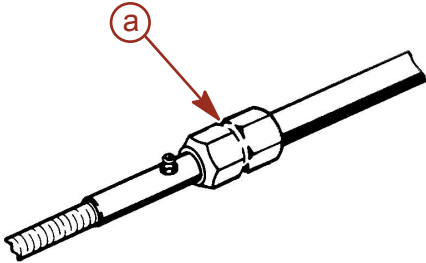
**b** - Steering lever

**c** - Clevis pin

**d** - Cotter pin

| Tube Ref No.                                                                           | Description           | Where Used | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|------------|-------------|
|  34 | Special Lubricant 101 | Clevis pin | 92-802865A1 |

**IMPORTANT:** Quicksilver RideGuidet steering cable has a self-locking coupler nut and does not require an external locking sleeve or locking plate.

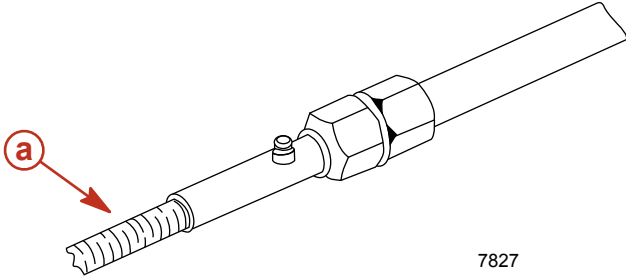


7255

**a -** Self-locking coupler nut

⚠ CAUTION

Proper steering system function requires that the steering cable and outer casing must be free to move back and forth. Items fastened to the steering cable and outer casing prevent free movement. Do not fasten any items to the steering cable and outer casing.



7827

**a -** Steering cable and outer casing

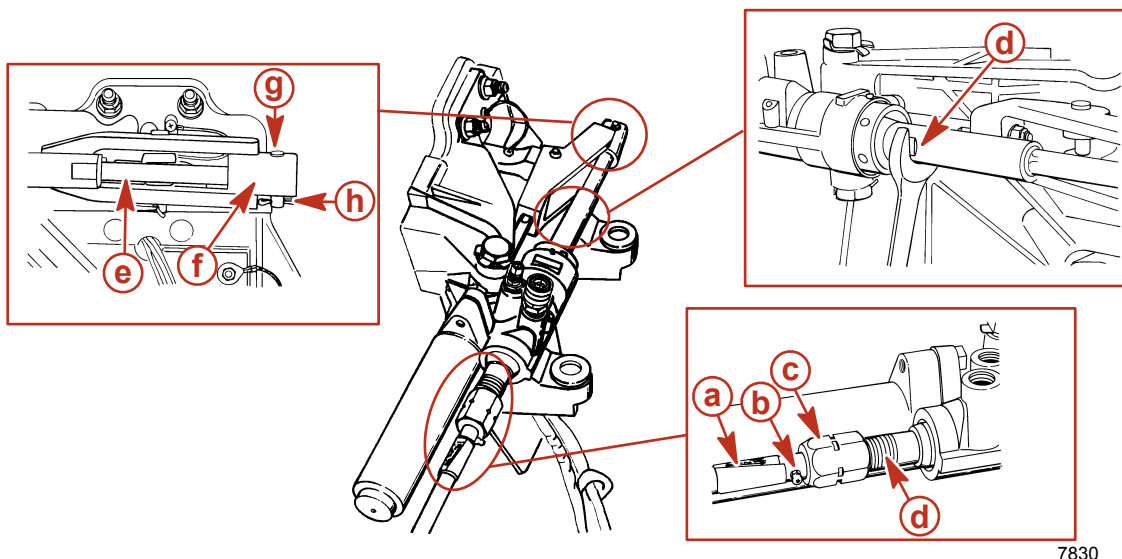
11. Connect the steering cable as follows:
- a. Coat the steering cable end with a liberal amount of lubricant.

| Tube Ref No.                                                                           | Description           | Where Used         | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|--------------------|-------------|
|  34 | Special Lubricant 101 | Steering cable end | 92-802865A1 |

- b. Install the steering cable and secure with hardware as shown.

**IMPORTANT:** Cable guide tube flat surfaces must be positioned vertically or slight feedback in the steering system could be encountered.

- c. Using a suitable wrench hold the flat surfaces on the cable guide tube in the vertical position. Torque the coupler nut. Ensure that the flat surfaces are still aligned vertically after torque is applied to the coupler nut.



**a** - Steering cable  
**b** - Grease fitting  
**c** - Cable coupler nut  
**d** - Cable guide tube

**e** - Steering cable end  
**f** - Clevis  
**g** - Clevis pin  
**h** - Cotter pin

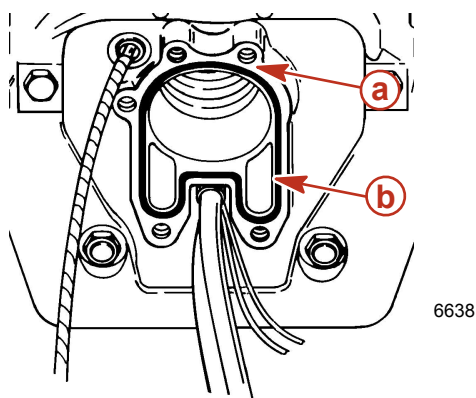
7830

## Engine Installation

### Transom Preparation

**IMPORTANT:** Exhaust pipe and gimbal housing mating surfaces must be clean and free of nicks and scratches and O-ring must be properly seated in groove or water and exhaust may leak into boat.

1. Ensure the exhaust pipe and gimbal housing mating surfaces are clean and free of nicks and scratches.
2. Ensure the O-ring is properly seated in the groove.

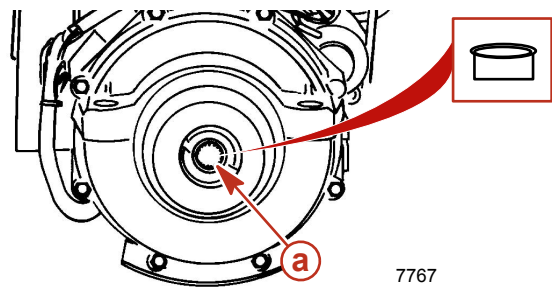


6638

**a** - Gimbal housing mating surface      **b** - O-ring

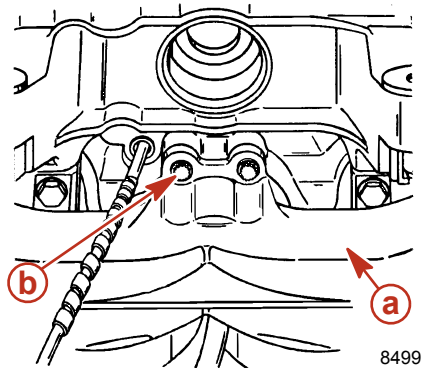
3. Loosen hose clamps and remove exhaust pipe and bellows from engine.

4. Remove the shipping plug from the engine coupler.



a - Shipping plug

5. **Through The Propeller Exhaust Models:** Install exhaust pipe assembly using 4 bolts and lockwashers. Torque bolts.

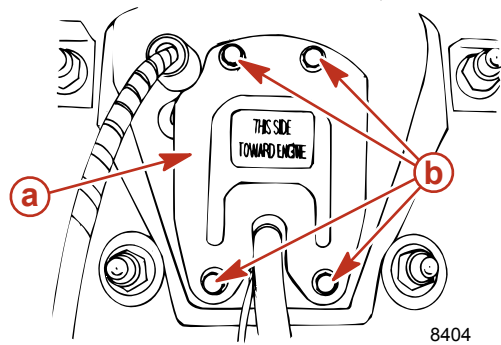


a - Exhaust pipe

b - Bolts and lockwashers (4)

| Description        | Nm | lb. in. | lb. ft. |
|--------------------|----|---------|---------|
| Exhaust pipe bolts | 34 |         | 25      |

6. **Through The Transom Exhaust Models:** Install block-off plate using 4 bolts and lockwashers. Torque bolts.



a - Block-off plate

b - Bolts and lockwashers (4)

| Description                   | Nm | lb. in. | lb. ft. |
|-------------------------------|----|---------|---------|
| Exhaust block-off plate bolts | 34 |         | 25      |

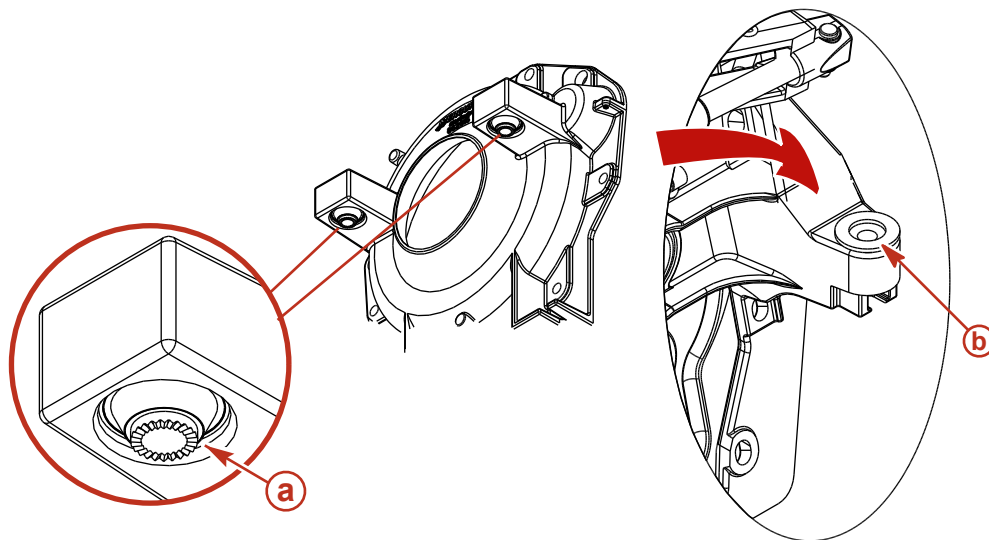
**NOTE:** Through the transom exhaust fittings can be installed at this time.



### ⚠ CAUTION

Avoid product damage caused by improper engine alignment. Improper engine alignment can be caused by mismatched flywheel housing mounts and inner transom plate mounting hardware. Ensure that the flywheel housing mounts and the inner transom plate mounting hardware, port and starboard, are the correct parts and match before installing the engine.

7. These models have new design mounts - knurled bottom surface: Use the fiber washer only. Do not use the double-wound lockwasher.



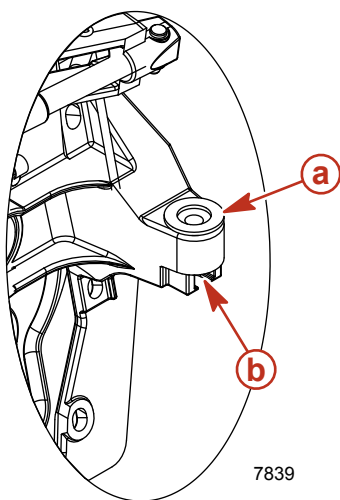
7960

**Typical flywheel housing, all similar**

**a** - Late style mount - knurled surface

**b** - Fiber washer

8. Position rear engine mount attaching hardware on inner transom plate mounts as shown.



7839

**a** - Fiber Washer (2)

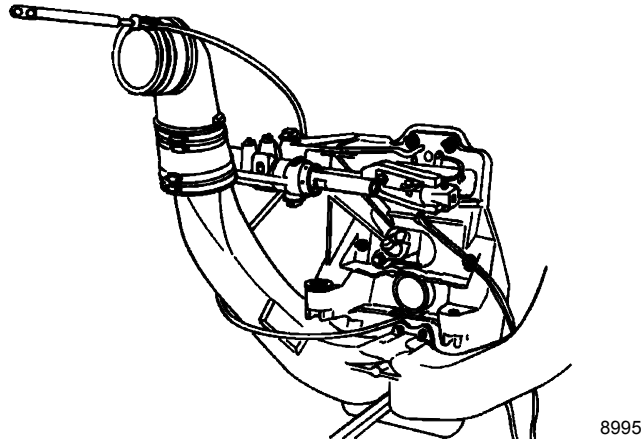
**b** - Locknut (2)

## Shift Cable Routing

1. Route the intermediate shift cable from the transom assembly to the shift actuator as follows:
  - a. The cable should come through the transom, above the exhaust pipe and make a turn toward the starboard side of the boat between the exhaust pipe and the engine flywheel housing.
  - b. The cable should then be routed under the starboard rear engine mount and turn toward the transom.

- c. The cable should then go up behind the power steering valve and loop over to the shift actuator on the engine.

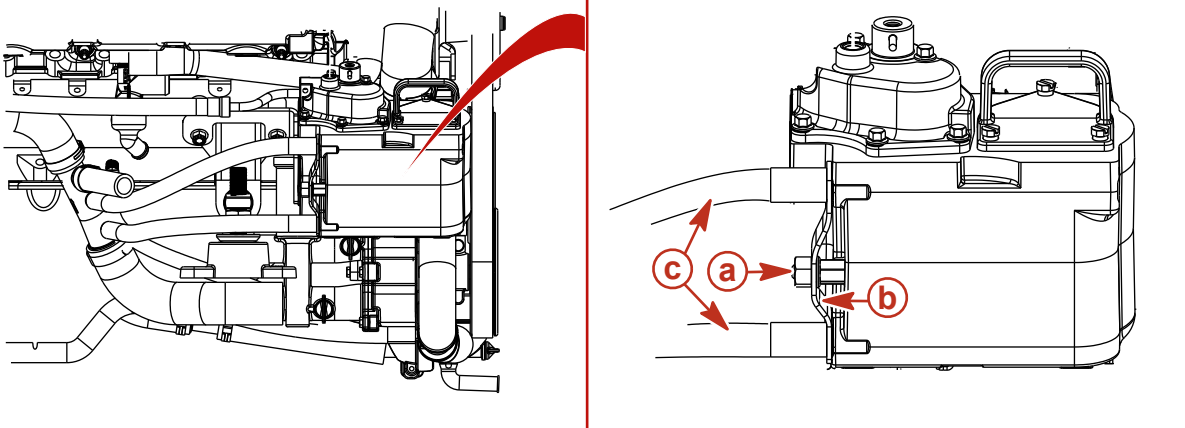
**NOTE:** Following this routing will prevent the engine coupler from damaging the cable.



Refer to **Section 8 - Remote Control**.

## Engine Preparation

1. To gain access to the starboard engine mount; loosen the captured nut from the hose retainer bracket and remove the bracket and water hose from the Gen III Cool Fuel Module.



**a** - Captured nut  
**b** - Retainer bracket

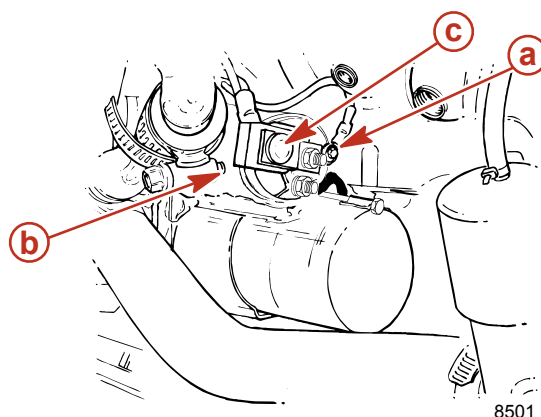
**c** - Water hose

2. Remove and read all tags attached to engine.
3. Remove all hardware that secures engine to shipping container.
4. Connect battery cables to engine. Observe the following:
  - a. Ensure that the grounding stud and starter solenoid terminal are free of paint or any other material that could cause a poor electrical connection.
  - b. Install battery positive (+) wire directly to the large starter solenoid stud.
  - c. After battery cables are connected, apply a thin coat of sealant to the terminals.

| Description  | Nm   | lb. in. | lb. ft. |
|--------------|------|---------|---------|
| Battery stud | 8-11 | 71-97   |         |

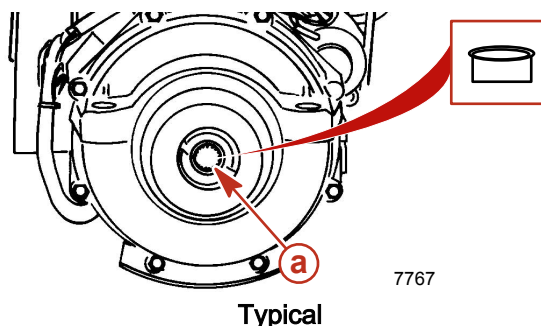
| Tube Ref No.                                                                           | Description     | Where Used        | Part No.   |
|----------------------------------------------------------------------------------------|-----------------|-------------------|------------|
|  25 | Liquid Neoprene | Battery terminals | 92-25711-3 |

- d. Slide rubber boot over positive (+) terminal after making connection.
  5. Drape battery cables over top of engine to prevent interference during installation.
- IMPORTANT: There is a fuse located at the starter solenoid. Do not remove this fuse.**



- a** - Positive (+) battery cable location      **c** - 90 amp fuse - Do not remove  
**b** - Starter solenoid

6. If not already done, remove shipping plug from coupler and lubricate splines.



- a** - Shipping plug

| Tube Ref No.                                                                           | Description                  | Where Used      | Part No.    |
|----------------------------------------------------------------------------------------|------------------------------|-----------------|-------------|
|  91 | Engine Coupler Spline Grease | Coupler splines | 92-802869A1 |

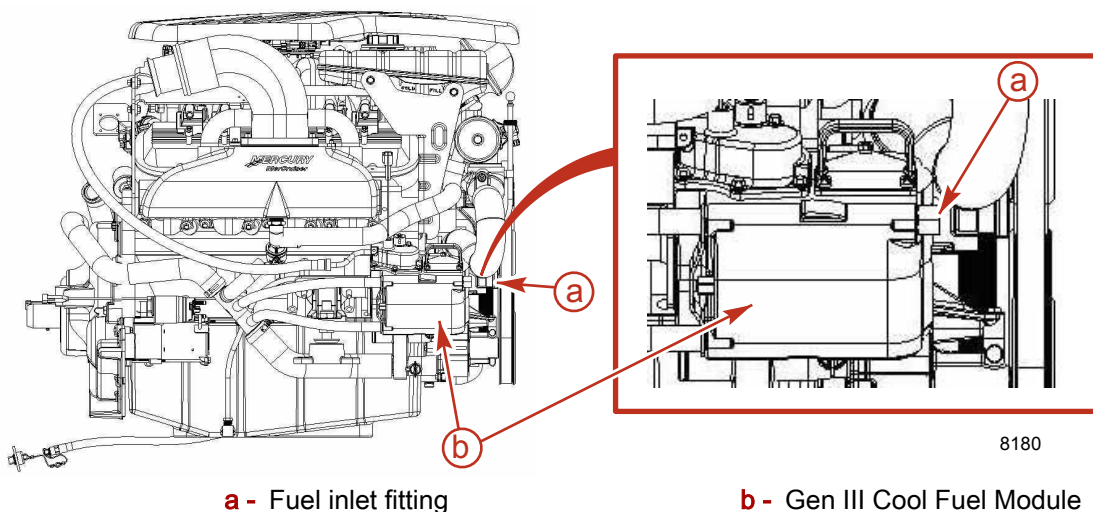
## Gen III Cool Fuel Module Inlet Fitting

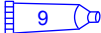
### **⚠ WARNING**

Overtightening the fuel inlet fitting can lead to fuel leaks, avoid severe personal injury or death from a gasoline fire or explosion. Do not use a power tool (i.e. impact wrench) to tighten the fuel inlet fitting.

1. Install a adaptor or a fitting to the brass inlet fitting of Gen III Cool Fuel Module. To prevent cracking the casting or causing fuel leaks, turn fuel inlet adaptor or fitting in by hand until finger-tight. Tighten the fitting an additional 1-3/4 to 2-1/4 turns with wrench. DO NOT OVERTIGHTEN.

**IMPORTANT:** Hold brass fuel inlet fitting with a suitable wrench while tightening the fuel inlet adaptor fittings.



| Tube Ref No.                                                                        | Description                  | Where Used         | Part No.  |
|-------------------------------------------------------------------------------------|------------------------------|--------------------|-----------|
|  9 | Loctite 567 PST Pipe Sealant | Fuel inlet fitting | 92-809822 |

| Description                   | Procedure                                                              |
|-------------------------------|------------------------------------------------------------------------|
| Fuel inlet adaptor or fitting | Finger-tight + 1-3/4 to 2-1/4 turns with a wrench. Do not overtighten. |

## Fuel Inlet Fitting

**IMPORTANT:** The following information is provided to ensure proper installation of brass fittings or plugs installed into fuel pump system.

- Use Loctite 565 Pipe Sealant with Teflon on threads of fuel inlet fittings or plugs. **DO NOT USE TEFLON TAPE.**

### WARNING

Avoid serious injury or death and property damage due to improper boat design and construction. Always adhere to all applicable Marine Regulations (United States Coast Guard [USCG], European Union - Recreational Craft Directive [EU-RCD], and so on) and the standards they reference (American Boat and Yacht Council [ABYC], Society of Automotive Engineers [SAE], International Standards Organization [ISO], and so on) when designing and constructing the boat and the boat components, such as the engine compartment, fuel delivery system and exhaust system.

### WARNING

Avoid gasoline fire or explosion. Improper installation of brass fittings or plugs into fuel pump or fuel filter base can crack casting and/or cause a fuel leak.

1. Remove plastic plug from fuel inlet hole.
2. Apply sealant to threads of fuel inlet fitting. **DO NOT USE TEFLON TAPE.**

### WARNING

Overtightening the fuel inlet fitting can lead to fuel leaks, avoid severe personal injury or death from a gasoline fire or explosion. Do not use a power tool (i.e. impact wrench) to tighten the fuel inlet fitting.

3. Install fuel inlet fitting in fuel pump or filter base. To prevent cracking the casting or causing fuel leaks, turn fuel inlet fitting in by hand until finger-tight. Tighten the fitting an additional 1-3/4 to 2-1/4 turns with wrench. **DO NOT OVERTIGHTEN.**

**IMPORTANT:** Hold brass fittings with a suitable wrench while tightening fuel inlet fittings.

| Tube Ref No.                                                                        | Description                  | Where Used         | Part No.  |
|-------------------------------------------------------------------------------------|------------------------------|--------------------|-----------|
|  9 | Loctite 567 PST Pipe Sealant | Fuel inlet fitting | 92-809822 |

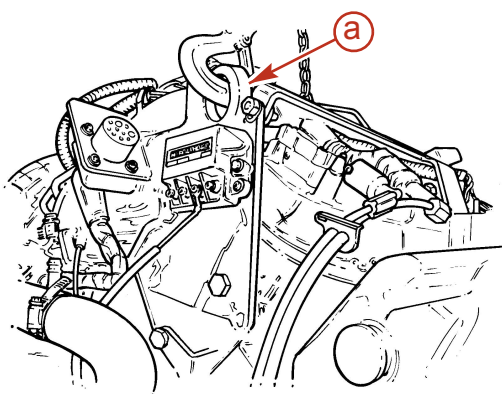
| Description        | Procedure                                                              |
|--------------------|------------------------------------------------------------------------|
| Fuel inlet fitting | Finger-tight + 1-3/4 to 2-1/4 turns with a wrench. Do not overtighten. |

### CAUTION

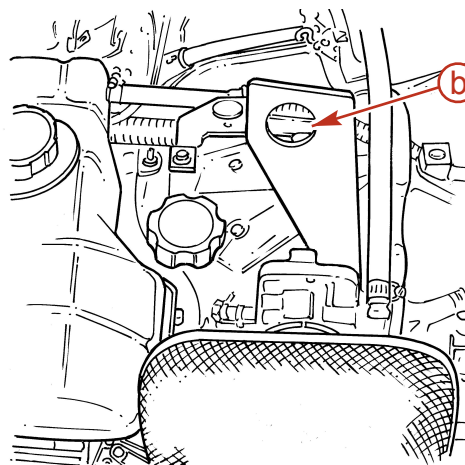
Engine compartment size may require the removal of additional components.

**NOTE:** An installation jig (91-806794A02) can be used to align and adjust engine mounts. Refer to instructions with fixture for proper use.

1. Attach a suitable sling to the front and rear lifting eyes on engine and adjust so that engine is level when suspended.



**a -** Rear lifting eye



8408

**b -** Front lifting eye

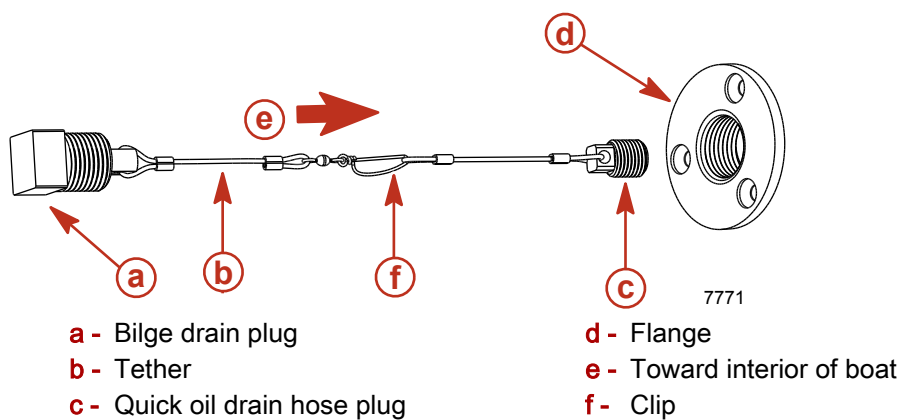
2. Lift engine into position (in boat) using an overhead hoist.
3. Align rear engine mounts with inner transom plate mounts while simultaneously aligning exhaust tube with exhaust pipe bellows.
4. To help with installation, apply lubricant into the exhaust tubes.

| To help with installation, apply lubricant into the exhaust tubes. | Exhaust tubes | Part Number    |
|--------------------------------------------------------------------|---------------|----------------|
| Liquid Soap                                                        | Exhaust tubes | Obtain locally |

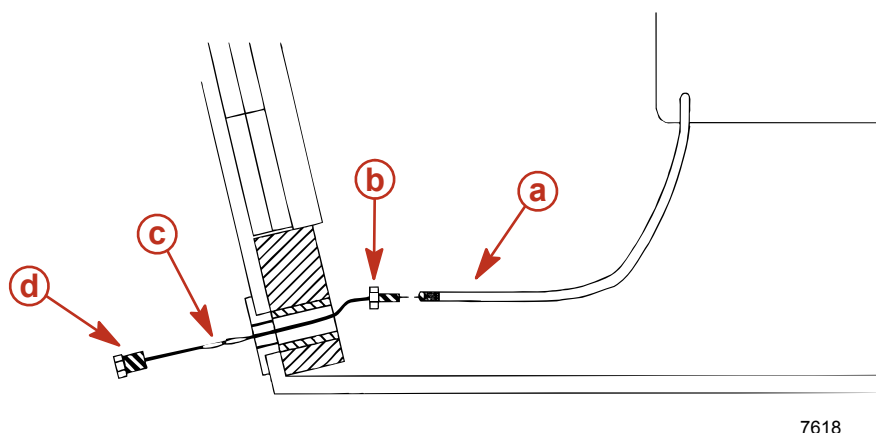
**IMPORTANT:** The quick drain oil fitting clearance must be greater than 13 mm (1/2 in.) from the engine compartment and boat bottom.

5. **If equipped with quick drain oil:** Ensure that the quick drain oil fitting has a clearance of more than 13 mm (1/2 in.) from the engine compartment and boat bottom.
6. **If clearance is 13 mm (1/2 in.) or less:** Remove the quick drain oil fitting and install the oil drain plug from parts bag directly into the engine oil pan.

7. If clearance is greater than 13 mm (1/2 in.):

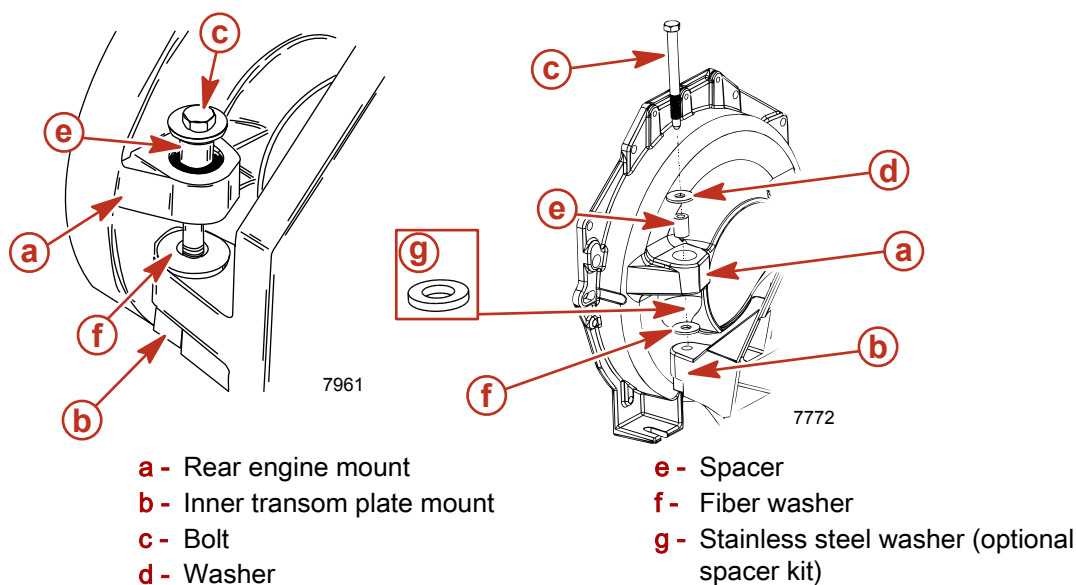


- a. Push end of oil drain hose out of boat hull through flange.
- b. Pull oil drain hose out until it is 30.48 cm (12 in.) from the flange.
- c. Move alignment clip on the oil drain hose and squeeze to position it on the hose just inside of the boat hull against the flange.
- d. Connect bilge drain plug to oil drain hose plug using clip.



- e. Push oil drain hose through flange into boat hull.
- f. Install bilge drain plug in hull.

8. Install both rear engine mounting bolts and hardware and torque. Do not relieve hoist tension.



| Description                | Nm | lb. in. | lb. ft. |
|----------------------------|----|---------|---------|
| Rear engine mounting bolts | 47 |         | 35      |

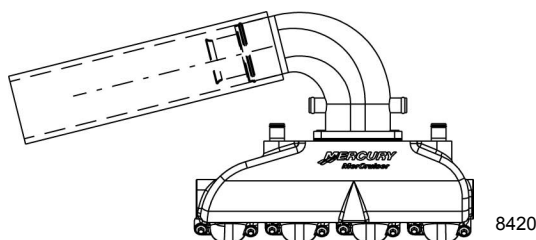
**IMPORTANT:** If quick drain oil fitting is within 13 mm (1/2 in.) of boat bottom, remove fitting and install drain plug from parts bag directly into oil pan.

9. Ensure that the quick drain oil fitting is more than 13 mm (1/2 in.) above the boat bottom.
10. Loosen both adjusting nuts on front engine mounts to allow for adjustment during alignment.
11. Attach the front mounts to the stringers.
12. Remove the engine hoist.

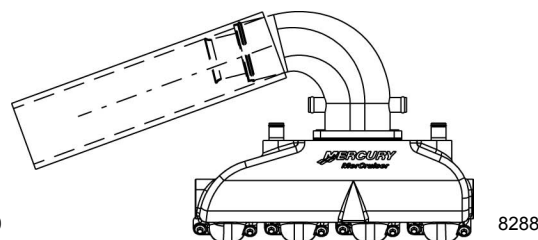
## Exhaust System Hose / Tube Connection

### ⚠ CAUTION

Avoid exhaust hose failure which could cause exhaust or discharge water to enter the boat. Discharge water from the exhaust elbow must flow without restriction around the entire inside diameter of the exhaust hose to avoid causing hot spots which could eventually result in a burned-through exhaust hose. Connect the exhaust hoses and tubes to the exhaust elbows so that they do not restrict the flow of discharge water from the exhaust elbows.



Correct alignment

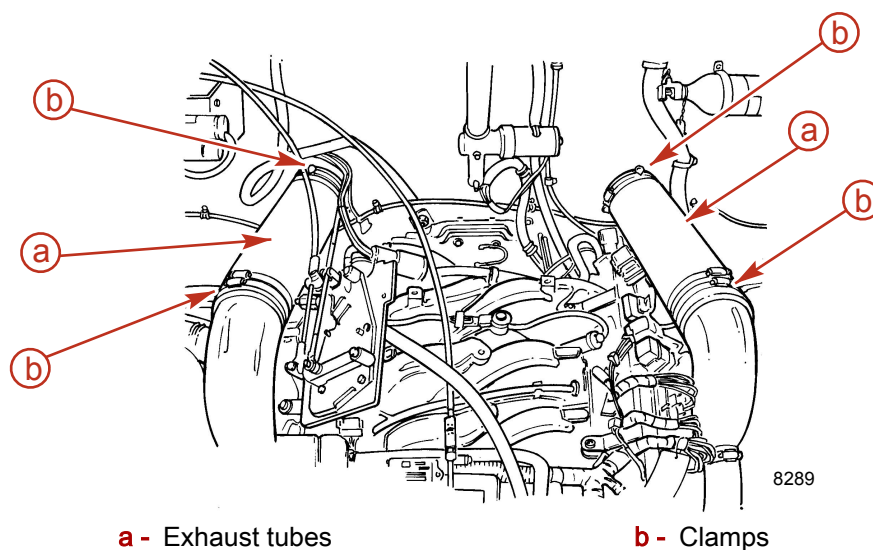


Incorrect connection

**IMPORTANT:** Exhaust hoses/tubes should be secured at each connection with at least 2 hose clamps.

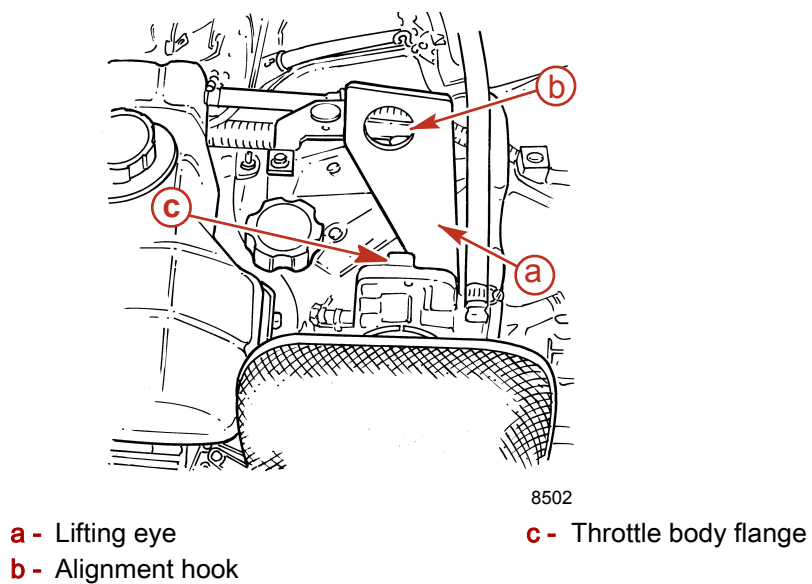


1. Tighten all exhaust hose and/or exhaust tube clamps securely.



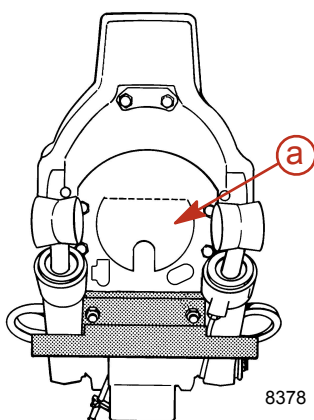
## Engine Alignment

1. Install the engine alignment hook (863375-1) to the hoist and the throttle body flange.





2. If applicable, open perforated area in bell housing dust cover.



**a** - Dust cover

### ⚠ CAUTION

Do not use an alignment tool from another manufacturer. Alignment tools other than Quicksilver Alignment Tool may cause improper alignment and damage to gimbal bearing and/or engine coupler.

### ⚠ CAUTION

To avoid damage to gimbal bearing, engine coupler, or alignment tool:

Do not attempt to force Quicksilver alignment tool.

Do not raise or lower engine with alignment tool inserted (or partially inserted) in gimbal bearing or engine coupler.

Do not raise engine mount bracket above top of engine mount stud.

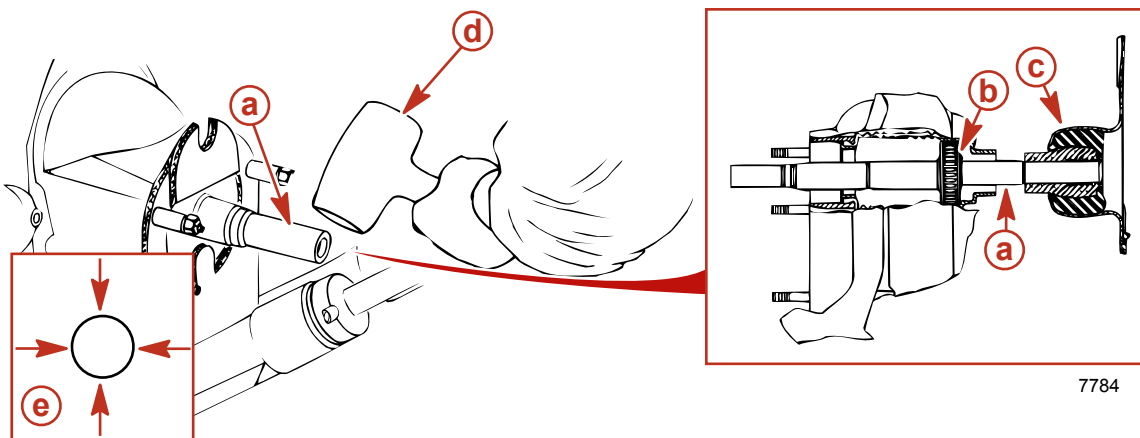
3. Attempt to insert the solid end of the Alignment Tool through the gimbal bearing and into the engine coupler splines.

|                         |              |
|-------------------------|--------------|
| Alignment Tool Assembly | 91-805475A 1 |
|-------------------------|--------------|

4. If the tool does not fit, remove it and carefully raise or lower the front end of the engine as necessary, and attempt to insert the Alignment Tool.

**NOTE:** It may be necessary to hit the Alignment Tool with a synthane hammer to set the gimbal bearing to the coupler.

5. If necessary, firmly strike the sides of the Alignment Tool at 90 degree increments to help align the gimbal bearing.



7784

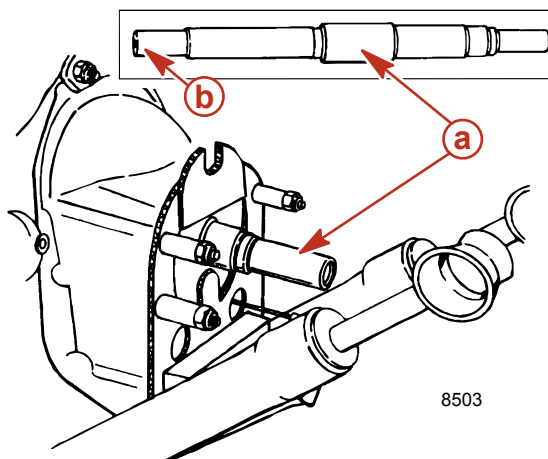
- a - Alignment Tool  
b - Gimbal bearing  
c - Engine coupler  
d - Hammer  
e - 90 degree increments

6. Repeat step 4. until the Alignment Tool installs easily (**SLIDES FREELY WITH MINIMAL EFFORT**) all the way into and out of engine coupler splines. Do not check by turning the alignment tool.

**IMPORTANT:** The finished boat stringer must position the front engine mount so that a minimum of 6 mm (1/4 in.) up or down adjustment exists after the mount is adjusted to contact the stringer. This allows for future engine alignment or adjustments. Make proper alterations to the boat stringer (structure) to obtain the 6 mm (1/4 in.) dimension.

**IMPORTANT:** Turn both front engine mount adjustment nuts an equal amount in direction required to align engine.

7. Adjust front engine mounts until they rest on boat stringers.  
8. Relieve hoist tension entirely and fasten both front mounts to boat stringer using 9 mm (3/8 in.) lag bolts.  
9. Recheck alignment with Alignment Tool. Tool must enter coupling splines freely. If not, readjust front mounts.

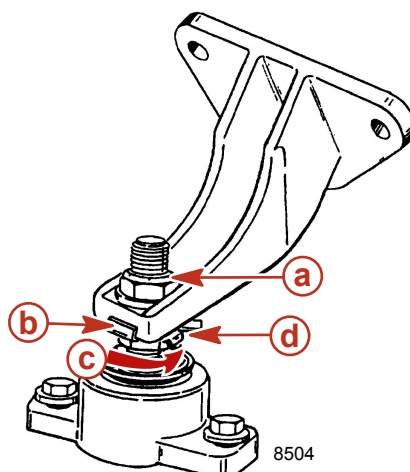


8503

- a - Alignment Tool (use only recommended Alignment Tool)  
b - End to be inserted through gimbal housing assembly

10. When alignment is correct, tighten locknut securely. Recheck alignment.

11. Bend tab down on adjusting nut.



**a** - Nut and lockwasher

**b** - Tab washer

**c** - Direction (counterclockwise) to raise front of engine

**d** - Adjustment nut

12. Remove Alignment Tool. If not installing drive, fold bell housing dust cover flap back into place and tape shut for boat shipment. Dust cover flap will have to be removed before operating engine.

13. Remove the engine alignment hook from the engine.

## Electrical Connections

### ⚠ CAUTION

Avoid damage to the electrical system components caused by improper work or diagnostic practices. Observe the following precautions when working on or around an electrical harness, or when adding electrical accessories:

- Do not tap electrical accessories into the engine electrical harness.
- Do not puncture (probe) wires for testing.
- Do not reverse battery leads.
- Do not splice wires into the electrical harness.
- Do not attempt diagnostics without proper, approved service tools.

**IMPORTANT:** When routing all wire harnesses and hoses, ensure that they are routed and secured to avoid coming in contact with hot spots on engine and to avoid contact with moving parts.

| Tube Ref No.                                                                                                                                                               | Description     | Where Used                 | Part No.   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------|------------|
|  25  | Liquid Neoprene | All electrical connections | 92-25711-3 |

## SMARTCRAFT PRODUCT

A Mercury SmartCraft System instrument package can be purchased for this product. A few of the functions the instrument package will display are engine RPM, coolant temperature, water pressure, battery voltage, fuel consumption and engine operating hours.

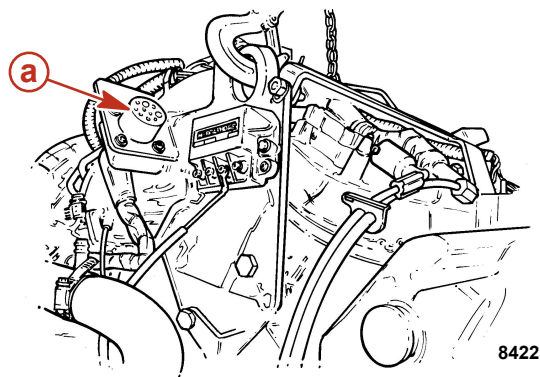
The SmartCraft Instrument package will also aid in Engine Guardian diagnostics. The SmartCraft Instrument package will display critical engine alarm data and potential problems.

Refer to the **Mercury SmartCraft Operator's Supplement** (90-10229023) for the warning functions monitored and basic operation of the SmartCraft Instrument package. Refer to the instructions included with the instruments for installation instructions.

## ENGINE HARNESS

**IMPORTANT:** 14 pin wiring harness cannot supply accessory power without relay and harness kit.

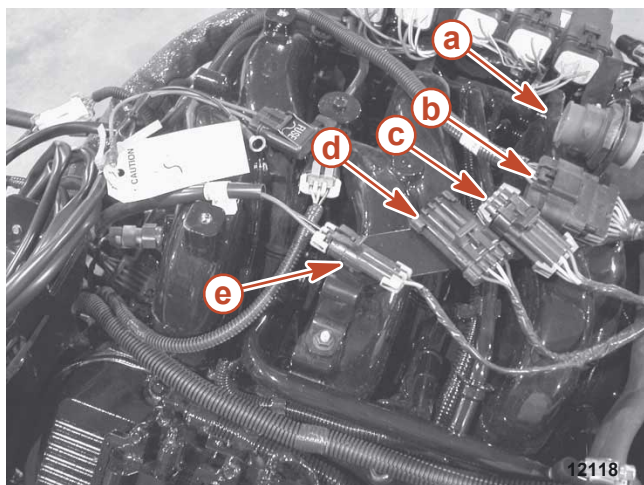
1. Route instrumentation wiring harness back to engine, making sure that harness does not rub or get pinched. If an extension harness is required, be sure to secure connection properly.
2. Fasten harnesses to boat at least every 45.7cm (18 in.) , using appropriate fasteners.
3. Models with 10 pin harness or SmartCraft Harness: Place hose clamp over instrumentation wiring harness.
4. Connect instrumentation wiring harness to engine harness plug. Secure connection with hose clamp.



Typical round 10 pin harness shown

**a** - Engine harness plug

5. Tighten hose clamp to secure wiring harness to engine harness plug.
6. Models with 14 Pin Harness: Connect instrumentation wiring harness to engine harness plug.
  - a. Connect the transom harness connector.
  - b. Connect the depth transducer connector to the DLC/Depth transducer connector on the engine harness.
  - c. Connect the paddle wheel/tank level connector.
  - d. Connect the power harness (Clean Power w/ 5 amp fuse) connector (DTS only).



14 pin harness connections

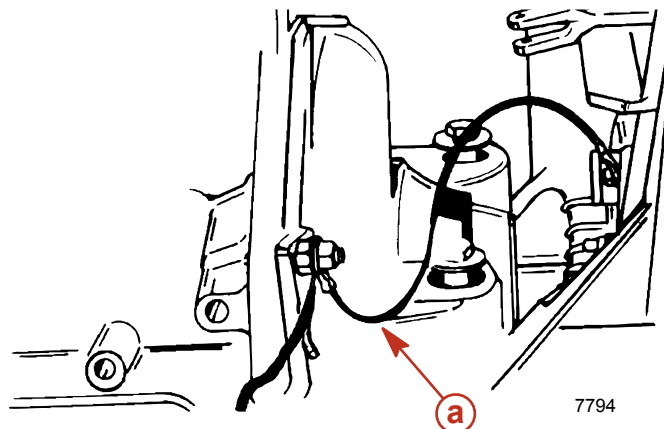
**a** - Engine harness connector  
**b** - Transom harness connector  
**c** - Paddle wheel/Tank level connector

**d** - DLC/Depth transducer connector  
**e** - Power harness connector/Clean Power w/ 5 amp fuse (DTS only)

## CONTINUITY WIRE CONNECTION

1. Connect continuity circuit wire from engine to transom assembly.

**IMPORTANT:** Do not attach any accessory ground (-) wires to transom plate ground point. Accessory ground wires can only be attached to ground stud on engine.



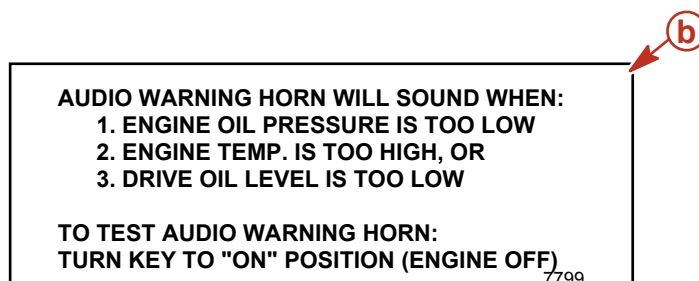
**a** - Continuity wire

## AUDIO WARNING SYSTEM

1. Place the large decal on the instrument panel or other appropriate location in easily viewed by the operator.



**APPLY THE PROPER DECAL TO THE DASHBOARD  
OR OTHER APPROPRIATE LOCATION:**



**a** - Small decal (transparent)

**b** - Larger decal

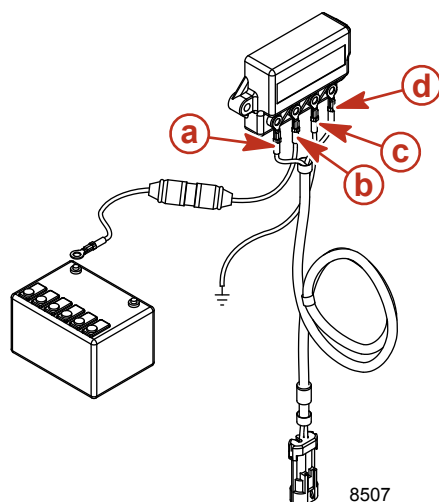
2. Test audio warning system during Pre-delivery Preparation section.

## MERCATHODE CONNECTIONS

### MERCATHODE CONNECTIONS

**IMPORTANT:** Opposite end of RED/PURPLE wire must be connected directly to battery positive (+) terminal. Do not connect it to a switched positive (+) circuit. MerCathode system must function continuously for proper corrosion protection.

1. Connect MerCathode controller assembly to positive (+) battery terminal.



**a** - ORANGE lead - from anode on transom assembly (part of quick connect)

**b** - RED/PURPLE wire - to positive (+) battery terminal

**c** - BLACK wire - from engine harness

**d** - BROWN wire - from electrode on transom assembly (part of quick connect)

| Tube Ref No.                                                                         | Description     | Where Used             | Part No.   |
|--------------------------------------------------------------------------------------|-----------------|------------------------|------------|
|  25 | Liquid Neoprene | MerCathode connections | 92-25711-3 |

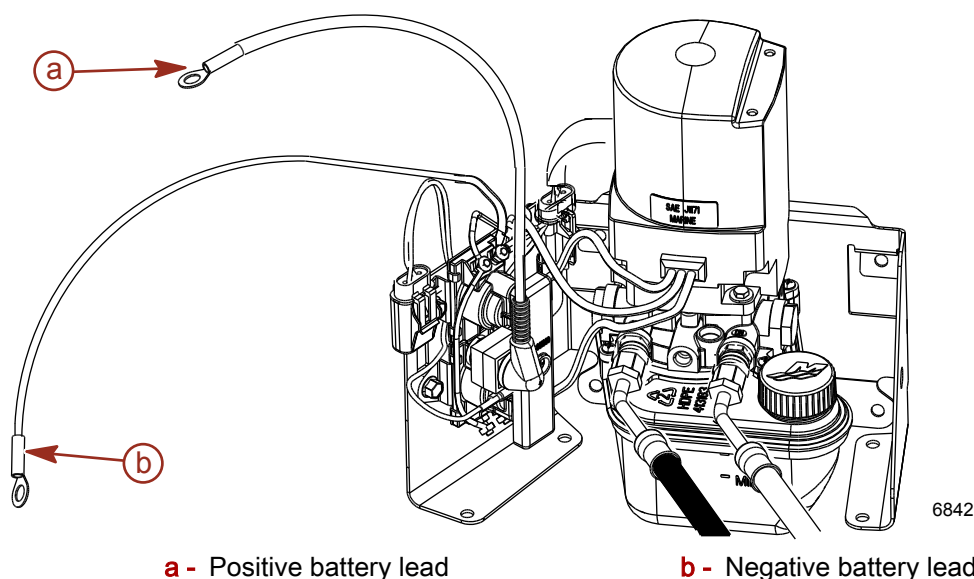
## BATTERY CABLES

**IMPORTANT: Engine electrical system is negative (-) ground.**

1. Connect engine positive (+) battery cable (usually RED) to positive (+) battery terminal.
2. Connect engine negative (-) battery cable (usually BLACK) to negative (-) battery terminal.

## POWER TRIM PUMP

1. Connect power trim pump BLACK (-) battery cable to negative (-) battery terminal and pump RED (+) battery cable to positive (+) battery terminal.



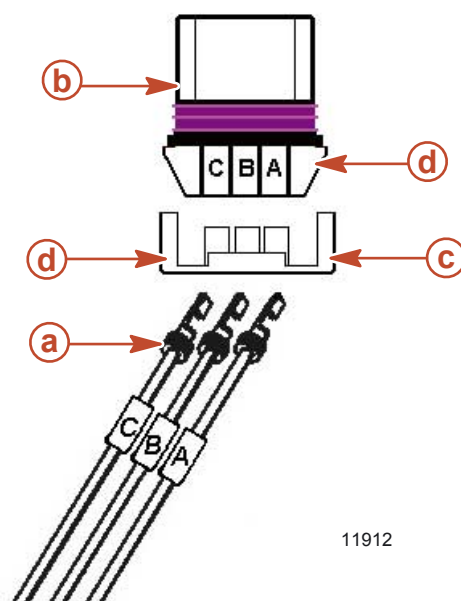
**a** - Positive battery lead

**b** - Negative battery lead

| Tube Ref No.                                                                         | Description     | Where Used        | Part No.   |
|--------------------------------------------------------------------------------------|-----------------|-------------------|------------|
|  25 | Liquid Neoprene | Battery Terminals | 92-25711-3 |

## TRIM LIMIT / SENDER HARNESS

1. Install the harness terminal leads into the trim limit/sender harness terminal connector block as follows:
  - a. Insert the terminal lead "A" into the terminal marked "A" on the terminal connector. Push the terminal lead into the terminal block until the terminal lead clicks into place and cannot be pulled out.
  - b. Repeat Step a. for terminals "B" and "C" ensure that all 3 terminals are securely locked in place.
  - c. Place the terminal lead retaining clip over the leads at the rear of the terminal connector block.
  - d. Push the the retaining clip onto the terminal connector block until it snaps into place over the locking tabs located on either side of the terminal connector block.
  - e. Connect the trim limit/sender connector to the transom harness connector at the engine.



11912

- a** - Trim limit/sender harness terminal lead  
**b** - Terminal connector block

- c** - Retaining clip  
**d** - Locking tab

## Fluid Connections

### Gear Lube Monitor Connection

**IMPORTANT:** Avoid using excessive hose when routing it to gear lube monitor. Hose should be routed directly to oil reservoir in as straight a line as possible to avoid low spots (traps) in the system.

#### ⚠ CAUTION

Ensure that hose is not kinked when connecting in the following step. If hose is kinked, gear lube monitor will not function properly and damage to sterndrive unit could occur.

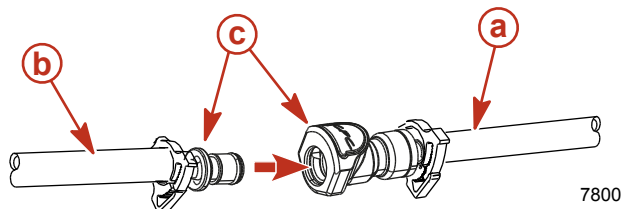
1. Locate the gear lube monitor quick connect at the rear of the engine.



2. Locate the gear lube monitor quick connect at transom.

**IMPORTANT:** Hose must not come in contact with steering system components, engine coupler, U-joint shaft, or drive shaft.

3. Fasten the quick connect.



**a** - Gear lube monitor hose assembly from transom

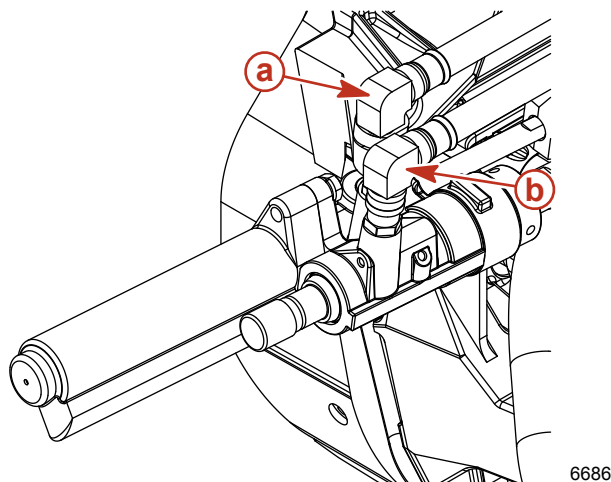
**c** - Quick connect fitting

**b** - Gear lube monitor hose assembly from gear lube monitor

## Power Steering Hoses

**IMPORTANT:** Make hydraulic connections as quickly as possible to prevent fluid leaks.

1. Disconnect the quick connect fittings on the power steering hoses.
2. Connect the power steering hoses to the control valve. Ensure that the quick connects snap into place.
3. Route hoses as appropriate to avoid contact with the steering system components.
4. Use extra hose clips to secure hose to transom.



**Models with one hose routed behind power steering control valve**

**a** - Pressure hose

**b** - Return hose

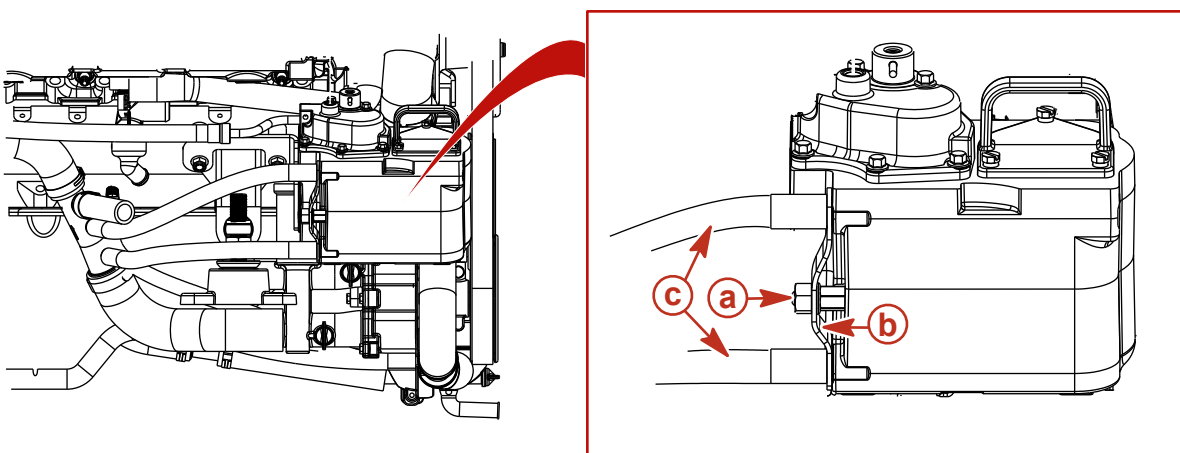
**NOTE:** Power Steering Fluid can be added at this time if desired.

## Gen III Cool Fuel Module Water Hose Connection

1. Install water hose and hose retainer bracket to the Gen III Cool Fuel Module. Secure with captured nut.



2. Torque the captured nut.



8208

- a** - Captured nut  
**b** - Retainer bracket

- c** - Water hose

| Description               | Nm | lb. in. | lb. ft. |
|---------------------------|----|---------|---------|
| Gen III Cool Fuel Module. | 19 | 168     |         |

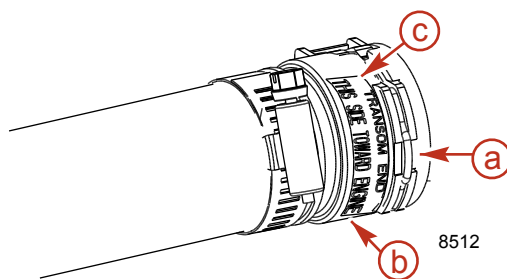
## Bravo Seawater Cooled Models Using Sterndrive Water Pickups

### ⚠ CAUTION

Excess water in the bilge can damage the engine or cause the boat to sink. An improperly connected seawater inlet hose could result in excess water in the bilge. Ensure that the seawater inlet hose is connected properly by performing the specified pull test.

**NOTE:** The retainer clip must be in the closed position prior to installation.

1. Install the seawater inlet hose assembly to the water inlet fitting.
  - a. Position the retainer clip in the closed position.



Seawater inlet hose assembly

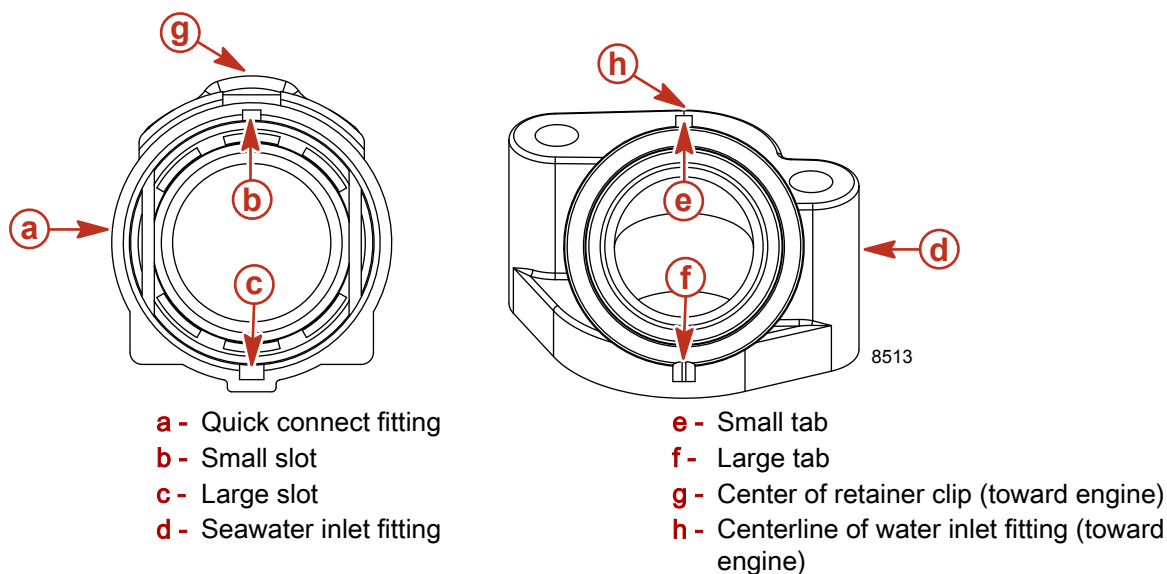
- a** - Retainer clip closed  
**b** - Quick connect fitting

- c** - Hose decal

- b. Position the seawater inlet hose assembly with the center of the retainer clip and the hose decal toward the engine.

**IMPORTANT:** Tabs and slots are sized to only mate at the correct orientation. Mate the small tab with the small slot.

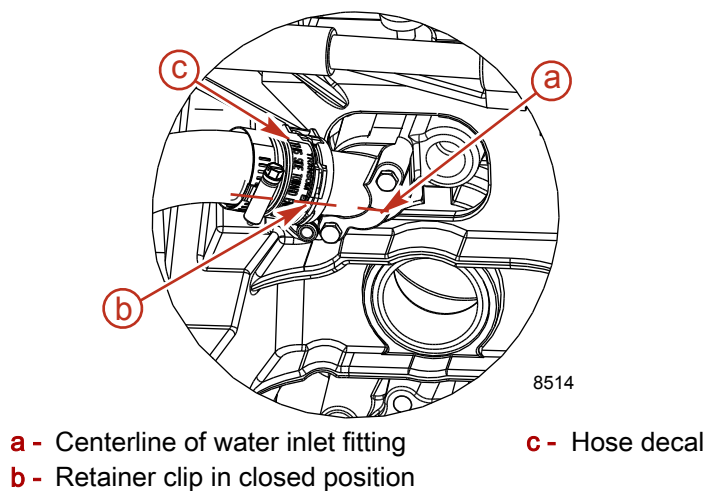
- c. Align the slots of the quick connect fitting to the tabs of the water inlet fitting.



- d. Ensure that the center line of the water inlet fitting and the center of the retainer clip are positioned toward the engine.

2. Push the seawater inlet hose assembly onto the water inlet fitting until connected.

**NOTE:** The retainer clip snaps into place and resumes the closed position when properly connected.



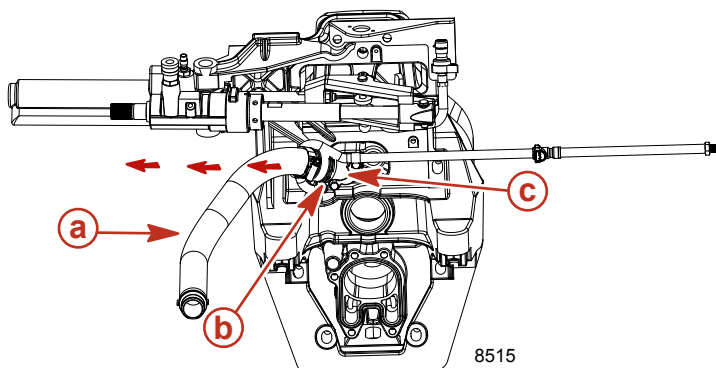
### ⚠ CAUTION

Excess water in the bilge can damage the engine or cause the boat to sink. An improperly connected seawater inlet hose could result in excess water in the bilge. Ensure that the seawater inlet hose is connected properly by performing the specified pull test.

**IMPORTANT:** A pull test must be performed at the seawater inlet connection.

3. Perform a pull test on the water hose quick connection.

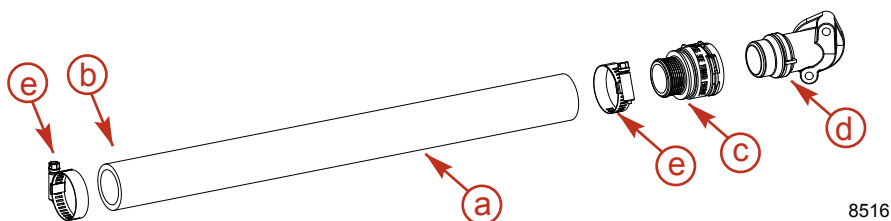
- a. Pull on the seawater inlet hose near the connection point with an approximate force of 111 N (25 lbf). If the seawater inlet hose does not become separated from the seawater inlet fitting when force is applied, the seawater inlet hose is connected and sealed properly.



- a** - Seawater inlet hose  
**b** - Quick connect fitting  
**c** - Seawater inlet fitting

- b. If the seawater inlet hose does become separated from the seawater inlet fitting, reinstall as specified.
  - c. When all steps have been completed, check for any leaks at this connection.
4. Connect the seawater inlet hose to the engine seawater pump.

**NOTE:** The seawater inlet hose connects to the engine and the transom.



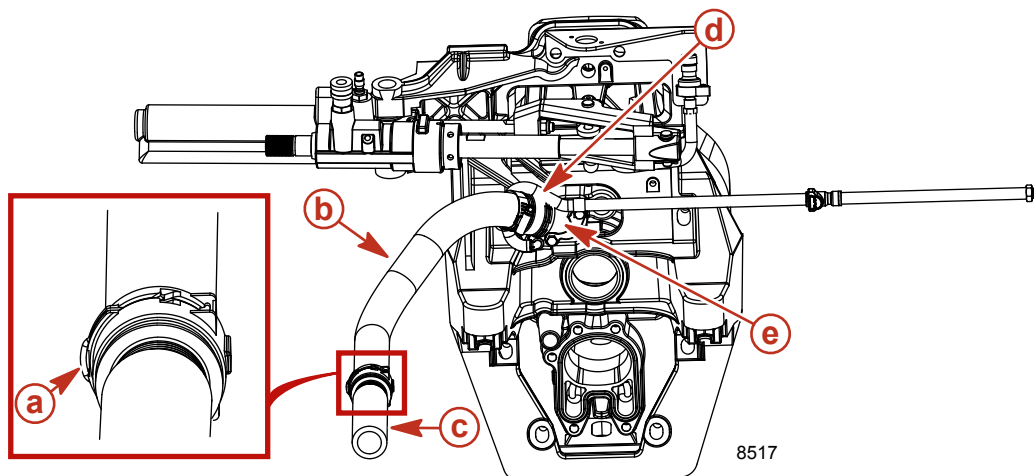
**Seawater inlet hose assembly**

- a** - Seawater inlet hose  
**b** - To engine  
**c** - Quick connect fitting  
**d** - Seawater inlet fitting  
**e** - Hose clamps

5. Models Using The Seawater Extension Hose Assembly:

**NOTE:** The seawater inlet hose connects to the engine and the transom, the seawater extension hose assembly connects to the transom and the seawater inlet hose.

- a. When connecting the seawater extension hose assembly to the seawater inlet hose assembly, position the center of the retainer clip away from the engine.



a - Retainer clip position (away from engine)

b - Seawater extension hose

c - Seawater inlet hose (to engine seawater pump)

d - Quick connect fitting (to seawater inlet fitting)

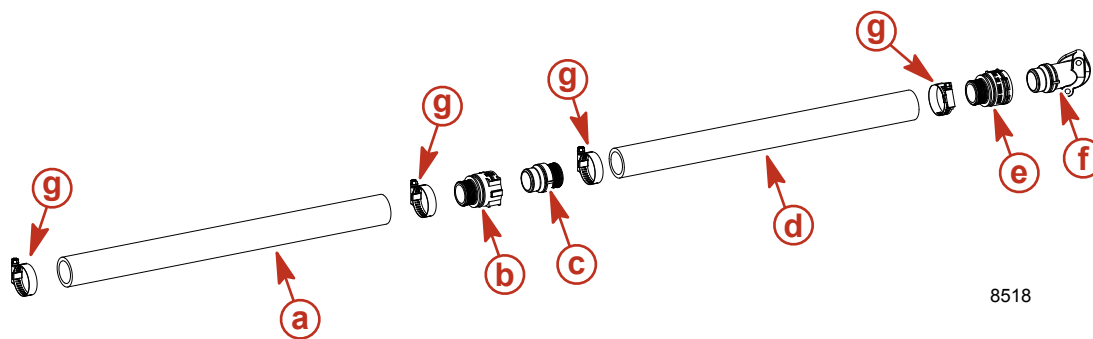
e - Seawater inlet fitting (to transom)

### ⚠ CAUTION

Excess water in the bilge can damage the engine or cause the boat to sink. An improperly connected seawater inlet hose could result in excess water in the bilge. Ensure that the seawater inlet hose is connected properly by performing the specified pull test.

- b. Perform a pull test and ensure that the requirements for checking the integrity of the connection are met.

**NOTE:** The seawater extension hose assembly connects to the transom and the seawater inlet hose.



a - Seawater inlet hose

b - Quick connect fitting to extension hose

c - Quick connect male fitting

d - Extension hose

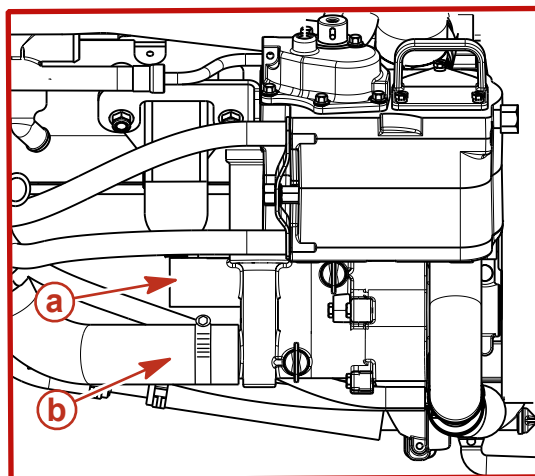
e - Quick connect fitting to seawater inlet fitting

f - Seawater inlet fitting

g - Hose clamp

## Seawater Pump Pickup Connection

1. Remove shipping cap and connect the seawater inlet hose to the upper hose fitting of the seawater pump.



9321

### Seawater Pump Connections

**a -** Seawater inlet hose fitting

**b -** Seawater (out) hose to cooler

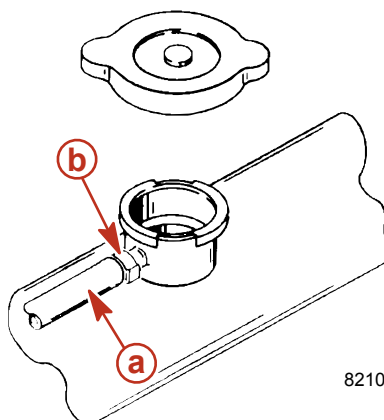
## Coolant Recovery System

**NOTE:** This section applies to Closed Cooled models only.

### ⚠ CAUTION

Avoid engine overheating and subsequent damage to the engine. The coolant recovery system will operate properly only when the connections are completely sealed. Ensure that the plastic tubing connections are completely sealed.

1. Connect plastic tubing to bayonet fitting on heat exchanger. Secure with tubing clamp provided.



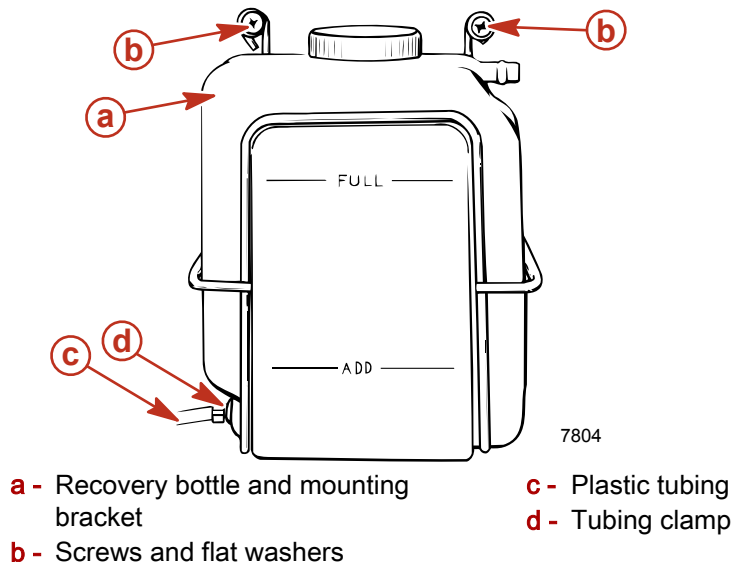
8210

**a -** Plastic tubing

**b -** Tubing clamp

2. Remove cap from coolant recovery reservoir and fill to FULL mark with coolant solution.
3. Reinstall cap.
4. Select a mounting location for coolant recovery bottle and mounting bracket that meets all of the following:
  - Within limits of clear plastic tubing.
  - Level with or above the heat exchanger fill neck.

- Accessible for observing coolant level and filling.
5. Mount coolant recovery bottle and mounting bracket in desired location using two 19 mm (3/4 in.) long screws and flat washers.
  6. Route plastic tubing to recovery bottle. Ensure that tubing is positioned away from any moving parts. Cut plastic tubing as required and connect to bottom connection on recovery bottle and secure with tubing clamp provided.
  7. Fasten plastic tubing to boat, as necessary, with 2 hose clips and 13 mm (1/2 in.) long screws (provided).



## Fuel Connection To Fuel Supply

A flexible fuel line must be used to connect fuel line to engine to absorb deflection when engine is running.

1. Connect the flexible fuel line from the boat fuel supply to the engine inlet fuel fitting.

**IMPORTANT:** Hold the fuel inlet fitting stationary with a suitable wrench while tightening the fuel lines.

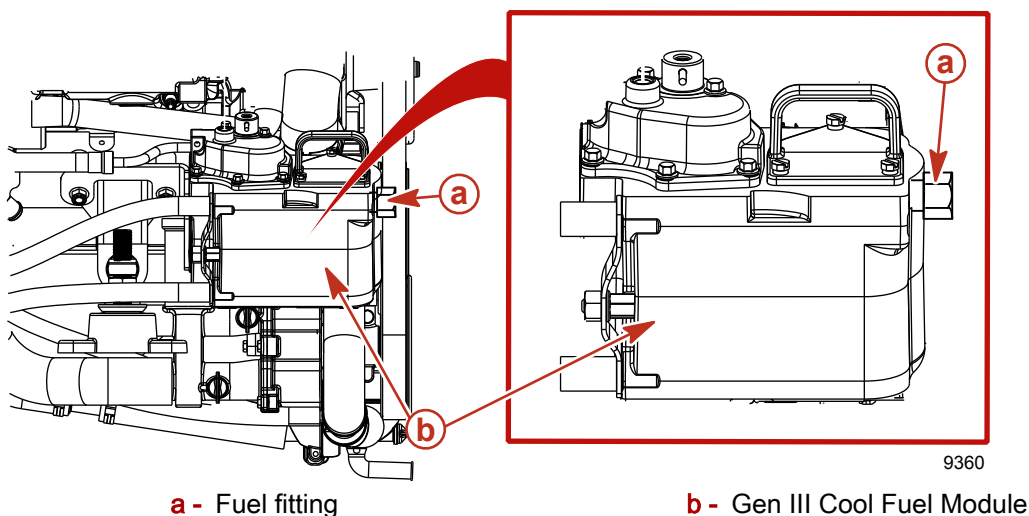
## Fuel Line Connection To Gen III Cool Fuel Module

### FUEL LINE CONNECTION

A flexible fuel line must be used to connect fuel line to engine to absorb deflection when engine is running.

1. Remove shipping plug.
2. Connect the flexible fuel line to the Gen III Cool Fuel Module fitting.

**IMPORTANT:** Hold fuel inlet fitting stationary with a suitable wrench while tightening the fuel line.



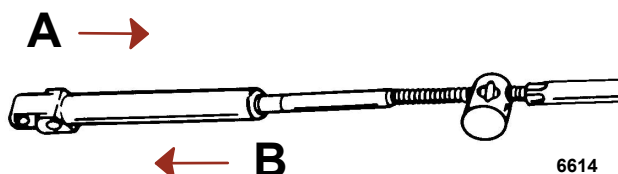
## Bravo Model Shift Cable Installation

### Bravo Models Shift Cable Installation

**NOTE:** *Bravo Models Only:* Using Adjustment Tool (91-12427), shift cables can be adjusted without or with the sterndrive installed, using the following procedure.

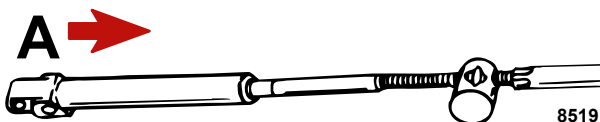
**IMPORTANT:** Sterndrive unit propeller rotation is determined by the shift cable installation in the remote control.

- **Bravo One/Two** - If shift cable end guide moves in direction A when control lever is placed in FORWARD, remote control is set up for RIGHT-HAND (RH) propeller rotation.
- **Bravo One/Two** - If shift cable end guide moves in direction B when control lever is placed in FORWARD, remote control is set up for LEFT-HAND (LH) propeller rotation.



Arrow indicates direction of motion

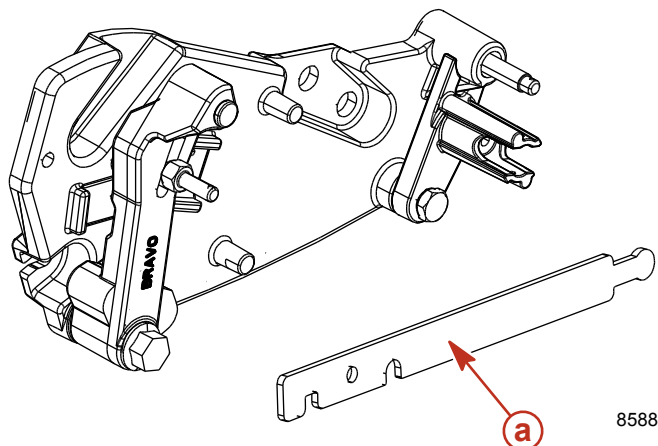
- **Bravo Three** - Front propeller on sterndrive unit is always LH Rotation and rear propeller is always RH Rotation. Shift cable end guide must move in direction A, when control lever is placed in FORWARD gear position.



**IMPORTANT:** When installing shift cables, ensure that cables are routed in such a way as to avoid sharp bends and/or contact with moving parts. Do not fasten any items to shift cables.

## Bravo Models Shift Cable Adjustment

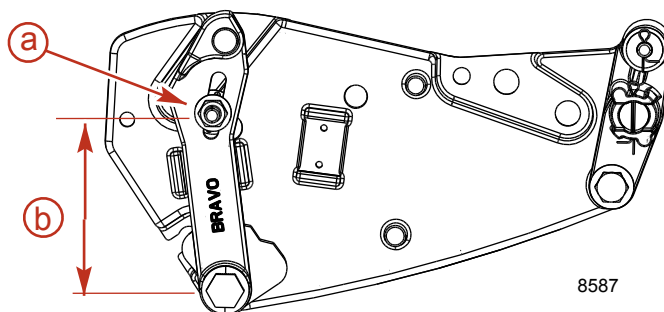
1. Remove the adjustment tool.



Typical Bravo shift bracket shown without switch

**a** - Adjustment tool

2. Loosen the adjustable stud and move it to dimension, as shown. Retighten stud.



Typical Bravo shift bracket shown without switch

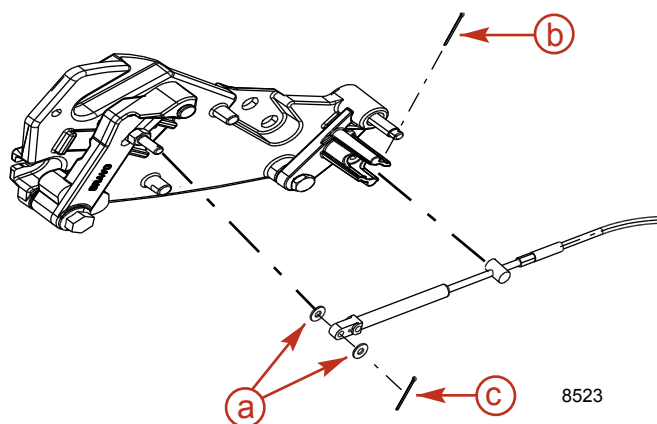
**a** - Adjustable stud

**b** - 76 mm (3 in.) (center of pivot bolt to center of stud)

3. Install sterndrive unit shift cable.
4. Install cotter pin.



5. Insert cotter pin from top and spread ends fully.



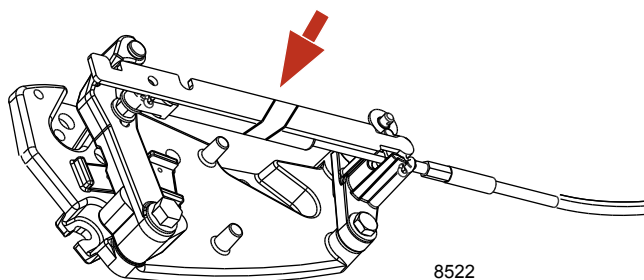
**Typical Bravo shift bracket shown without switch**

**a** - Washers (2)

**b** - Long cotter pin

**c** - Short cotter pin

6. Place adjustment tool over sterndrive unit shift cable, as shown. Hold tool in place using a piece of tape over the barrel retainer.



**Typical Bravo shift bracket shown without switch**

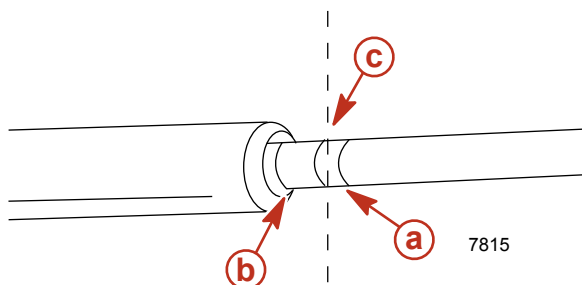
**a** - Adjustment tool

**b** - Sterndrive unit shift cable

7. Locate center of remote control and control cable play (backlash).

**IMPORTANT: Keep center mark "c" aligned with control cable end guide edge when making the following adjustment.**

- Shift remote control to NEUTRAL.
- Push in on control cable end with enough pressure to remove play and mark position "a" on tube.
- Pull out on control cable end with enough pressure to remove play and mark position "b" on tube.
- Measure distance between marks "a" and "b" and mark position "c" half-way between marks "a" and "b."

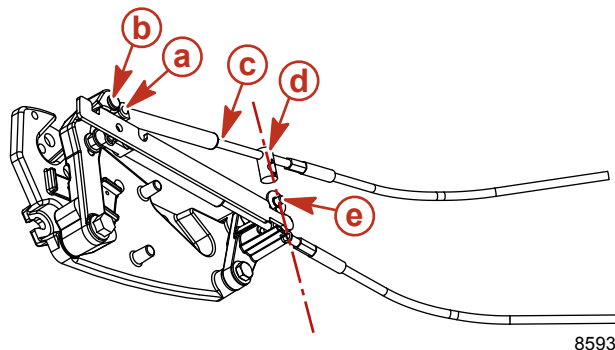


- Temporarily install control cable end guide into shift lever and insert anchor pin.
- Adjust control cable barrel so that hole in barrel centers with vertical center line of stud. Ensure that backlash center mark is aligned with edge of control cable end guide.

## ⚠ CAUTION

Do not attempt to install or remove control cable barrel from stud without first removing end guide anchor pin from shift lever and removing cable. Attempting to bend control cable to install or remove barrel will place undue stress on cable end guide and shift lever and damage to both could occur.

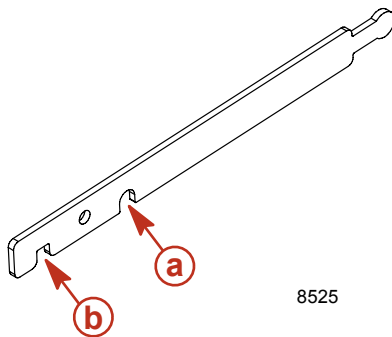
10. Remove control cable end guide from shift lever by removing clevis pin.



**Typical Bravo shift bracket shown without switch**

- |                                    |                                 |
|------------------------------------|---------------------------------|
| <b>a</b> - Control cable end guide | <b>d</b> - Control cable barrel |
| <b>b</b> - Clevis pin              | <b>e</b> - Stud                 |
| <b>c</b> - Backlash center         |                                 |

11. Install the control cable.
12. Install the washer and cotter pin to secure the barrel.
13. Install the clevis pin.
14. Install the cotter pin into the clevis pin from the top and spread the ends.
15. Remove the adjustment tool.
16. Shift remote control lever into FORWARD position. Place end of adjustment tool in barrel retainer. If slot does not fit over stud, loosen shift lever stud and slide stud up or down until slot in tool fits over stud. When adjustment is correct, retighten stud.
17. Lift the adjustment tool so that the slot is above the stud.
18. Shift the remote control into REVERSE and repeat the adjustment process.



- |                                                                                                  |                                                                                                     |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>a</b> - RH rotation Bravo One, Two, Three FORWARD, LH rotation Bravo One and Two REVERSE slot | <b>b</b> - LH rotation Bravo One and Two FORWARD, RH rotation Bravo One, Two and Three REVERSE slot |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|

19. Remove adjustment tool.
20. Ensure that all cotter pins are secure and that the ends of the cotter pins are spread to 180 degrees.
21. Lubricate shift cable pivot points.

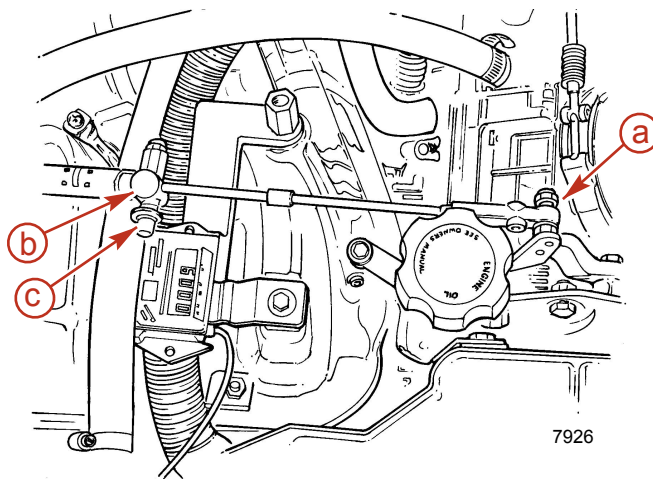
| Tube Ref No.                                                                         | Description        | Where Used               | Part No.       |
|--------------------------------------------------------------------------------------|--------------------|--------------------------|----------------|
|  80 | SAE Engine Oil 30W | Shift cable pivot points | Obtain Locally |

## Throttle Cable Installation And Adjustment

1. Place remote control handles in neutral idle position.

**IMPORTANT:** Ensure that cable is routed to avoid sharp bends and/or contact with moving parts. Do not fasten any items to throttle cable. Outer cable must be free to move when cable is actuated.

2. Install cable end guide on throttle lever, then push cable barrel end lightly toward throttle lever end. (This will place a slight preload on shift cable to avoid slack in cable when moving remote control lever.) Adjust barrel on throttle cable to align with hole in anchor plate. Ensure that hole in barrel positions cable as shown.



Typical

**a** - Flat washer and locknut

**c** - Flat washer and locknut

**b** - Cable barrel

3. Secure throttle cable with hardware as shown and tighten securely. Loosen locknut "a" 1/2 turn.
4. Place remote control throttle level in the wide open throttle (WOT) position. Ensure that throttle plates are completely open.
5. Return remote control throttle lever to idle position and ensure that throttle lever is completely closed.

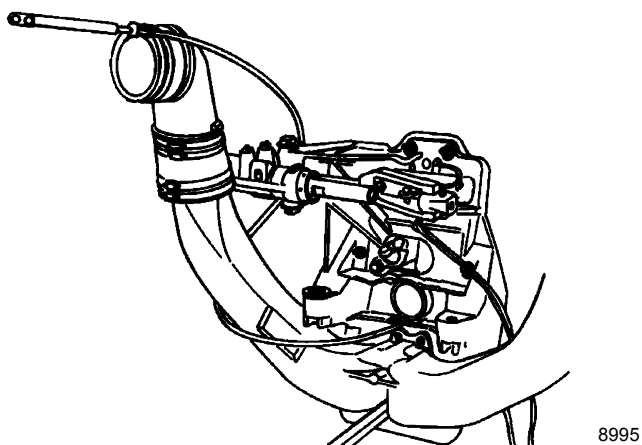
## Shift Cable Installation For DTS System

**IMPORTANT:** Do not move the shift cable stud on the shift arm.

**IMPORTANT:** The shift cable barrel is preset and **CANNOT** be adjusted.

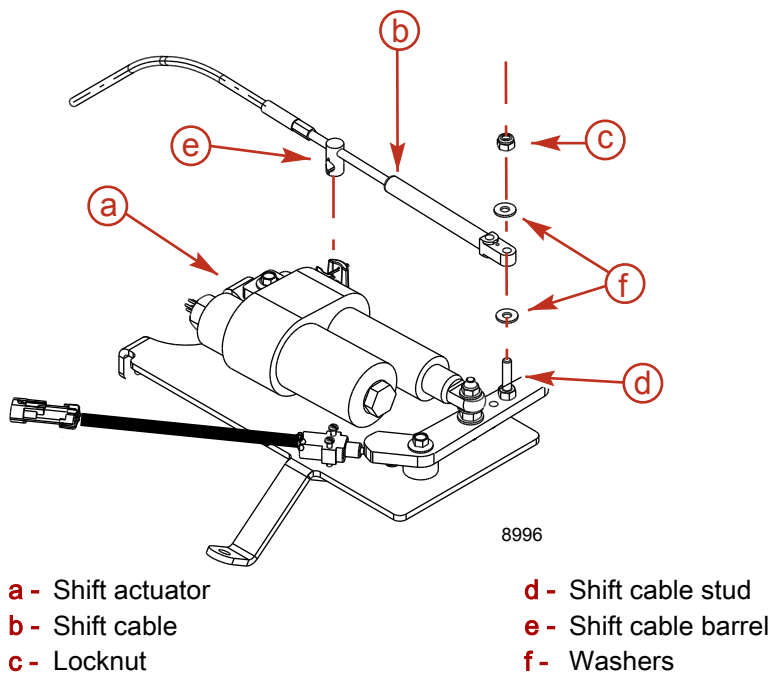
1. Route the intermediate shift cable from the transom assembly to the shift actuator as follows:
  - a. The cable should come through the transom, above the exhaust pipe and make a turn toward the starboard side of the boat between the exhaust pipe and the engine flywheel housing.
  - b. The cable should then be routed under the starboard rear engine mount and turn toward the transom.
  - c. The cable should then go up behind the power steering valve and loop over to the shift actuator on the engine.

**NOTE:** Following this routing will prevent the engine coupler from damaging the cable.

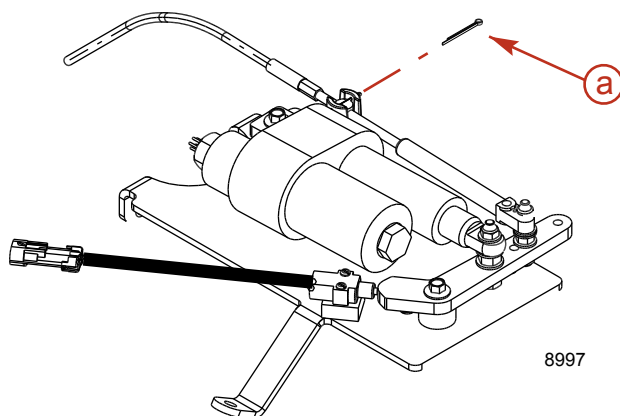


**NOTE:** A final check of the adjustments should be made with the boat in the water and engine running. If this cannot be done or is not done at your manufacturing facility, arrangement should be made with the dealer to do this as part of the pre-delivery inspection.

2. Install the intermediate shift cable to the shift actuator on the engine.
3. Tighten locknut until it contacts and then loosen 1/2 turn.



4. Insert cotter pin from top and spread ends.



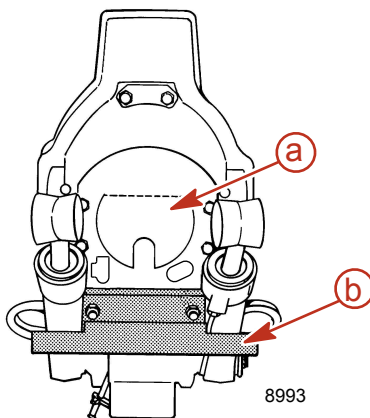
**a** - Cotter pin

## DTS System Installation

Refer to DTS System Installation section 7 - Electrical System

## Bravo Sterndrive Installation

1. If applicable, remove trim cylinder support and dust cover from bell housing studs. (Retain elastic stop nuts and flat washers.)

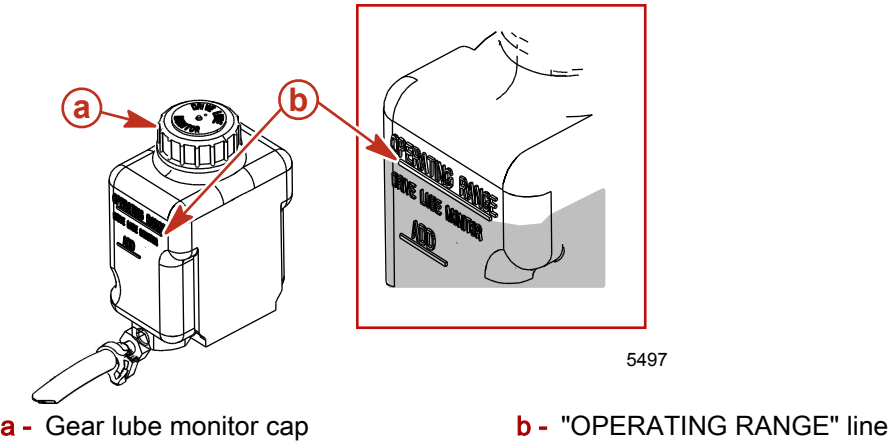


Typical

**a** - Dust cover

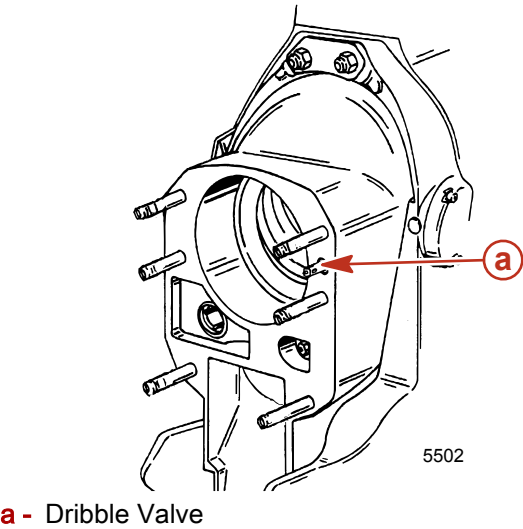
**b** - Trim cylinder support

2. Remove gear lube monitor cap. Fill the gear lube monitor to the "OPERATING RANGE".



| Tube Ref No.                                                                         | Description                     | Where Used        | Part No.    |
|--------------------------------------------------------------------------------------|---------------------------------|-------------------|-------------|
|  87 | High Performance Gear Lubricant | Gear Lube Monitor | 92-802854A1 |

3. To purge air from the system, push in on the dribble valve stem until the new gear lube appears.

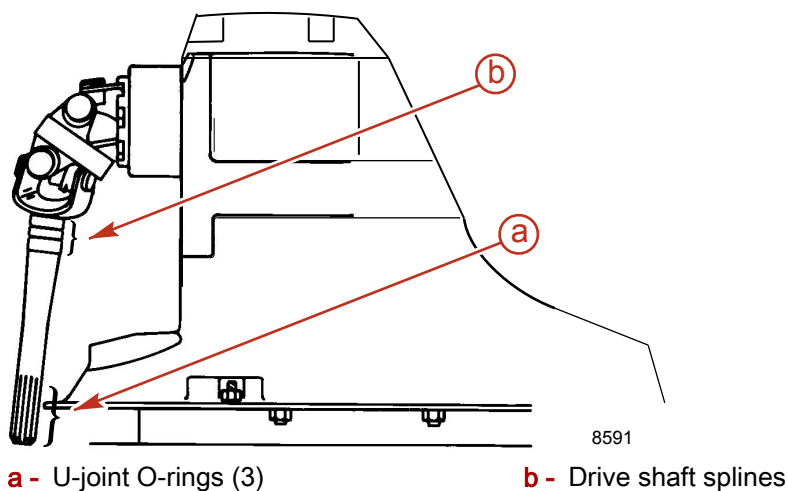


4. Release the dribble valve.
5. If the gear lube monitor is below the (full) line: Fill the gear lube monitor to the "OPERATING RANGE" (full) line with specified fluid. Do not overfill.

| Tube Ref No.                                                                           | Description                     | Where Used        | Part No.    |
|----------------------------------------------------------------------------------------|---------------------------------|-------------------|-------------|
|  87 | High Performance Gear Lubricant | Gear Lube Monitor | 92-802854A1 |

6. Install the gear lube monitor cap. Ensure that the rubber gasket is inside the monitor cap. Do not overtighten the cap.

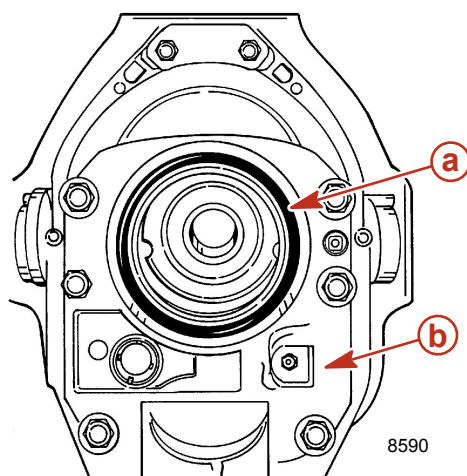
7. Coat sterndrive U-joint O-rings and drive shaft splines with grease.



| Tube Ref No.                                                                         | Description                  | Where Used          | Part No.    |
|--------------------------------------------------------------------------------------|------------------------------|---------------------|-------------|
|  91 | Engine Coupler Spline Grease | U-joint O-rings     | 92-802869A1 |
|  91 | Engine Coupler Spline Grease | Drive shaft splines | 92-802869A1 |

**IMPORTANT:** The edge of the U-joint bellows acts as a seal between the bell housing and the drive shaft housing. Ensure that the surface is not damaged.

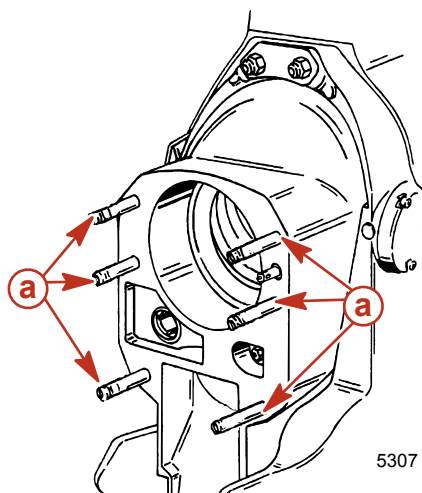
8. Ensure that the U-joint bellows are clean and free of debris.



**a** - U-joint bellows

**b** - Bell housing

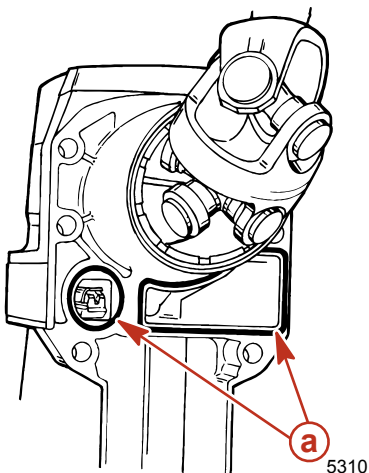
9. Lubricate the bell housing studs.



**a** - Bell Housing Studs (6)

| Tube Ref No.                                                                         | Description                        | Where Used         | Part No.    |
|--------------------------------------------------------------------------------------|------------------------------------|--------------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Bell Housing Studs | 92-802859A1 |

10. Lubricate the O-ring seals.

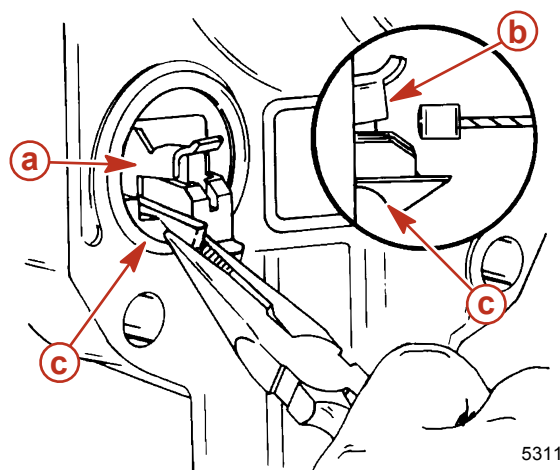


**a** - O-ring seals

| Tube Ref No.                                                                           | Description                        | Where Used   | Part No.    |
|----------------------------------------------------------------------------------------|------------------------------------|--------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | O-ring seals | 92-802859A1 |



11. Pull out shift linkage as far as it moves. Jaws will open.



**a** - Shift linkage assembly

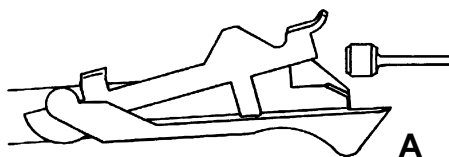
**b** - Jaws open

**c** - Underside of lower lip

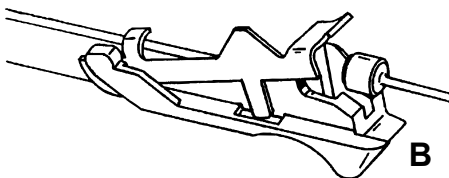
**IMPORTANT:** As sterndrive is inserted into sterndrive unit, entry of the bell housing shift cable must be closely checked to ensure that cable enters the jaws of shift linkage assembly in the sterndrive.

12. Place remote control in NEUTRAL position.

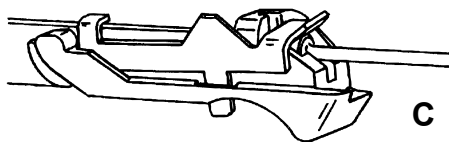
**NOTE:** As bell housing shift cable enters the shift linkage assembly, it pushes the assembly back into the sterndrive housing, and the jaw closes, securing the cable, as shown in steps "A", "B" and "C."



**A**



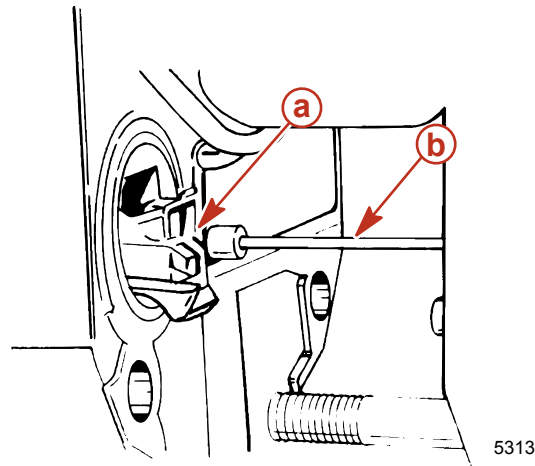
**B**



**C**

5312

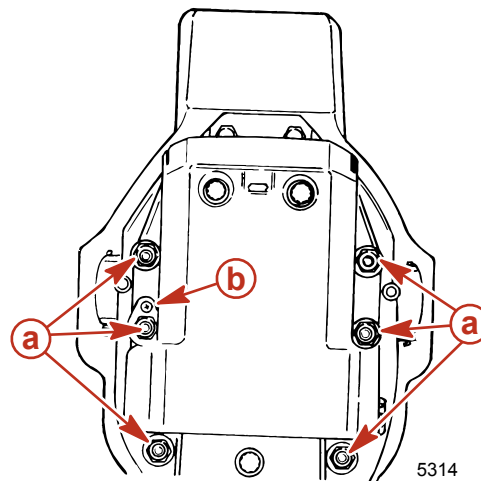
**IMPORTANT:** If bell housing shift cable does not line up to properly enter jaws of shift linkage assembly, use your hand to guide the cable into place while installing the sterndrive.



**a** - Shift linkage assembly

**b** - Shift cable

13. Place drive shaft housing in position on bell housing and install sterndrive unit, as follows:
  - a. Remove the nuts from the trim cylinders.
  - b. Position trim cylinders so they point straight backwards.
  - c. Position sterndrive so that universal joint shaft aligns with bell housing bore.
  - d. Guide U-joint shaft through bearing in gimbal housing and into engine coupler. Ensure that shift linkage jaws engage the bell housing shift cable assembly.
  - e. If necessary, rotate propeller shaft COUNTERCLOCKWISE slightly (using a propeller) to align U-joint shaft splines with splines in engine coupling, then slide sterndrive unit all the way into bell housing.
14. Secure sterndrive unit to bell housing with 5 flat continuity washers and 6 locknuts. Start from the center and torque the nuts.



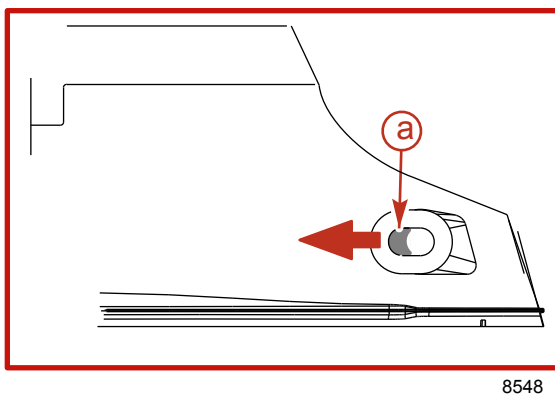
**a** - Locknut (6) flat continuity washers (5)

**b** - Ground plate (continuity washer not used here)

| Description               | Nm | lb. in. | lb. ft. |
|---------------------------|----|---------|---------|
| Sterndrive unit fasteners | 68 |         | 50      |

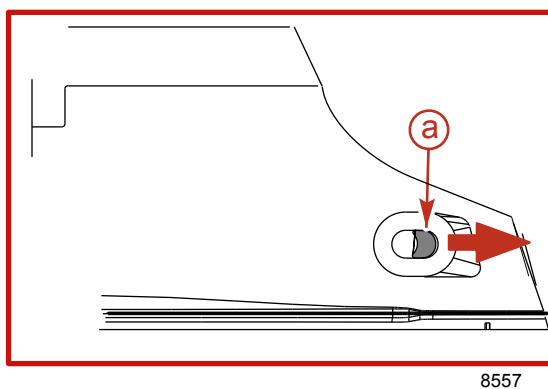
**IMPORTANT:** On Bravo One, Two and Three Models, the Trim-In Limit Insert must be properly positioned before installing the trim cylinder anchor pin in the following steps.

15. Ensure that the Trim-In Limit Insert is positioned as shown for the appropriate Bravo model.



Bravo One and Two (positioned forward)

a - Trim-in limit insert

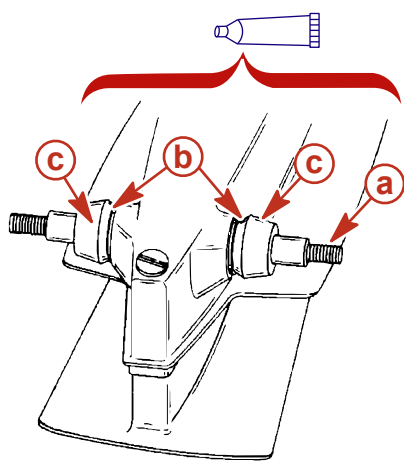


Bravo Three (positioned aft)

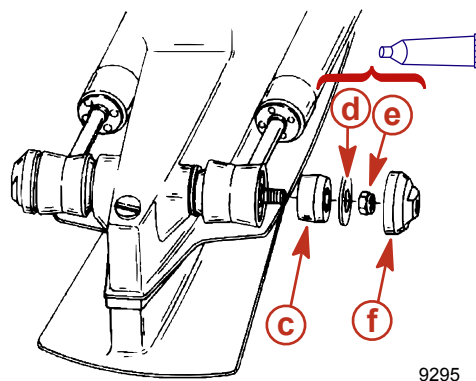
## Trim Cylinder installation

1. Install trim cylinders on aft end of sterndrive unit with hardware as shown.
2. Tighten the locknuts until the washer and locknut contact the shoulder on the anchor pin.
3. Install plastic caps and tighten hand-tight only.

**NOTE:** Upon installation of hardware apply lubricant to all components except plastic caps.



- a - Aft anchor pin
- b - Larger flat washers (2)
- c - Bushings (4)



- d - Small ID flat washers (2)
- e - Locknuts (2)
- f - Plastic caps (2)

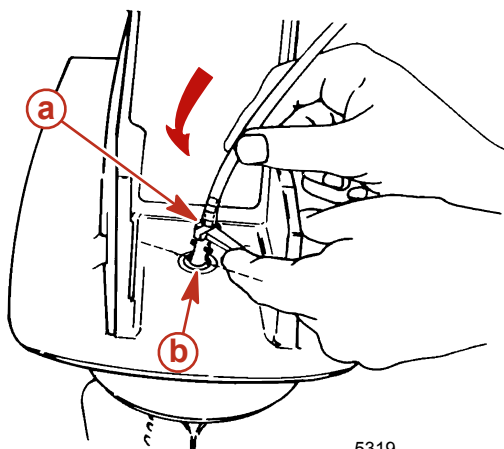
| Tube Ref No.                                                                           | Description                        | Where Used             | Part No.    |
|----------------------------------------------------------------------------------------|------------------------------------|------------------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Trim cylinder hardware | 92-802859A1 |

4. Position the sterndrive unit serial number decal.

## Speedometer Connections - Bravo Models

1. Raise sterndrive to gain access to area between gimbal housing and sterndrive, immediately atop the transom end of the anti-ventilation plate.

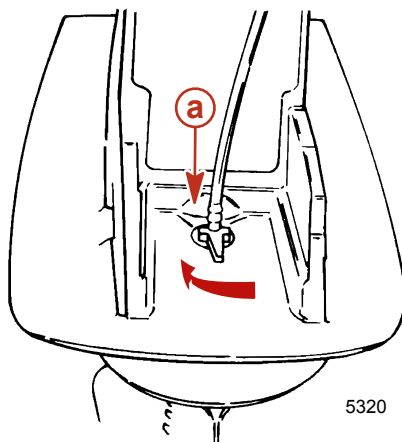
2. Insert speedometer tube fitting into opening on topside of anti-ventilation plate, in position shown.



a - Tube fitting

b - Opening

3. With fitting fully seated, turn handle to left to a tightly seated position, as shown.

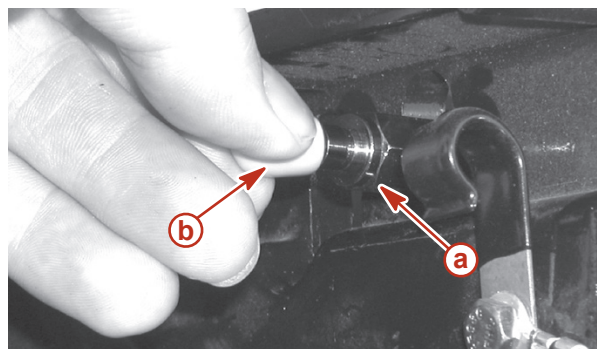


a - Fitting installed (handle pointing forward)

## Installing the Pitot Sensor

**IMPORTANT:** The pitot hose must not come into contact with the steering system components or the engine coupler.

1. Remove the yellow cap from the quick-connect fitting at the transom.



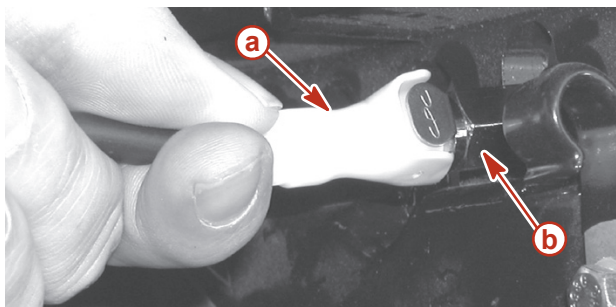
mc79613-1

a - Male quick-connect fitting

b - Yellow plug

**IMPORTANT: Ensure that the fittings snap into place.**

2. Connect the quick-connect pitot hose to the fitting on the transom.

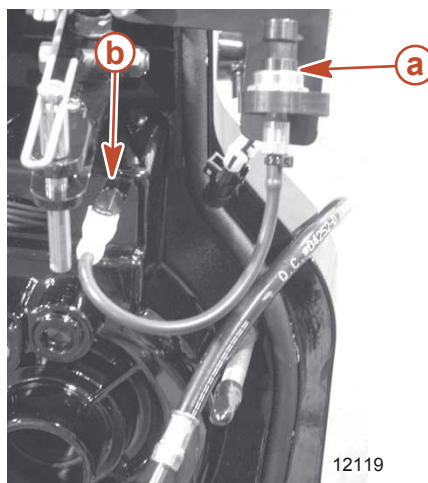


mc79614-1

**a** - Female quick-connect fitting

**b** - Male quick-connect fitting

3. Connect the pitot hose quick-connect fitting on the transom.



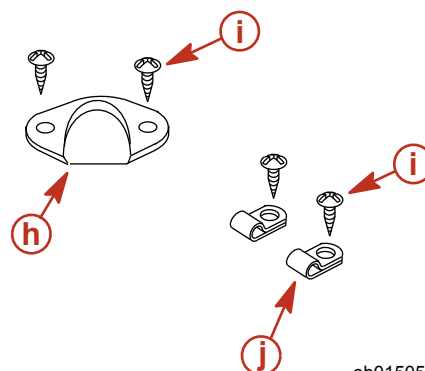
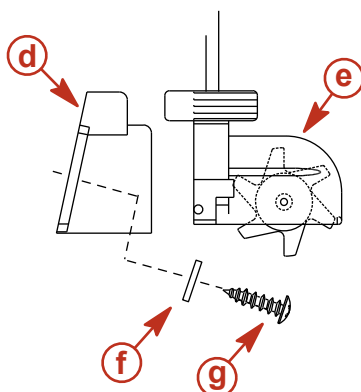
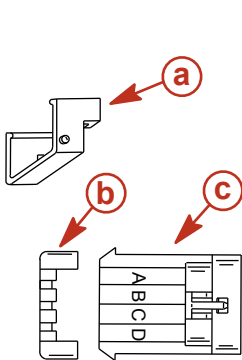
12119

**a** - Pitot sensor

**b** - Quick-connect fitting on transom

## Paddle Wheel Speed Sensor Installation (If Equipped)

### Parts Provided



ob01505

**a** - Spare pin yoke

**b** - Wire retainer

**c** - Connector

**d** - Bracket

**e** - Paddle wheel

**f** - Flat washer (2)

**g** - #10 - 19 mm (3/4 in.) screw (4)

**h** - Cable cap

**i** - #6 - 12 mm (1/2 in.) screw (4)

**j** - Clamp (2)

## Selecting Location

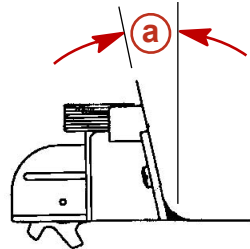
Single engine installation - Mount paddle wheel on the transom where the propeller blade is rotating downward. Usually the right (starboard) side to minimize cavitation. If feasible, mount at least 50 mm (2 in.) beyond the swing radius of the propeller.

Dual engine installation - Mount the paddle wheel between the engines as close to the center line (keel) of the boat as possible. On slower, heavier displacement boats, however, positioning it farther from the keel is acceptable.

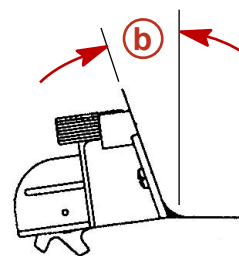
**NOTE:** Do not mount the paddle wheel directly behind any stakes, ribs, intakes or outlets for live wells or any protrusion that may cause turbulence or cavitation.

## Transom Angle Requirements

Standard 13° to 20° transoms - No special adjustment required.



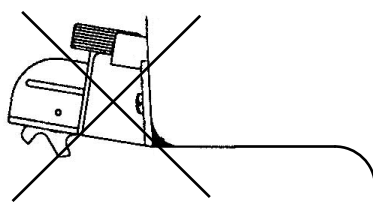
**a** - 13° transom angle



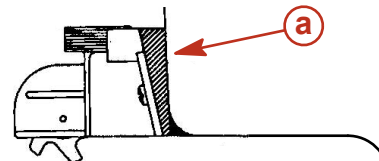
ob01507

**b** - 20° transom angle

Stepped or undercut transom with 3 angles - A small shim of tapered plastic, metal or wood must be fabricated and installed as shown. Mount the paddle wheel on the step for best performance.



**a** - Shim



ob01508

## Installing Bracket

1. Cut out the template. At the location selected, tape the template to the transom. Make sure the black dotted line on the template is aligned with the transom bottom edge, as shown.

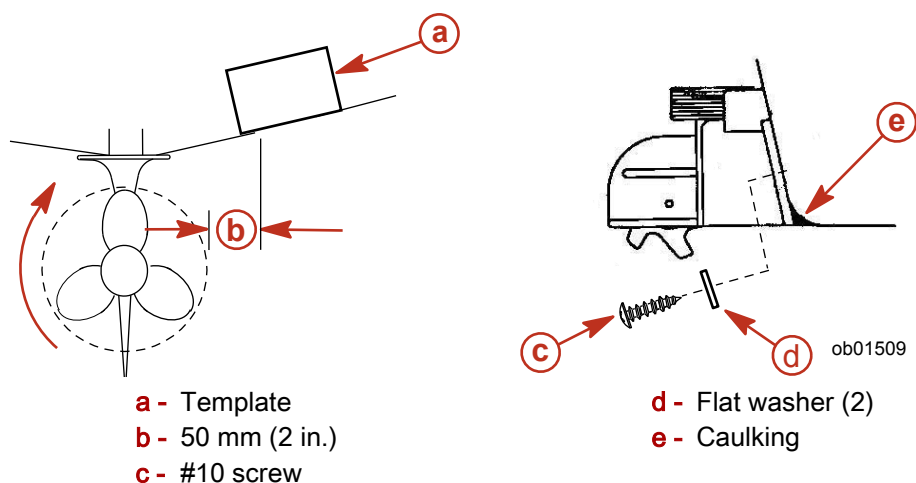
**NOTE:** The mounting template provided is located on the last page of this instruction sheet.

2. Using a #28 or 9/64 in. bit, drill two 22 mm (7/8 in.) deep holes where indicated on the template. To prevent drilling too deeply, wrap masking tape around the drill bit 22 mm (7/8 in.) from the point end of drill bit.

**NOTE:** In fiberglass hulls, first chamfer the gelcoat using a 6 mm (1/4 in.) drill; drilling about 15 mm (1/16 in.) deep to prevent surface cracks.

3. To prevent water seepage into the transom, apply a marine sealer (such as RTV) to the two #10 screws provided. Using the washer provided, attach and tighten the bracket to the hull making sure the bracket is flush with the underside of the hull.

4. Fill any gap between the housing and the transom with a caulking material, as shown. Using a putty knife, smooth the surface to ensure proper water flow.



## Routing the Cable

### DRILLING HOLE THROUGH TRANSOM (OPTIONAL)

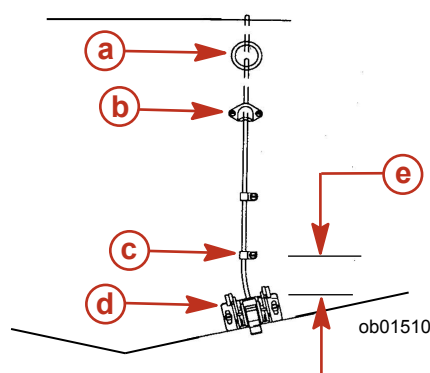
1. Select a transom location for the hole above the water line that does not interfere with other cables and controls.
2. Drill a 15 mm (5/8 in.) diameter hole.
3. Route the cable through the drilled hole. Seal the transom hole with silicone (RTV) or a comparable marine sealer after the cable has been routed through.

**NOTE:** The hole for the first clamp should be 25 mm (1 in.) above the paddle wheel. The hole for the second clamp should be positioned halfway between the first clamp and the cap covering the transom hole drilled for the cable.

4. Using a 2.8 mm (7/64 in.) bit, drill holes for the clamps and cap approximately 13 mm (1/2 in.) deep.
5. Apply silicone sealer (RTV) or a comparable marine sealer to the screw threads, install the cable clamps and feed the cable through cable cap.

### WITHOUT DRILLING HOLE THROUGH TRANSOM (OPTIONAL)

Route the cable over the transom or through a drain hole that is above the water line.

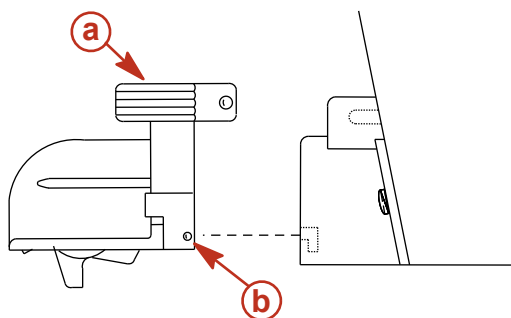


- a** - Splash well drain hole  
**b** - Cable cap  
**c** - Cable clamp  
**d** - Paddle wheel assembly  
**e** - Distance between first cable clamp and top of paddle wheel - 25.4 mm (1.0 in.)

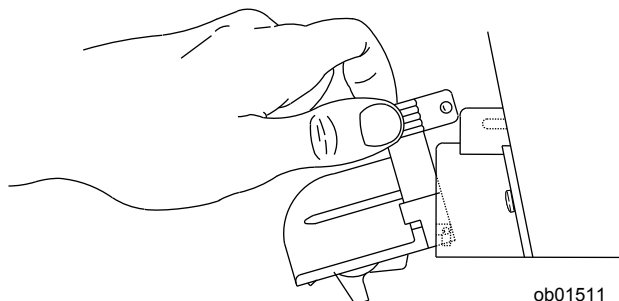
## Installing and Removing the Paddle Wheel

Installation - Slide the pins into the slots in the bracket and snap the tabs into place.

Removal - squeeze open (unlock) the tabs and pull on the paddle wheel.



**a** - Tabs



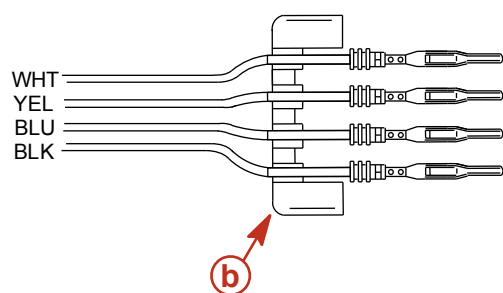
**b** - Pins

ob01511

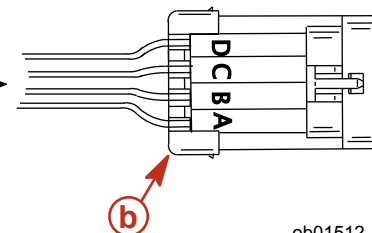
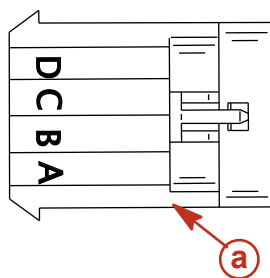
## Wiring Connections

**IMPORTANT:** Before making wire connections, make sure wires are routed through the transom.

**NOTE:** Wires can only be pushed into the connector one way. Align the wire terminal with the tabs inside the connector. Have the wiring routed through the transom. Push each wire terminal into its respective location in the connector. Push wire in until they snap into place. Secure wires into connector with the wire retainer.



**a** - Connector

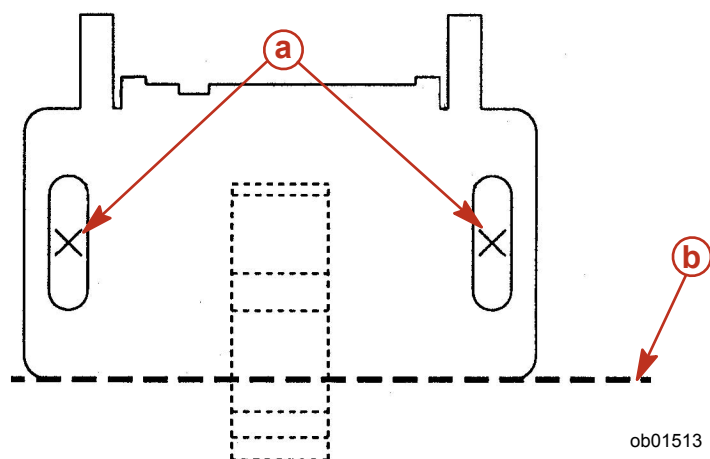


**b** - Wire retainer

ob01512



## Template - Paddle Wheel Speed Sensor



**a** - Drill holes here

**b** - Align dotted line with the transom bottom edge and fold under

# SECTION 7 - STARTING AND ELECTRICAL

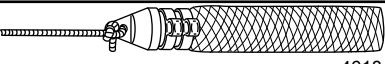
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---

## Special Tools

|                                                                                   |                                                                                                                  |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Data Cable Puller                                                                 | 91-888462A1                                                                                                      |
|  | Attaches to end of DTS data harness to aid in pulling harness through boat. Prevents damage to DTS data harness. |

## Battery Cables

**NOTE:** Battery should be located as close to engine as possible.

1. Select proper size positive (+) and negative (-) battery cables using the chart.
  - a. Add the positive and negative cable lengths together.
  - b. Divide by 2 to obtain the average cable length.

**IMPORTANT:** Terminals must be soldered to cable ends to ensure good electrical contact. Use electrical grade (resin flux) solder only. Do not use acid flux solder, as it may cause corrosion and a subsequent failure.

| Average cable length         | Cable gauge     |
|------------------------------|-----------------|
| Up to 1.1 m (3-1/2 ft)       | 25 mm 2 (4)     |
| 1.1-1.8 m (3-1/2 - 6 ft)     | 35 mm 2 (2)     |
| 1.8-2.3 m (6 - 7-1/2 ft)     | 50 mm 2 (1)     |
| 2.3-2.9 m (7-1/2 - 9-1/2 ft) | 50 mm 2 (0)     |
| 2.9-3.7 m (9-1/2 - 12 ft)    | 70 mm 2 (00)    |
| 3.7-4.6 m (12 - 15 ft)       | 95 mm 2 (000)   |
| 4.6-5.8 m (15 - 19 ft)       | 120 mm 2 (0000) |

## Multiple MPI Engine Battery Information

**Batteries:** Boats with multi-engine MPI power packages require each engine be connected to its own battery. This ensures that the engine's Electronic Control Module (ECM) has a stable voltage source.

**Battery switches:** Battery switches should always be positioned so each engine is operating off its own battery. Do not operate engines with switches in BOTH or ALL position. In an emergency, another engine's battery can be used to start an engine with a dead battery.

**Battery isolators:** Isolators can be used to charge an auxiliary battery used for powering accessories in the boat. They should not be used to charge the battery of another engine in the boat unless the type of isolator is specifically designed for this purpose.

**NOTE:** Sure Power Industries Inc., Model 32023A meets this design specification.

1. The boat may have 2 engines connected to a single Model 32023A battery isolator.
2. The Model 32023A battery isolator is connected to 2 banks of batteries.
3. Each bank contains 2 batteries with the cranking battery for 1 engine in each bank.
4. The second battery in each bank is connected in parallel to the cranking battery.
5. The Model 32023A battery isolator is designed for this type of use; 2 battery banks, 2 charging sources, 120 amps (maximum alternator output).
6. When the engines are operating, either engine's alternator could be charging either bank of batteries through the Model 32023A battery isolator.

Any other manufacturer's battery isolator that is the same type as the Sure Power Inc., Model 32023A could also be used.

**Generators:** The generator's battery should be considered another engine's battery.

## Battery

**IMPORTANT:** Boating industry standards (BIA, ABYC, etc.), federal standards and Coast Guard regulations must be adhered to when installing the battery. Ensure that battery cable installation meets the pull test requirements and that positive battery terminal is properly insulated in accordance with regulations.

**IMPORTANT:** It is recommended (required in some states) that the battery be installed in an enclosed case. Refer to regulations for your area.

**IMPORTANT:** Engine electrical system is negative (-) ground.

- Select a battery that meets all of the following specifications:
- 12-volt marine type.
- Tapered post connectors or side terminal connectors.

**IMPORTANT:** Do not use a battery with wing nut connectors.

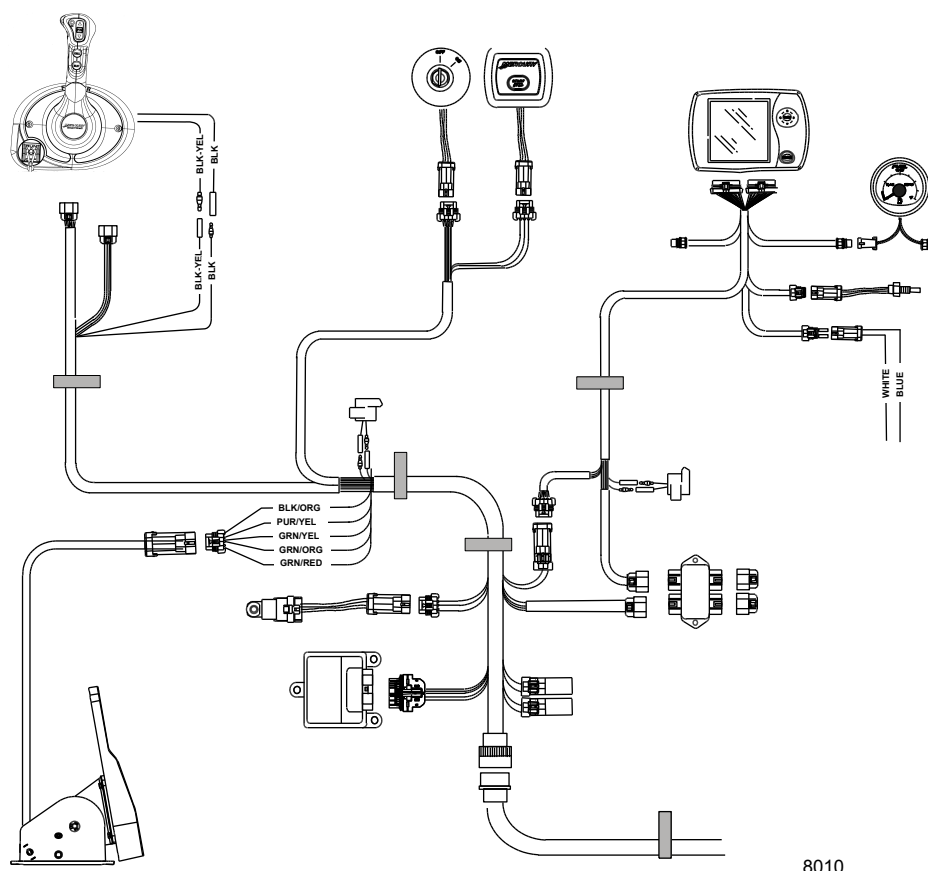
- Battery capacity rating of at least:

| Engine (cylinder/type) | liter (cid) | Minimum required cranking battery size |
|------------------------|-------------|----------------------------------------|
| V8 MPI                 | 8.1 (496)   | 750 cca, 950 mca, or 180 Ah            |
| V8 MPI DTS             | 8.1 (496)   | 800 cca, 1000 mca, or 180 Ah           |

## Typical DTS Control System

### Panel mount ERC and Smartcraft instrumentation

*NOTE: Refer to the Command Module Installation Kit.*



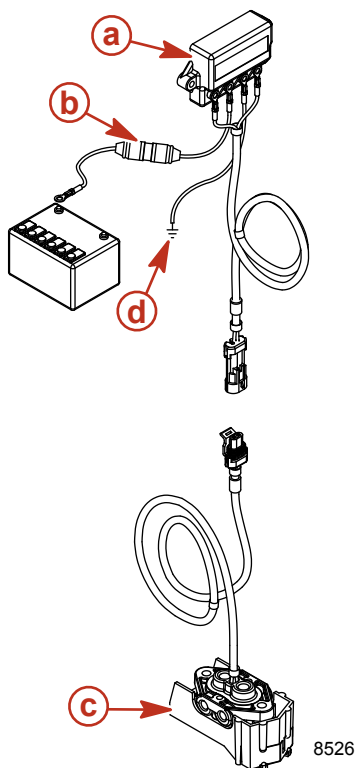
8010

Shown with panel mount ERC, Smartcraft instrumentation, foot throttle, accessory relay, and start/stop button.

# Wiring

## Wiring Diagrams

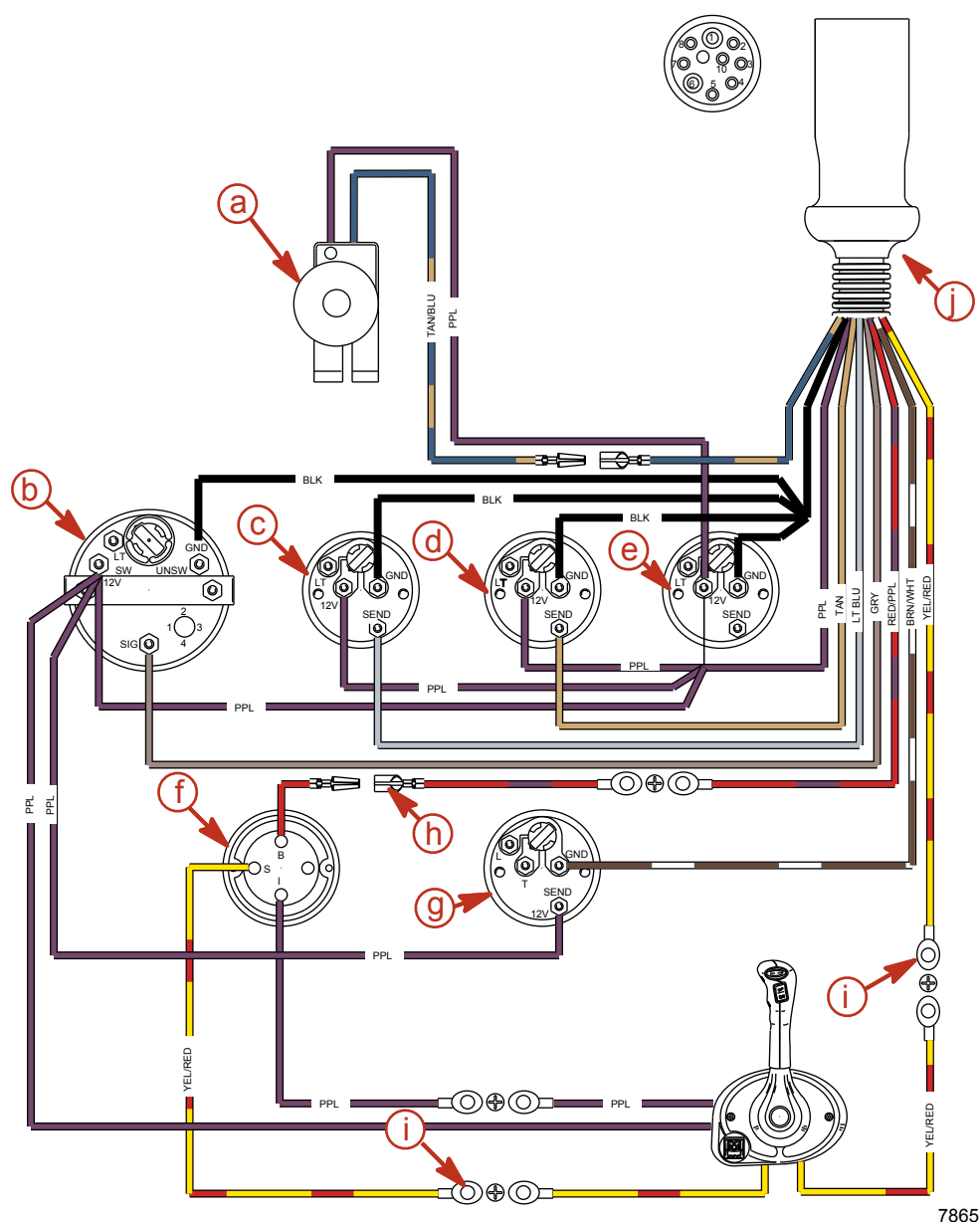
### MERCATHODE SYSTEM



**a** - Controller  
**b** - 20 amp fuse

**c** - Electrode  
**d** - BLACK wire - with engine harness

## SINGLE STATION ENGINE HARNESS INSTRUMENTATION (MECHANICAL)

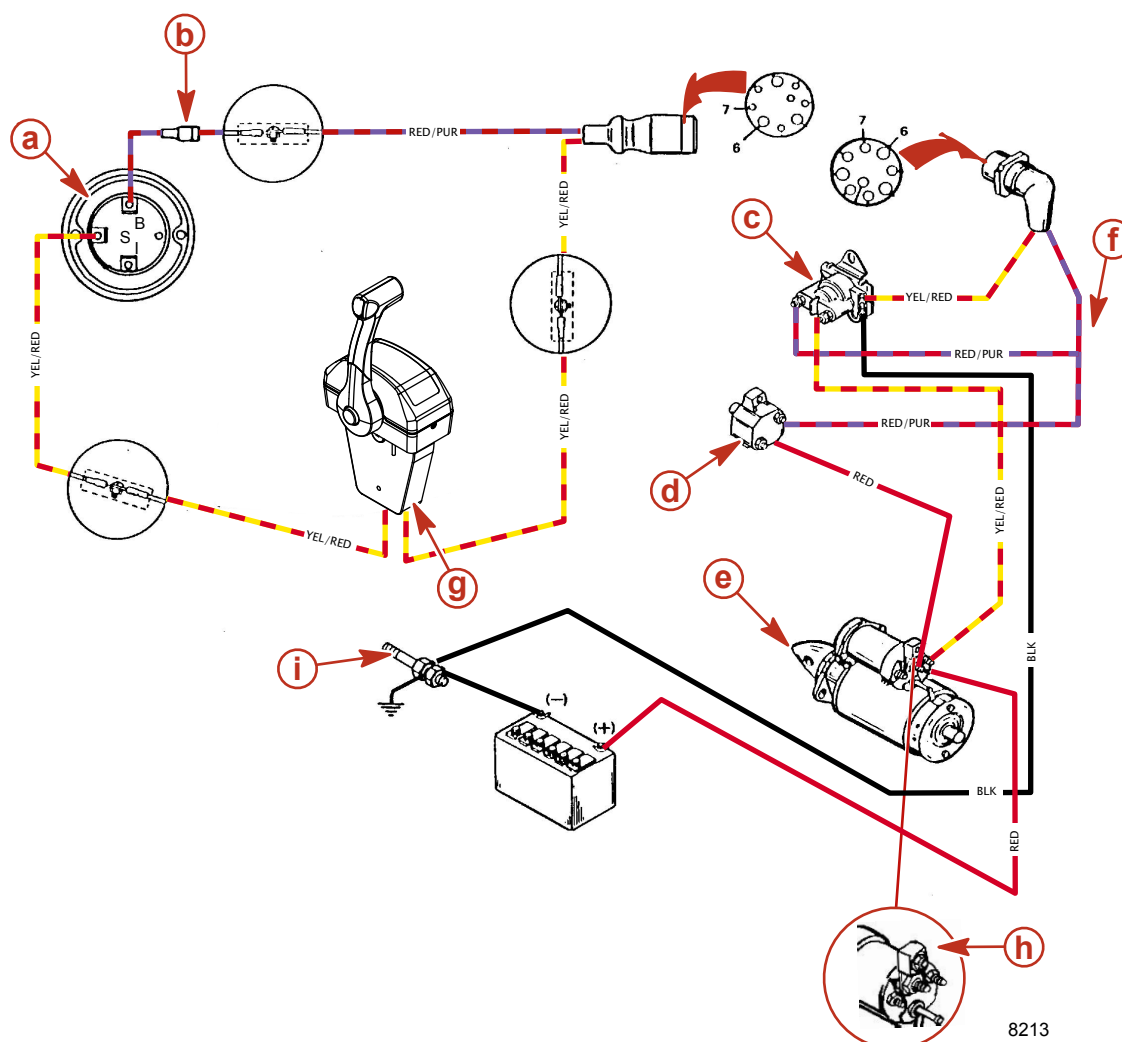


- |                                 |                                          |
|---------------------------------|------------------------------------------|
| <b>a</b> - Audio warning buzzer | <b>f</b> - Ignition switch               |
| <b>b</b> - Tachomete            | <b>g</b> - Trim indicator                |
| <b>c</b> - Oil pressure         | <b>h</b> - Read/observe <sup>1,2</sup> . |
| <b>d</b> - Water temperature    | <b>i</b> - Read/observe <sup>3</sup> .   |
| <b>e</b> - Battery meter        | <b>j</b> - To engine wiring harness      |

Refer to gauge manufacturer's instructions for specific connections.

1. Connect Wires Together with Screw and Hex Nut; Apply Liquid Neoprene to Connection and Slide Rubber Sleeve over Connection.
2. Power for a Fused Accessory Panel May Be Taken from This Connection. Load Must Not Exceed 40 Amps. Panel Ground Wire Must Be Connected to Instrument Terminal That Has an 8-Gauge Black (Ground) Harness Wire Connected to it.
3. Lanyard stop switch lead and neutral safety switch leads must be soldered and covered with shrink tube for a water proof connection. If an alternate method of connection is made, verify connection is secure and sealed for a water proof connection.

## TYPICAL STARTING SYSTEM (MECHANICAL)



- |                            |                           |
|----------------------------|---------------------------|
| a - Ignition switch        | e - Starter motor         |
| b - 20 amp fuse            | f - Wire junction         |
| c - Starter slave solenoid | g - Neutral safety switch |
| d - 50 Amp circuit breaker | h - 90 amp fuse           |

This is a general description of the positive current flow from the battery through the starting system until the starter motor cranks.

**NOTE:** Ensure that all connections are tight and have the required resistance.

- Battery to the solenoid switch on the starter (RED battery cable)
- Solenoid switch to the circuit breaker (RED)
- Circuit breaker to the wire junction (RED/PPL)
- Wire junction to the wiring harness plug Terminal 6 (RED/PPL)
- Wiring harness plug to the 20 amp fuse (RED/PPL)
- 20 amp fuse to the ignition switch Terminal B (RED/PPL); at this point the ignition switch is turned to the START position
- Ignition switch Terminal B to Terminal S
- Ignition switch Terminal C to the neutral start switch (YEL/RED); NEUTRAL START SWITCH MUST BE AT NEUTRAL POSITION
- Neutral start switch to the wiring harness plug Terminal 7 (YEL/RED)



- Wiring harness plug to the starter solenoid (small terminal) (YEL/RED); also, ensure that the small terminal (BLK) wire is grounded
- Starter solenoid is now CLOSED, completing circuit between the large terminal (RED/PPL) and the other large terminal (YEL/RED), causing the starter motor to crank.

## 14 Pin Engine Harness Connector

| Mechanical 14-Pin Connector Pin-Out |                 |                            |
|-------------------------------------|-----------------|----------------------------|
| Pin                                 | Wire Color      | Function                   |
| A                                   | PINK            | + 12 Volt                  |
| B                                   | BLACK           | Ground (-)                 |
| C                                   | PURPLE          | Wake                       |
| D                                   | DK GREEN/YELLOW | E-Stop                     |
| E                                   | DK BLUE         | Analog oil pressure        |
| F                                   | WHITE           | CAN 1+                     |
| G                                   | LT BLUE         | CAN 1-                     |
| H                                   | Open            | Spare                      |
| J                                   | Open            | Spare                      |
| K                                   | ORANGE/WHITE    | Analog trim position       |
| L                                   | BROWN/DK BLUE   | Audio warning horn         |
| M                                   | GRAY/WHITE      | Tachometer/Link gauge      |
| N                                   | YELLOW/BLACK    | Crank                      |
| P                                   | TAN             | Analog coolant temperature |

## DTS Installation

### Special Tools - DTS Installation

|                   |             |
|-------------------|-------------|
| Data Cable Puller | 91-888462A1 |
|-------------------|-------------|

### Installation Guidelines for DTS System Components

|  WARNING                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| To avoid the possibility of serious injury or death from loss of boat control, do not splice or probe into any wire insulation of the DTS system. Splicing or probing will damage the wire insulation allowing water to enter the wiring. Water intrusion may lead to wiring failure and loss of throttle and shift control. |

### DATA HARNESS

|  WARNING                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| To avoid the possibility of serious injury or death from loss on boat control, do not pull on cable connectors when pulling cable into boat. Observe correct pulling procedure. Pulling on connectors can loosen terminals resulting in open or poor electrical connections. Open or poor electrical connections may result in loss of throttle and shift control. |

## CONNECTORS

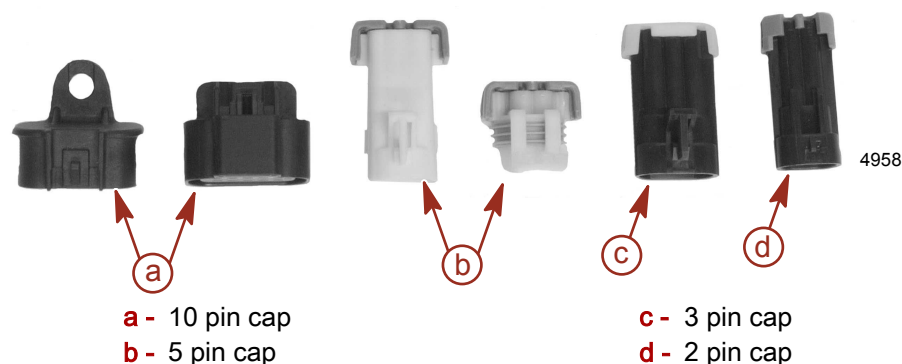
**IMPORTANT:** Connectors should never have to be forced into the receptacle. Ensure that connectors are free of any lubricant or dielectric grease before installation. When the connector is properly aligned, it will only take a small amount of pressure to insert it into the receptacle. Rotate the locking collar to secure the electrical connection.

**NOTE:** Connect only one data harness of the required length between the engine and helm. If a data harness is too short, do not connect multiple harnesses together to make up the required length. For installations requiring a data harness length longer than 12.2 m (40 ft.), contact Mercury Marine for more information.

## Weather Caps

Weather caps are to be used whenever there are any unused connectors on a harness. Verify all connections are tight to prevent moisture or corrosion occurring inside the connections.

Typical weather caps are as follows:



**NOTE:** A complete listing of weather caps with part numbers is not available at the time of the publication.

## Battery Harness Information and Installation

### DTS Battery Specifications

**IMPORTANT:** Do not use deep cycle batteries for the main engine starting battery.

**IMPORTANT:** Boating industry standards (BIA, ABYC, etc.), federal standards and Coast Guard regulations must be adhered to when installing the battery. Ensure that battery cable installation meets the pull test requirements and that positive battery terminal is properly insulated in accordance with regulations.

**IMPORTANT:** It is recommended (required in some states) that the battery be installed in an enclosed case. Refer to regulations for your area.

| Minimum SAE Starting Battery Requirements - BCI GRP 24 |                            |
|--------------------------------------------------------|----------------------------|
| MCA                                                    | 1000                       |
| CCA                                                    | 800                        |
| Ah                                                     | 180 (International Rating) |

**NOTE:** Due to the wide variety of battery manufactures throughout the world, ratings and physical battery sizes will vary. Check with the manufacturer for a starting battery with a MCA, CCA, or Ah specification that will be equal to or greater than the SAE Standard J537 specified above.

**IMPORTANT:** For DTS products, each engine must be equipped with its own starting battery. If your boat application requires additional battery loads for boat accessories or marine electronics, it is recommended that an auxiliary battery or batteries be installed.

**⚠ CAUTION**

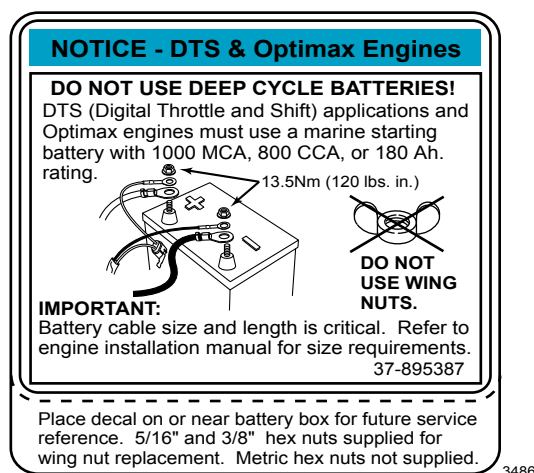
**Hex nuts must be used to secure battery leads to battery posts to avoid loss of electrical power.**

When connecting engine battery, hex nuts must be used to secure battery leads to battery posts. Torque nuts to specifications.

| Description | Nm   | lb. in. | lb. ft. |
|-------------|------|---------|---------|
| Hex nuts    | 13.5 | 120     |         |

**IMPORTANT:** Battery cable size and length is critical. Refer to Battery Cable Size tables or engine installation manual for size requirements.

Decal needs to be placed on or near battery box for future service reference. One 5/16 in. and one 3/8 in. hex nut are supplied per battery for wing nut replacement. Metric hex nuts are not supplied.



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## Data Harness Pulling Procedure

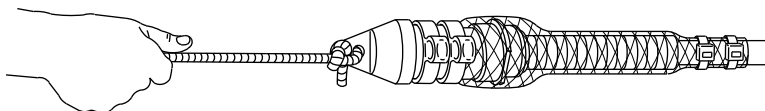
**IMPORTANT:** Do not route data harness near engine ignition components (coils, spark plug leads, and spark plugs), high power VHF coax or radios. An electrical field generated from these components could cause interference with data transmission.

**IMPORTANT:** Do not route data harness near sharp edges, hot surfaces or moving parts. Fasten cables away from any sharp edges, fasteners or objects that could wear into the harness.

**IMPORTANT:** Avoid sharp bends in the data harness. Minimum bend radius should be 7.6 cm (3 in.) for the final wiring installation.

1. Inspect the routing path to make sure surfaces are free of any sharp edges or burrs that could cut the harness.
2. Install cable pulling tool to data harness.
3. Secure pulling tool with 2 cable ties.

**IMPORTANT:** The cables ties must be tight to prevent any slipping during installation.



3836

|                   |             |
|-------------------|-------------|
| Data Cable Puller | 91-888462A1 |
|-------------------|-------------|

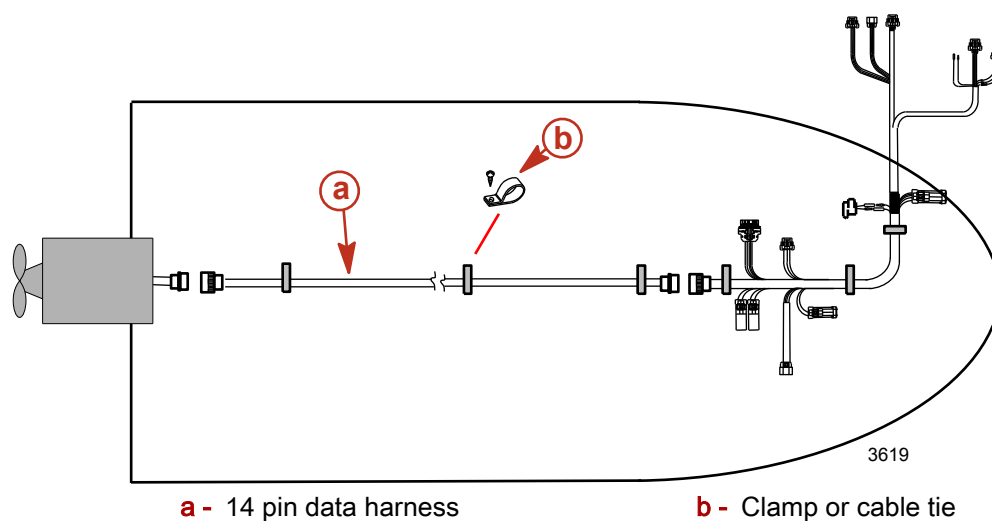
**IMPORTANT:** Carefully inspect data harness pins to ensure all pins are securely fastened to data harness connector end following installation.

**NOTE:** Data harness should be secured with mounting clips or cable ties along the routing path.

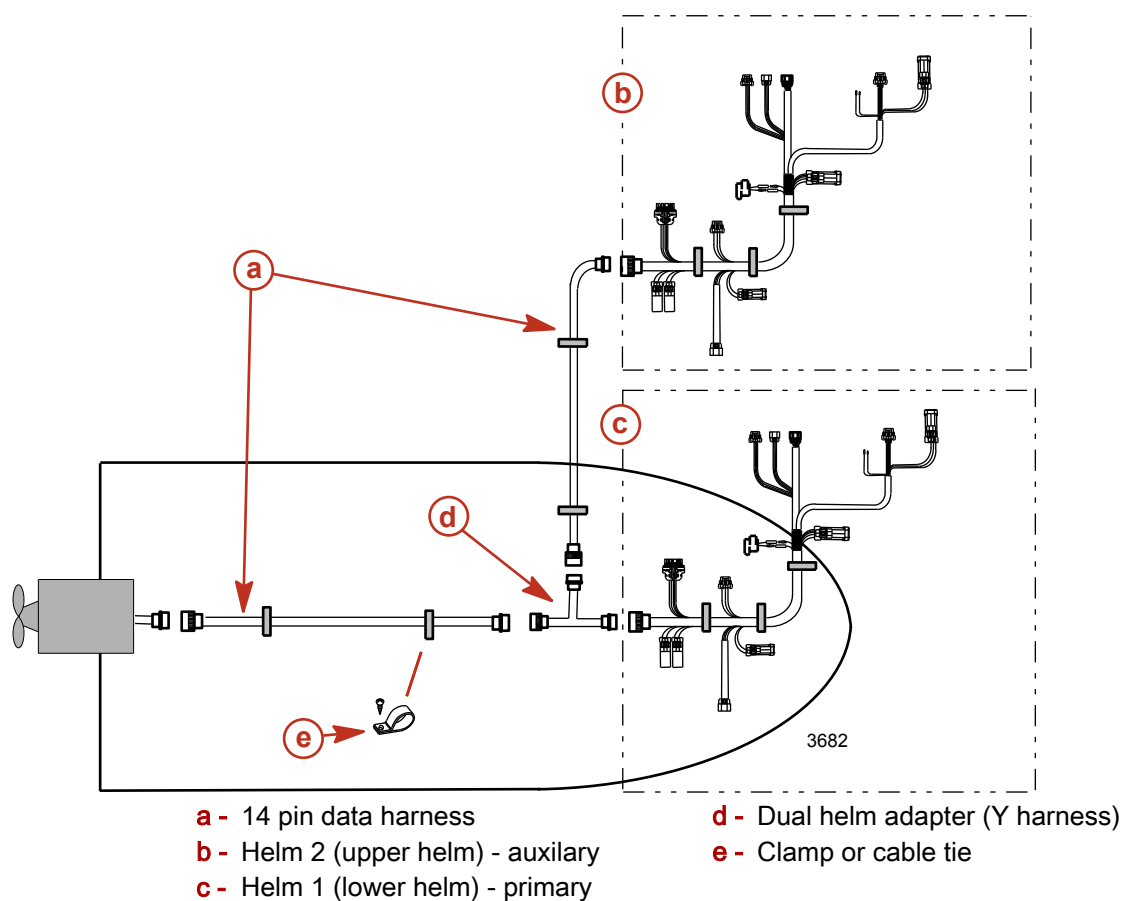
## Connecting 14 Pin Data Harness - Single Engine

### Single Helm

**IMPORTANT:** Avoid sharp bends in the harness. Minimum bend radius should be 7.6 cm (3 in.).



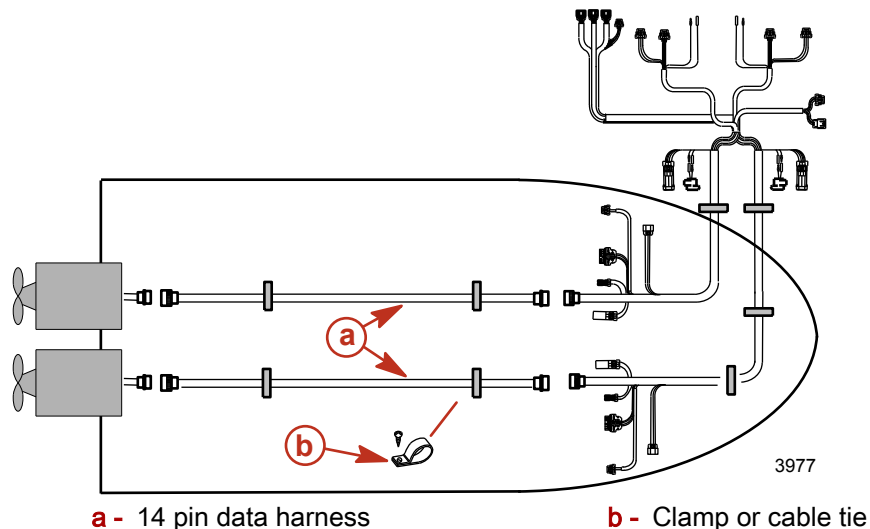
### Dual Helm



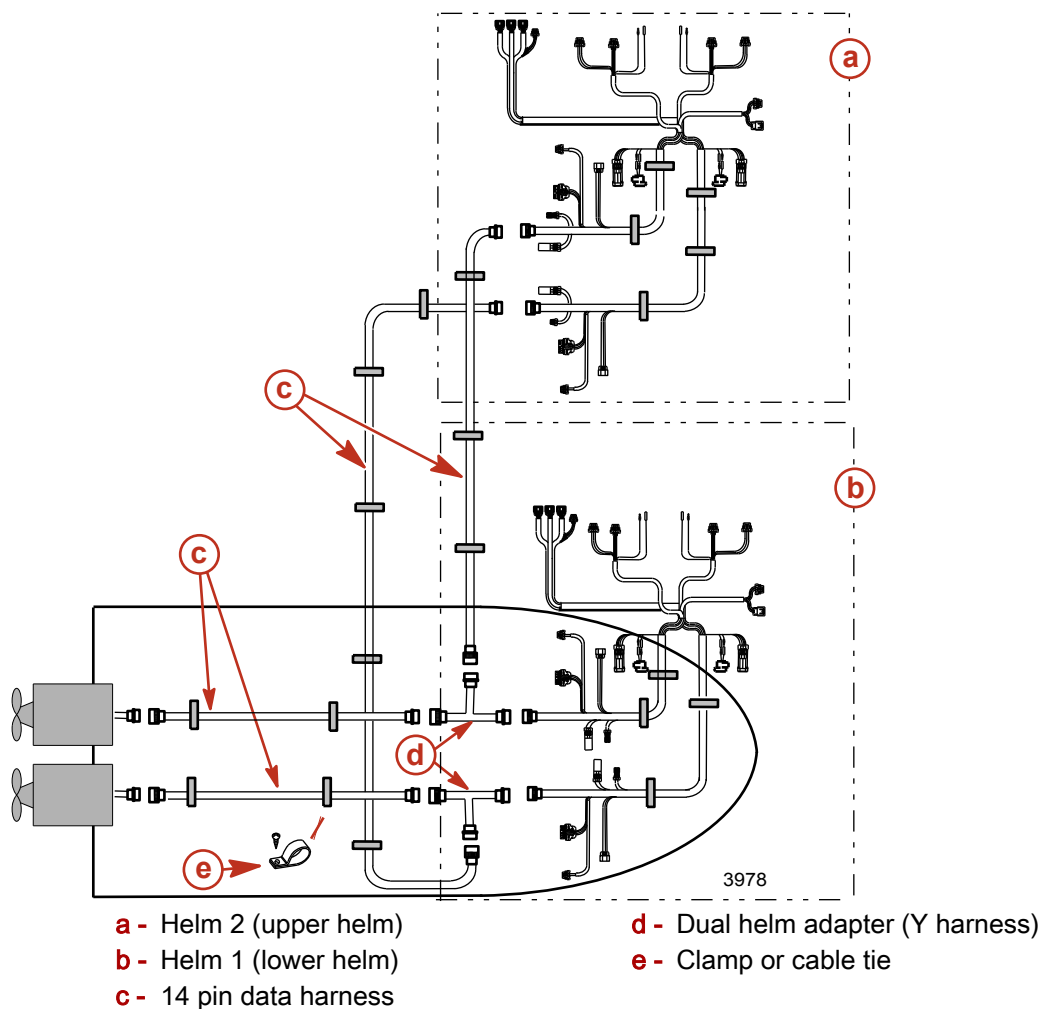
# Connecting 14 Pin Data Harness - Dual Engine

## Single Helm

**IMPORTANT:** Avoid sharp bends in the harness. Minimum bend radius should be 7.6 cm (3 in.).



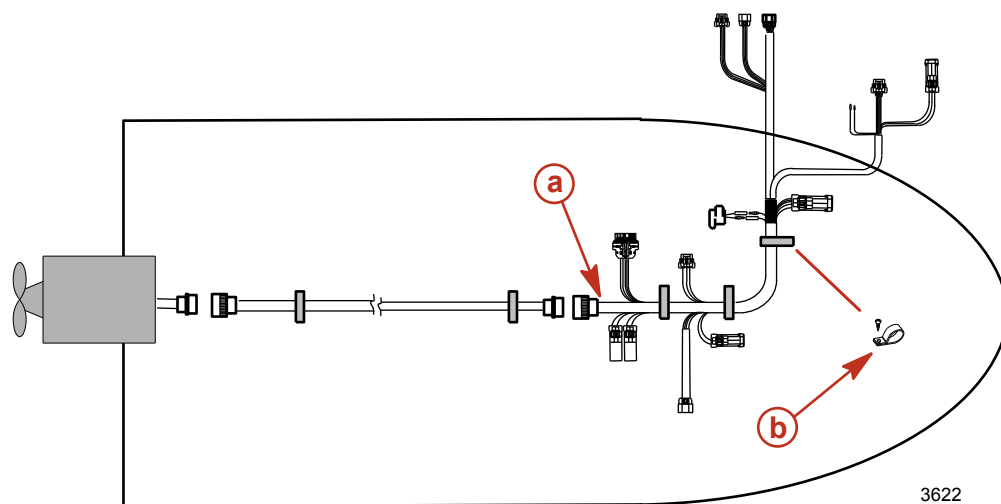
## Dual Helm



# Installing DTS Command Module and Harness - Single Engine

## Harness Installation

- Locate a routing path for the harness connections so they reach their installation points.
- Inspect the routing path to make sure surfaces are free of any sharp edges or burrs that could cut the harness.
- Fasten and support the harness with clamps or cable ties along the routing path.
- Make sure all connections are tight and seal all unused connectors with weather caps.

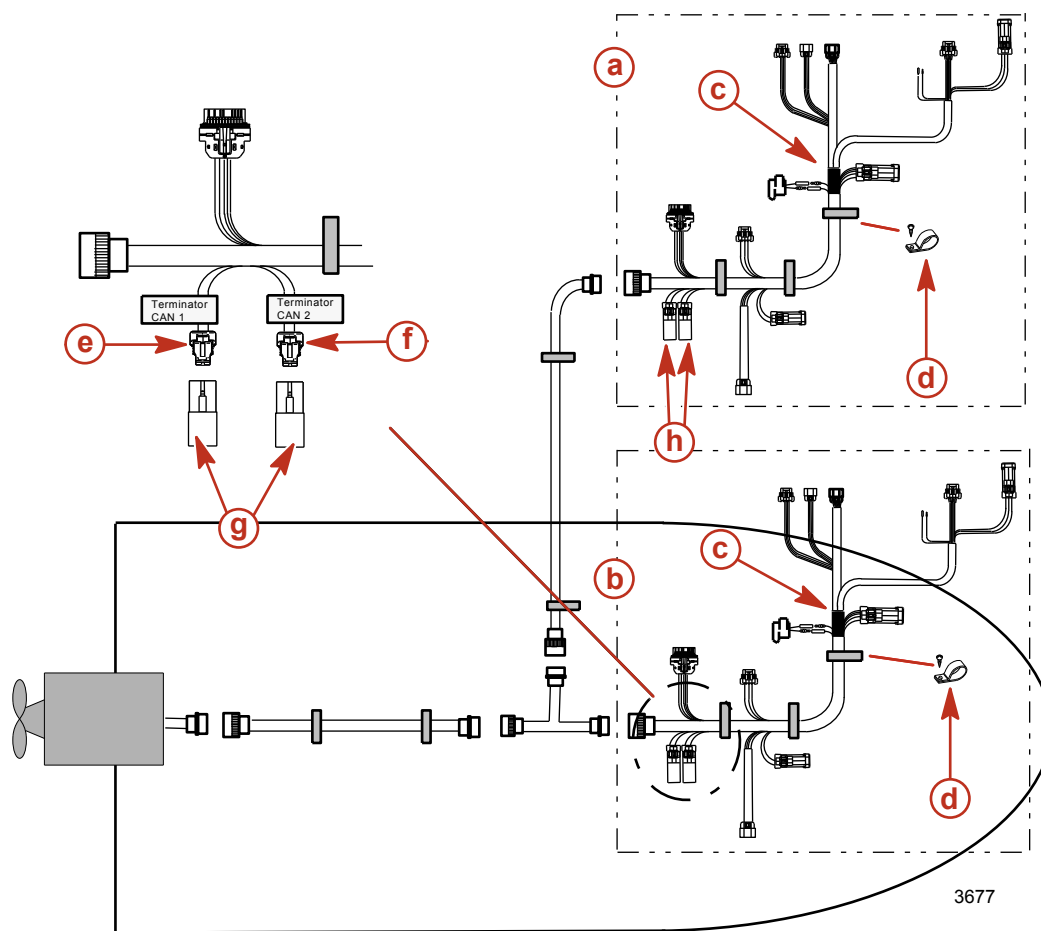


Single Helm Application

**a** - DTS command module harness

**b** - Clamp or cable tie

**NOTE:** For dual helm application - Remove CAN 1 and CAN 2 terminator resistors from helm 1 (helm closest to the engine), and seal connectors with weather caps.



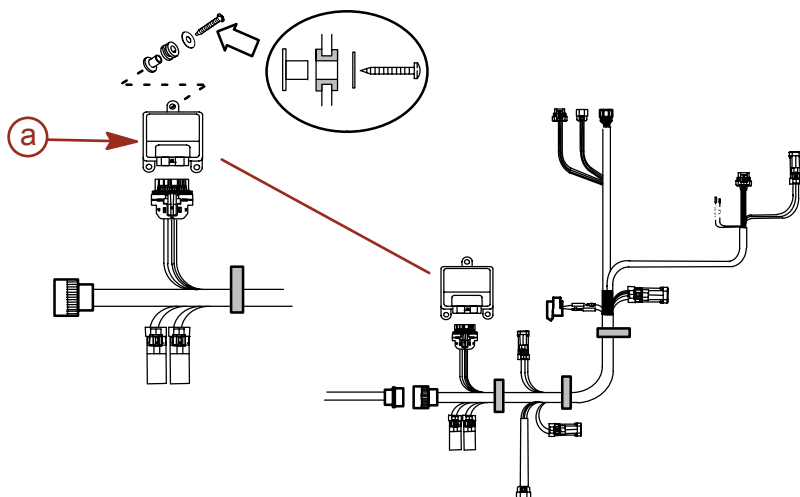
**Dual Helm Application**

- |                                       |                                                     |
|---------------------------------------|-----------------------------------------------------|
| <b>a</b> - Helm 2 (upper helm)        | <b>e</b> - CAN 1 connector                          |
| <b>b</b> - Helm 1 (lower helm)        | <b>f</b> - CAN 2 connector                          |
| <b>c</b> - DTS command module harness | <b>g</b> - Weather caps                             |
| <b>d</b> - Clamp or cable tie         | <b>h</b> - Terminator resistors, blue (CAN1 & CAN2) |

## Module Installation

- Although the Command Module connection is watertight, it is recommended that it be mounted in an area that stays relatively dry.
- Mount in an area where the wiring connection will not get stepped on or disturbed.
- Mount in an area that is accessible for troubleshooting and servicing the system.
- Ensure the wiring harness connected to the command module will reach all the connection points.

- Mounting the Command Module with the supplied rubber grommets/bushings to minimize vibration.



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**a** - DTS Command Module

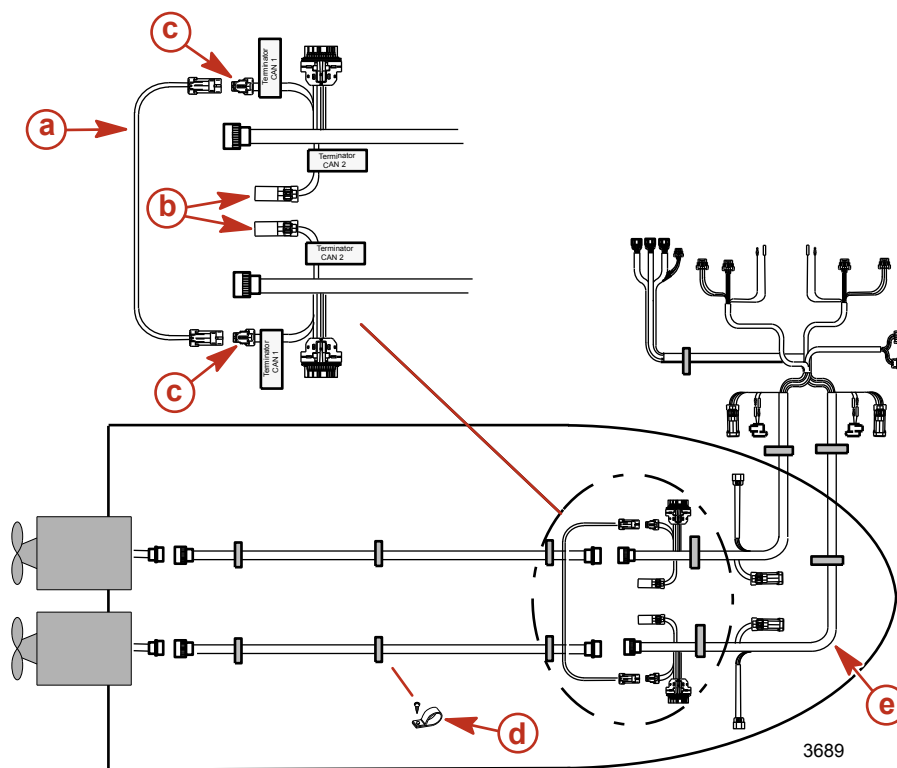
## Installing DTS Command Module and Harness - Dual Engine

### Harness Installation

- Locate a routing path for the harness connections so they reach their installation points.
- Inspect the routing path to make sure surfaces are free of any sharp edges or burrs that could cut the harness.
- Fasten and support the harness with clamps or cable ties along the routing path.



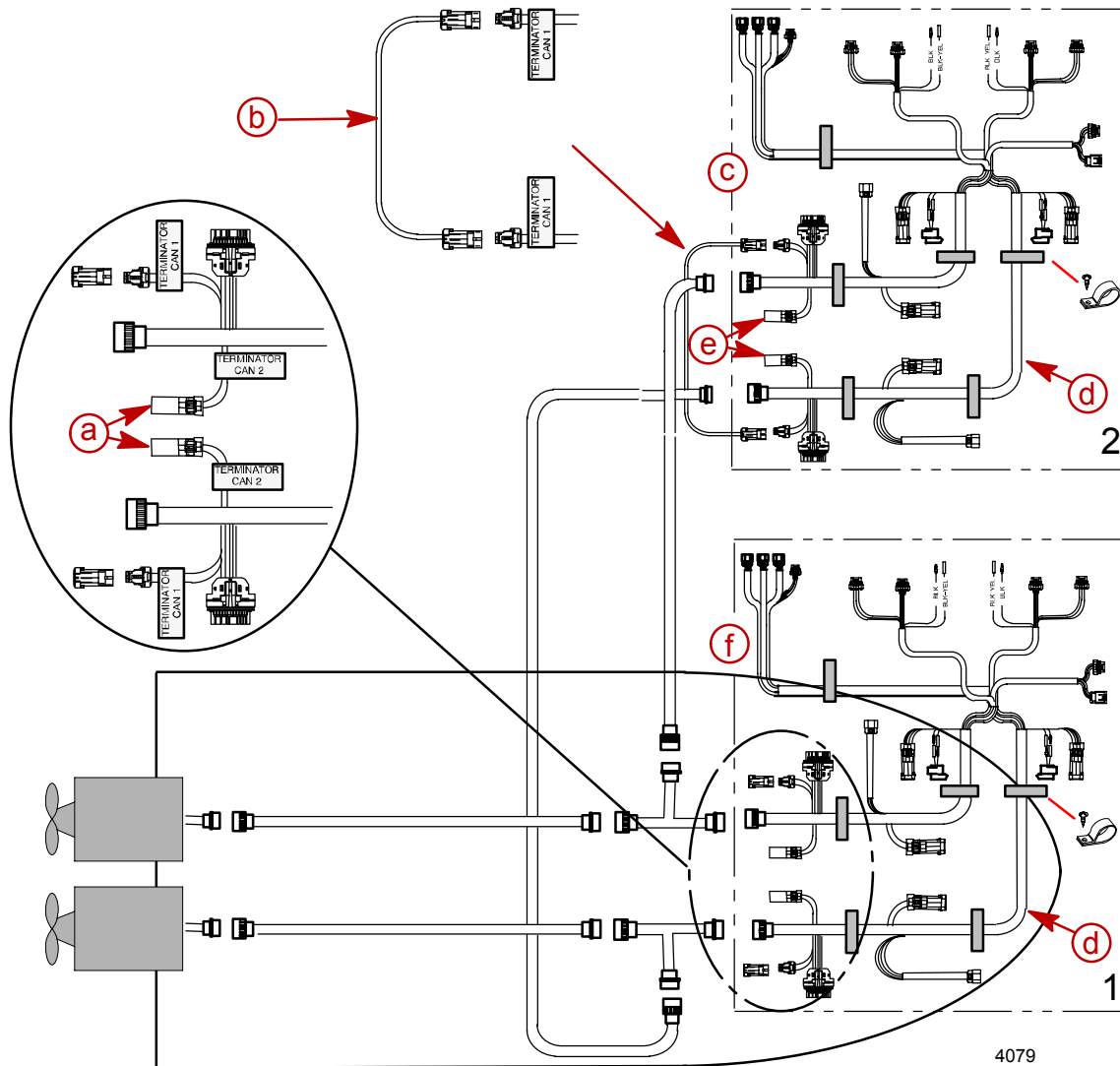
- Make sure all connections are tight and seal all unused connectors with weather caps.



Single Helm Application

- |                                                       |                                       |
|-------------------------------------------------------|---------------------------------------|
| <b>a</b> - CAN link harness                           | <b>d</b> - Clamp or cable tie         |
| <b>b</b> - CAN 2 Terminator resistors - do not remove | <b>e</b> - DTS command module harness |
| <b>c</b> - CAN 1 connectors                           |                                       |

**NOTE:** For dual helm application - Remove CAN 1 and CAN 2 terminator resistors from helm 1 (helm closest to the engine), and seal connectors with weather caps.



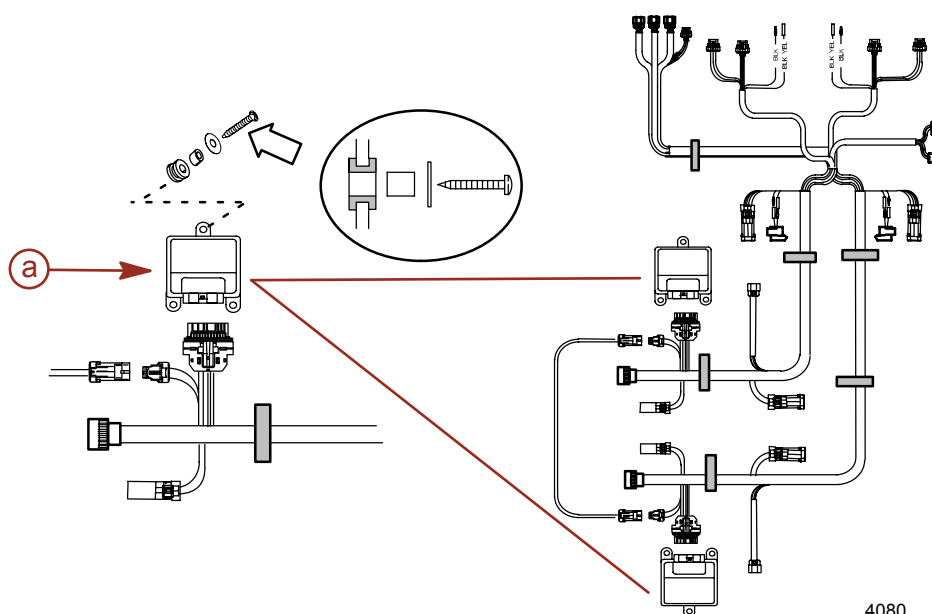
Dual helm application

- |                             |                                                              |
|-----------------------------|--------------------------------------------------------------|
| <b>a</b> - Weather caps     | <b>d</b> - DTS Command Module harness                        |
| <b>b</b> - CAN link harness | <b>e</b> - Termination resistors - do not remove from helm 2 |
| <b>c</b> - Helm 2           | <b>f</b> - Helm 1                                            |

## Module Installation

- Although the Command Module connection is watertight, it is recommended that it be mounted in an area that stays relatively dry.
- Mount in an area where the wiring connection will not get stepped on or disturbed.
- Mount in an area that is accessible for troubleshooting and servicing the system.

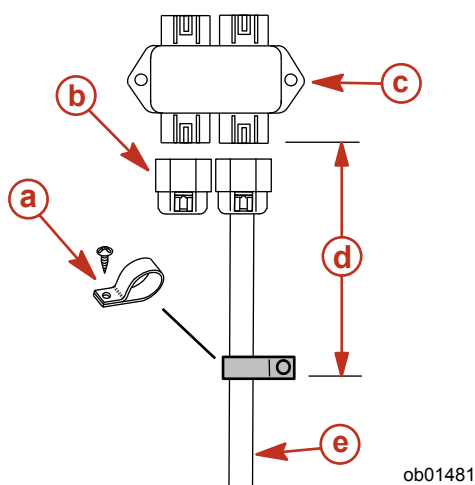
- Ensure the wiring harness connected to the command module will reach all the connection points.



**a** - DTS Command Module

## Junction Box (If Equipped)

- Although the junction box connections are watertight, it is recommended that the junction box be mounted in an area that stays relatively dry.
- Mount in an area where the wiring connection will not get stepped on or disturbed.
- Mount in an area that is accessible for troubleshooting and servicing the system.
- Ensure the DTS command module harness will reach all the connection points.
- Fasten all junction box connections within 25.4 cm (10 in.) of the junction box.
- Seal all unused connections with weather caps.



**a** - Clamp  
**b** - Weather cap (859318T 2)  
**c** - Junction box

**d** - 25.4 cm (10 in.)  
**e** - DTS Command Module harness

# Analog Gauge Interface (AGI)

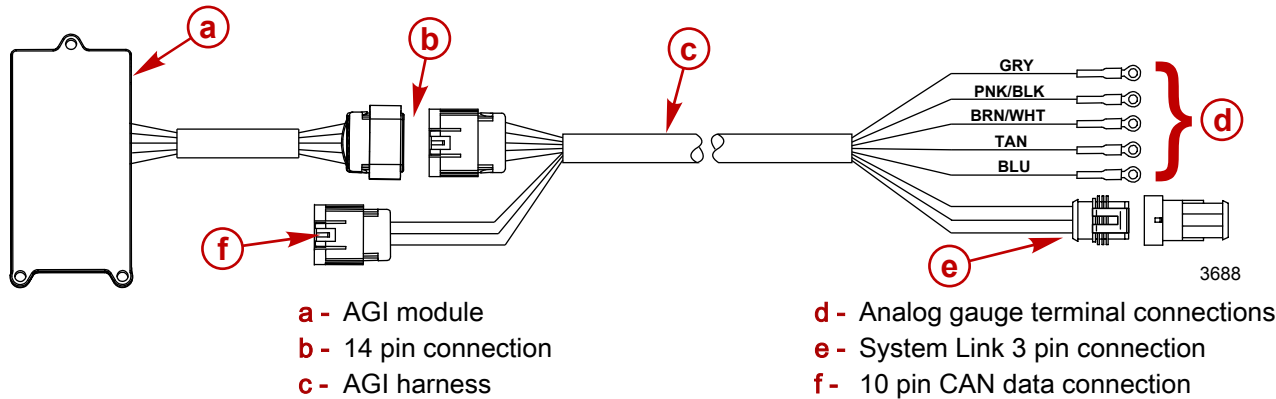
## Analog Gauge Interface (AGI) Installation

**NOTE:** This Analog Gauge Interface (AGI) can only be used with the 14 pin Digital Throttle and Shift (DTS) system to drive analog and/or SmartCraft System Link gauges. For analog gauges, use ring terminals on AGI harness to connect to analog sender inputs on gauge backs, and tape back any unused terminals. For SmartCraft System Link gauges, use 3 pin System Link connection on AGI harness. The AGI system can support 10 System Link gauges per helm, 2 helms maximum.

**IMPORTANT:** Mount AGI module with wires coming out of potting facing downward to prevent moisture from collecting at base of wires and wicking into module. Route and secure all wires and harnesses away from hot or moving parts.

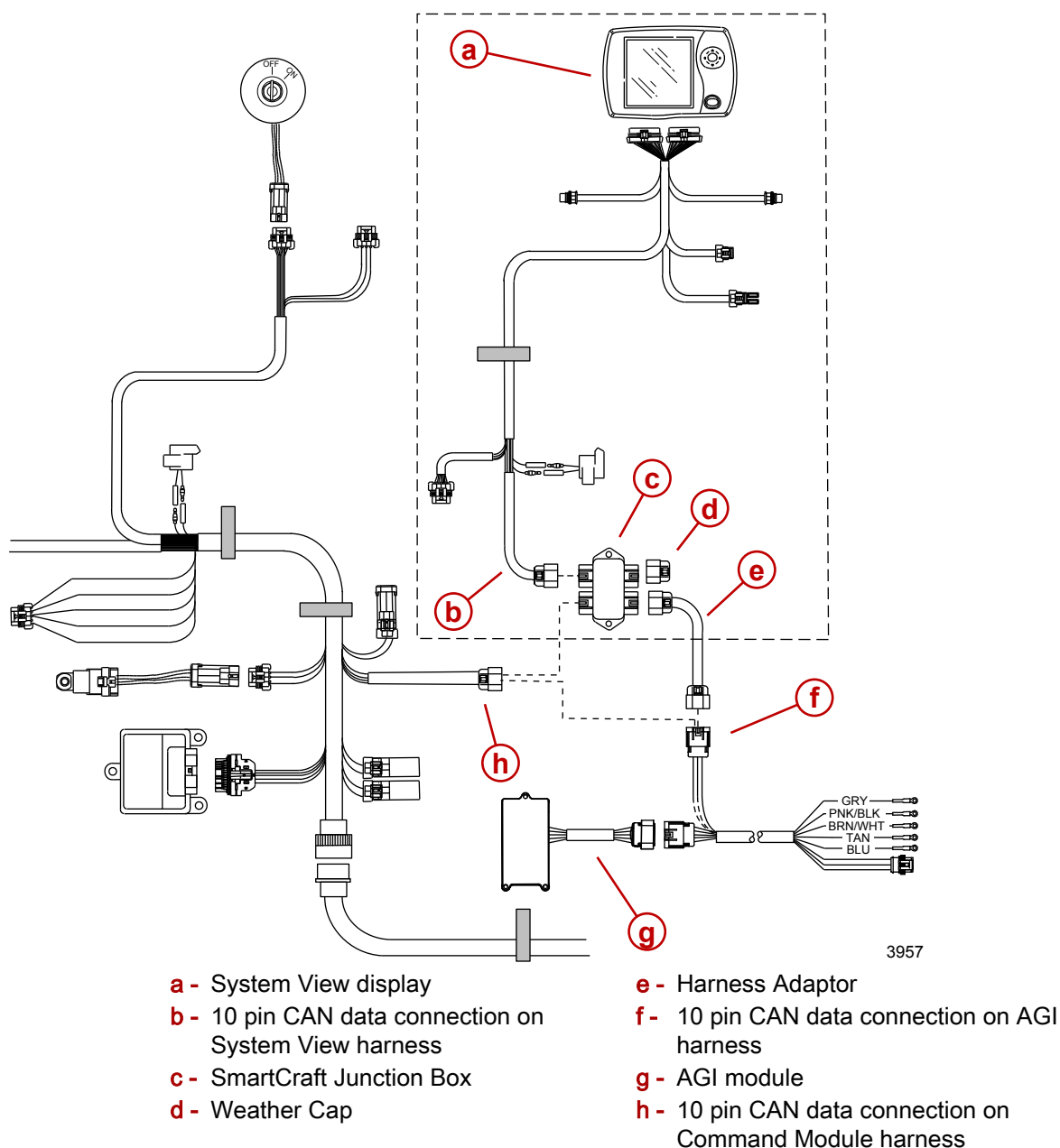
- 1. With screws and washers supplied in kit, mount the AGI module securely under dash or helm in close proximity to gauges being used.
- 2. Refer to the following table for AGI harness wire color/analog gauge sender input connections. Tape back any unused terminals. Secure connections per gauge manufacturers specifications.

| Analog Gauge Type      | AGI Harness Wire Color |
|------------------------|------------------------|
| Tachometer             | Gray                   |
| Oil Pressure/Oil Level | Blue                   |
| Water Temperature      | Tan                    |
| Trim Positions         | Brown/White            |
| Fuel Level             | Pink/Black             |



- 3. Route and connect wire from key switched 12 volt positive power source to analog gauges. Secure connections per gauge manufacturers specifications.
- 4. Route and connect ground wire from analog gauges to a common ground. Secure connections per gauge manufacturers specifications.
- 5. Connect any SmartCraft System Link gauges to 3 pin System Link connection. The AGI system can support 10 System Link gauges per helm, 2 helms maximum.
- 6. Plug 14 pin AGI harness connection into AGI module.
- 7. Connect 10 pin CAN data harness connection on command module harness to AGI harness.
  - a. If SmartCraft System View is not being used, plug 10 pin CAN data connection on AGI harness directly into 10 pin CAN data connection on command module harness.
  - b. If SmartCraft System View is being used, a junction box and harness adaptor will be required. Plug 10 pin CAN data connection on command module harness, 10 pin CAN data connection on System View harness, and one end of harness adaptor into junction box. Plug 10 pin CAN data connection on AGI harness into other end of harness adaptor. Insulate any unused connection ports on junction box with weather caps.

## TYPICAL AGI APPLICATION WITH SYSTEM VIEW



## Configuring Analog/Digital Tachometer Signal through PCM

**IMPORTANT:** The engine Propulsion Control Module (PCM) tachometer configuration factory default has been set to an analog. This will allow the operation of one analog tachometer. Depending on the desired use of analog/digital gauges, the PCM set-up may have to be configured from analog to a digital.

Following are optional uses of analog and digital gauges and the setting for the tachometer configuration in the PCM necessary to run them.

| Gauge Configuration                                                                                                                                              | Analog | Digital |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|
| Analog Tachometer Only                                                                                                                                           | X      |         |
| System Link Gauges used with System View, System Monitor, or System Tach                                                                                         | -      | -       |
| System Link Gauges used in conjunction with System Link Adaptor Harness and Command Module Harness without the use of System View, System Monitor or System Tach |        | X       |

| Gauge Configuration                                                                                             | Analog | Digital |
|-----------------------------------------------------------------------------------------------------------------|--------|---------|
| AGI used with or without System View, System Monitor or System Tachometer, to run analog and System Link Gauges |        | X       |

The Digital Diagnostic Tool (DDT) or Computer Diagnostic System (CDS) can be used to select analog or digital PCM tachometer configuration.

### PCM CONFIGURATION WITH DDT

**IMPORTANT: The use of DDT cartridge 1.3.1 or above must be used for PCM configuration.**

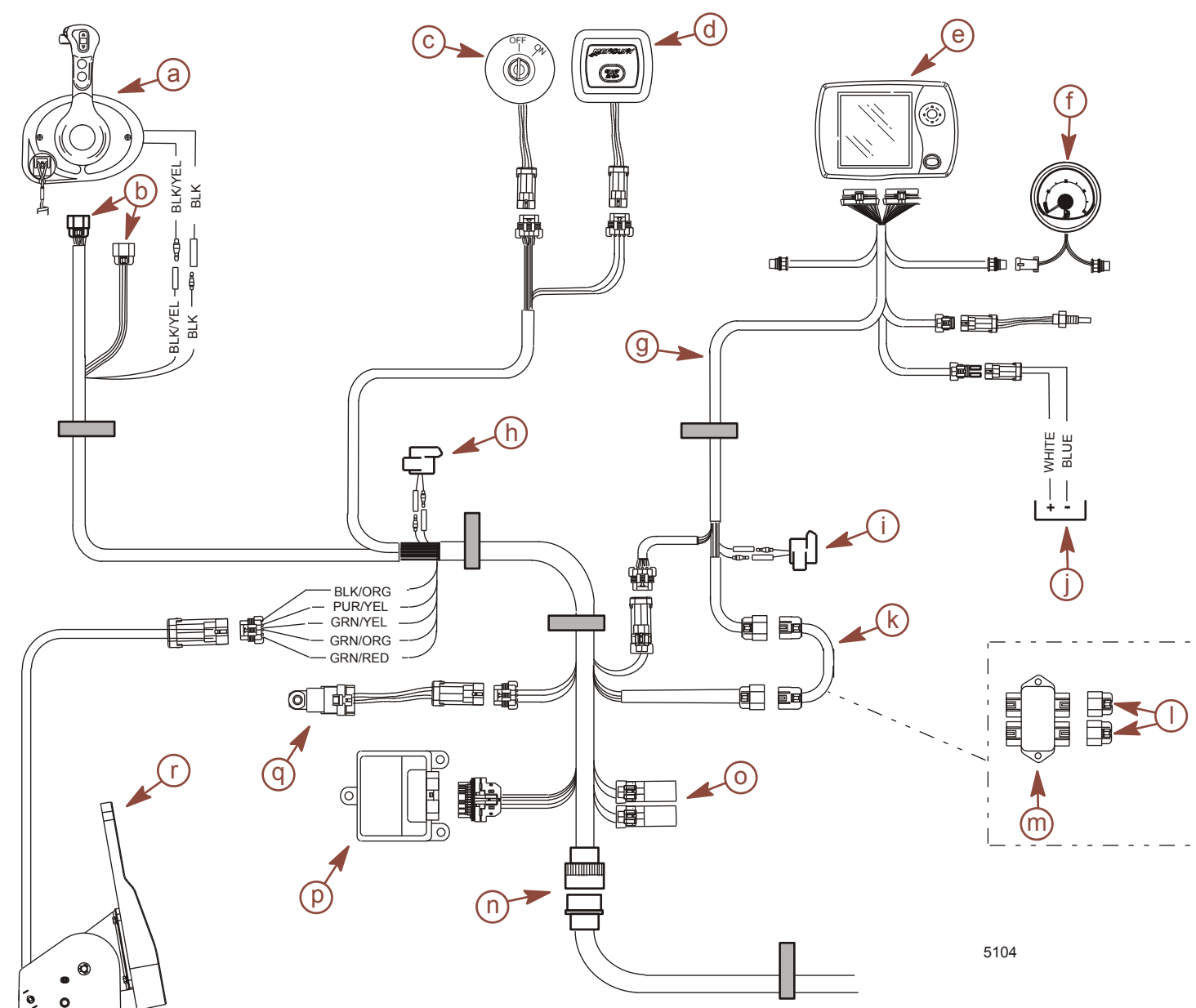
1. Attach DDT to engine and power up. Refer to DDT Owners Manual if needed.
2. Press 1. "MERCURY MARINE"
3. Press 1. "TO CONTINUE"
4. Press 2. "MANUAL TEST"
5. Arrow down and Press 5. "SPECIAL FUNCTION"
6. Arrow down and Press 9. "TACH LINK CONFIG"
7. "CONFIGURE TACH SOFTWARE DRIVER?" - Press 1. "YES"
8. "TACH LINK CONFIG" - Press 1. "FOR LINK" (Digital) - Press 2. "FOR ANALOG"
9. After task completion confirmation, Press "MODE" to Exit

### PCM CONFIGURATION WITH CDS

1. Attach CDS to engine. Refer to on-line help if needed.
2. From Logon screen, navigate to Engine Select screen.
3. From Engine Select screen fill in engine type information and select Tool Box.
4. From Tool Box screen, select Active Diagnostics.
5. From Active Diagnostics screen, scroll down and select Tach Link Config.
6. To change PCM configuration from default of analog to digital, select Enable and then select Run.
7. To change PCM configuration from digital to analog, select Disable and then select Run.

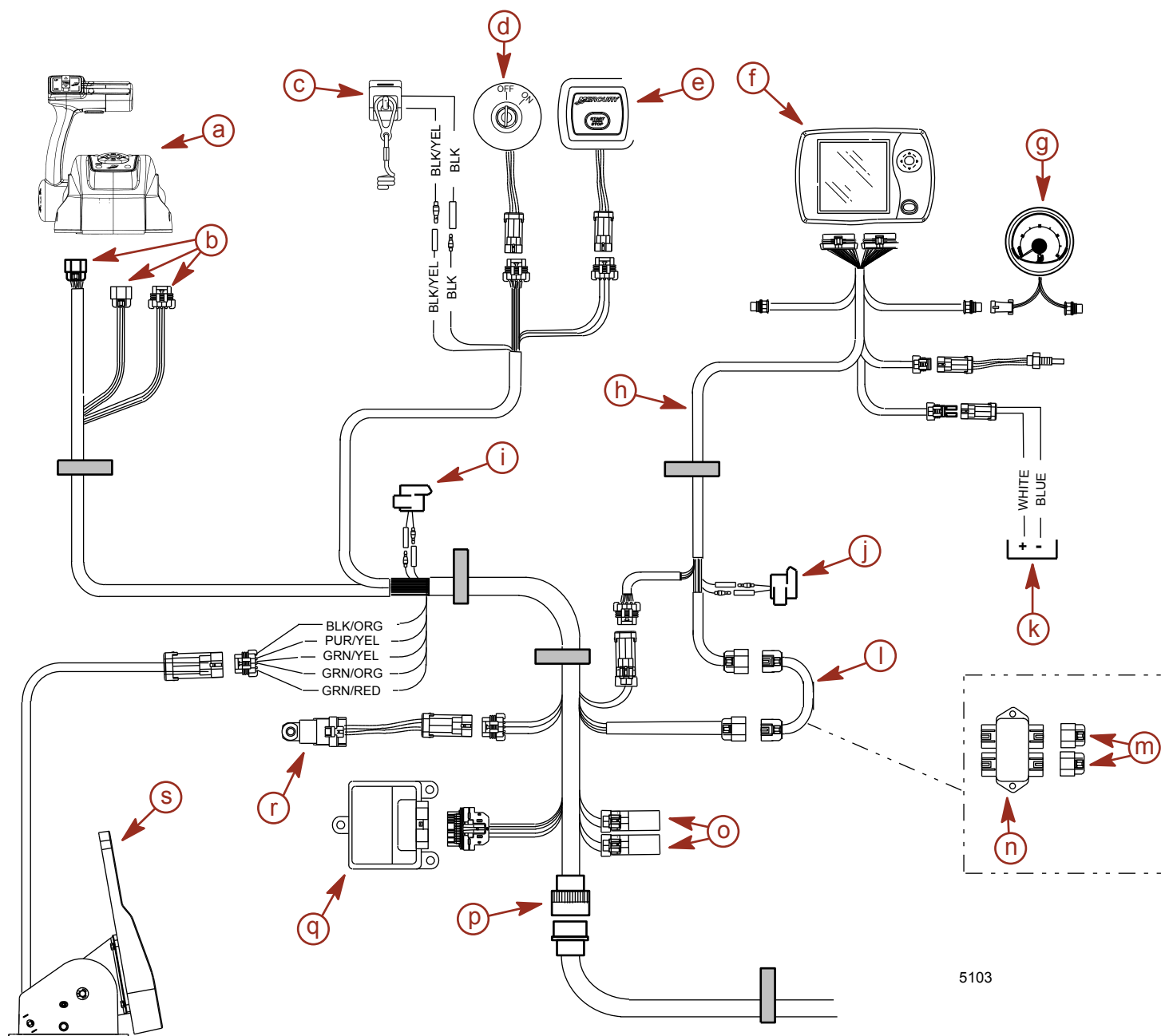
# Typical 14 Pin DTS Wiring Diagrams

## DTS Panel Control Wiring



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## DTS Single Console Control Wiring

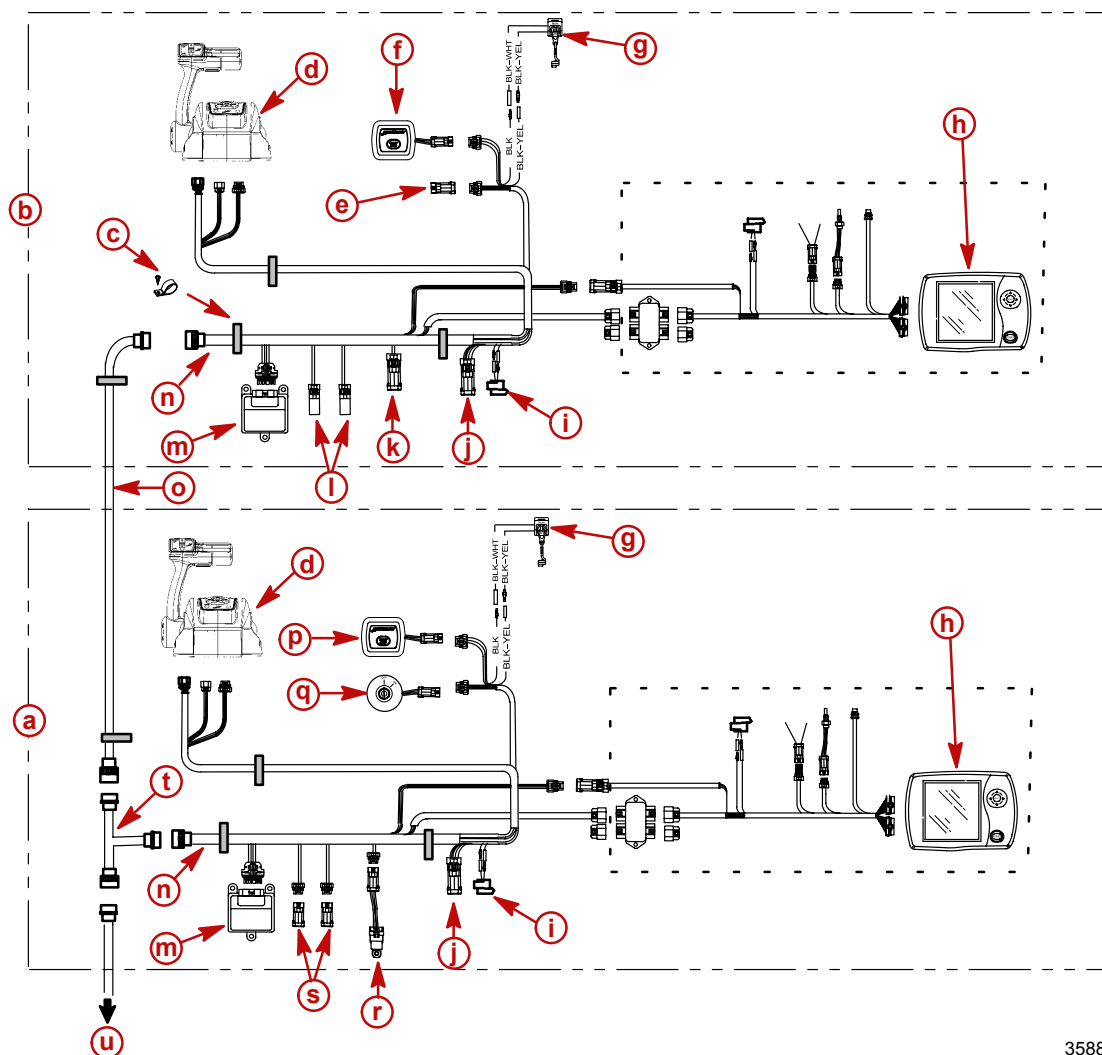


- a** - Remote control
- b** - Remote control connections
- c** - Lanyard stop switch
- d** - Key switch
- e** - Start/stop switch (optional)
- f** - SmartCraft System View (optional)
- g** - SmartCraft Link Gauge (optional)
- h** - Display harness
- i** - Horn
- j** - Horn

- k** - GPS connection
- l** - Cable adaptor
- m** - Weather caps
- n** - Junction box (optional)
- o** - Terminator resistor
- p** - DTS Command Module harness
- q** - DTS Command Module
- r** - Accessory power relay (optional)
- s** - Foot throttle (optional)



## DTS Single Console Control Wiring with Dual Helm

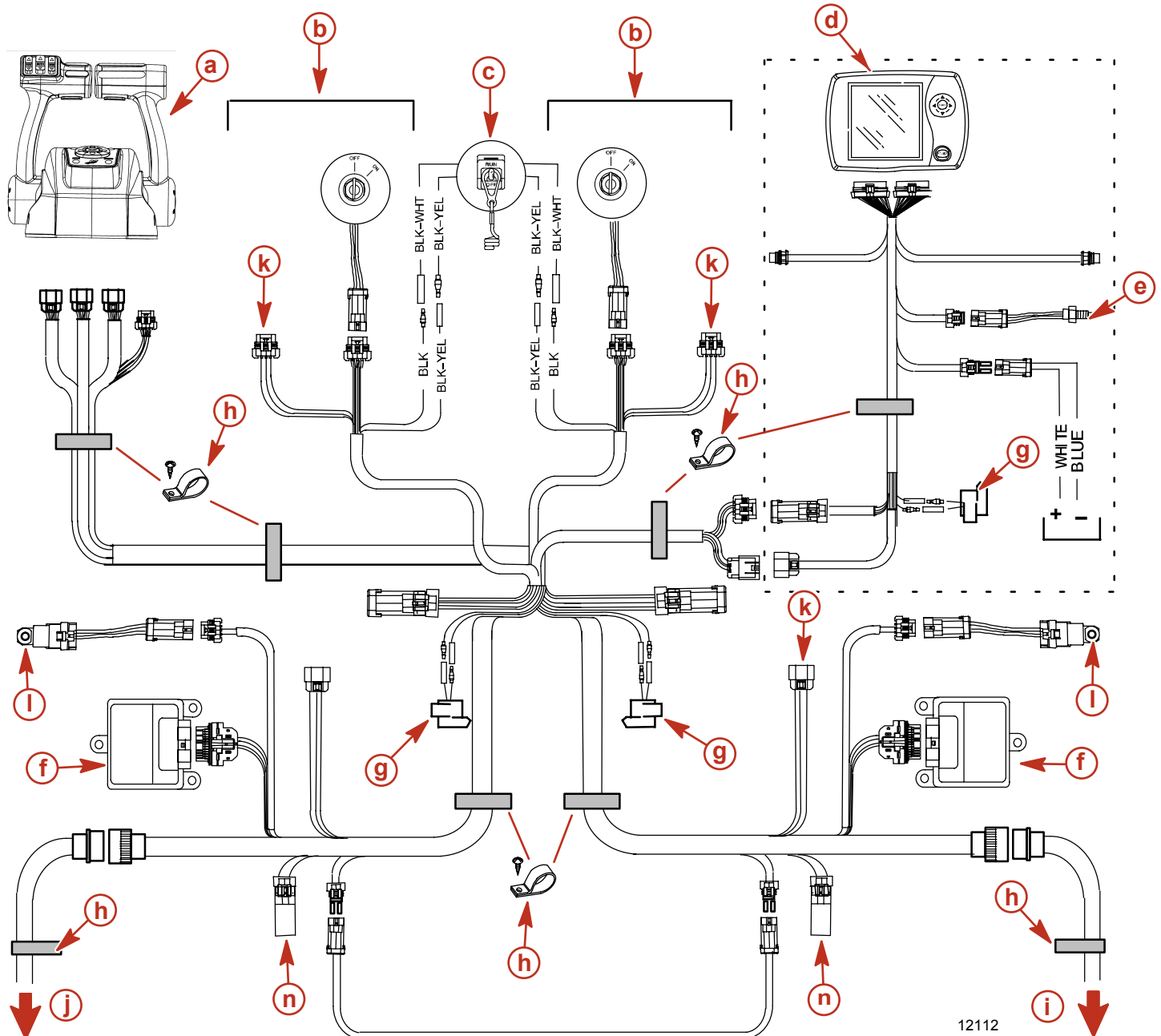


3588

- a** - Helm 1
- b** - Helm 2
- c** - Clamps (use as required)
- d** - Remote control
- e** - Key switch connector not used – seal with weather cap
- f** - Start/stop switch (2 required at helm )
- g** - Lanyard stop switch
- h** - System View (optional)
- i** - Horn
- j** - Foot throttle connector
- k** - Accessory power relay connector (optional, not used at second helm)
- l** - Terminator resistors (helm 2 only)
- m** - DTS Command Module
- n** - DTS Command Module harness
- o** - Data harness
- p** - Start/stop switch (optional at helm 1)
- q** - Key switch
- r** - Accessory power relay
- s** - Terminator resistors not used – seal connectors with weather caps
- t** - Dual helm adaptor harness
- u** - Data harness to engine

## DTS Dual Console Control Wiring

**NOTE:** Optional foot throttle is not compatible in multiple engine applications.



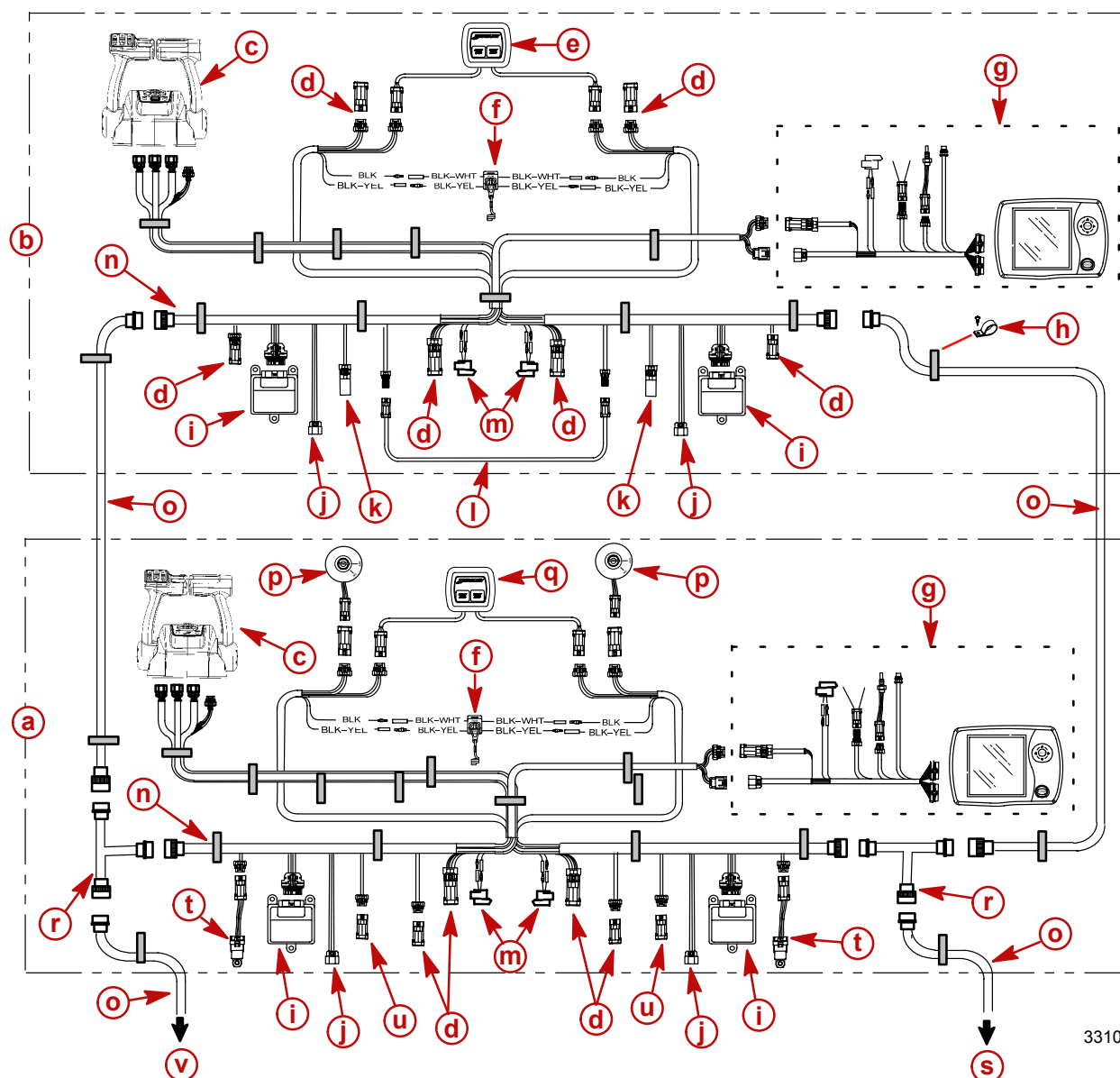
12112

- a** - DTS Control
- b** - Key Switch
- c** - Lanyard Stop Switch
- d** - System View (optional)
- e** - Air Temp Sensor
- f** - Command module

- g** - Horn
- h** - Clamp
- i** - To starboard engine
- j** - To port engine
- k** - Connector, Start/Stop Switch (optional)
- l** - Accessory Power Relay (optional)

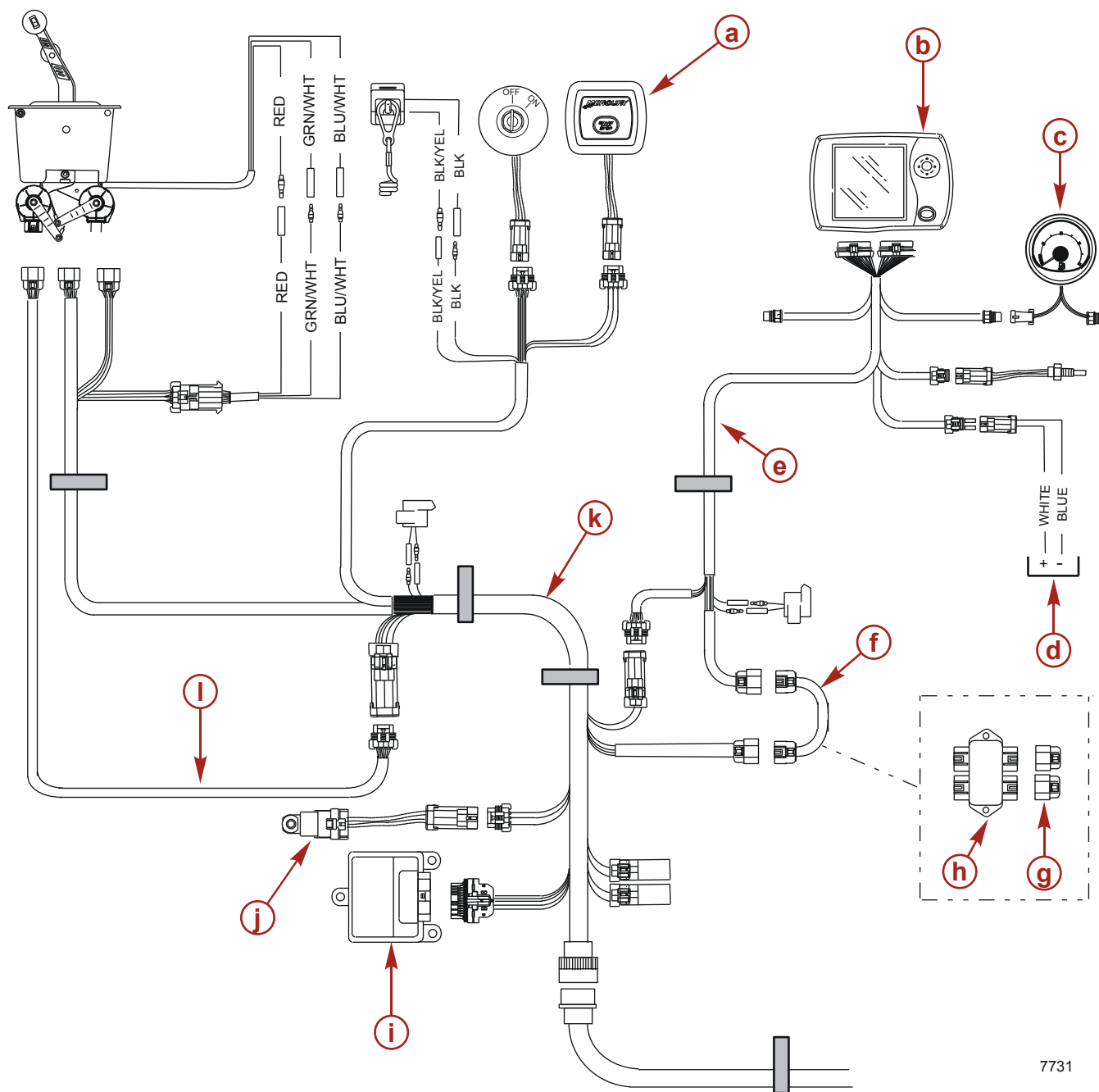
## DTS Dual Console Control Wiring with Dual Helm

**NOTE:** Optional foot throttle is not compatible in multiple engine applications.



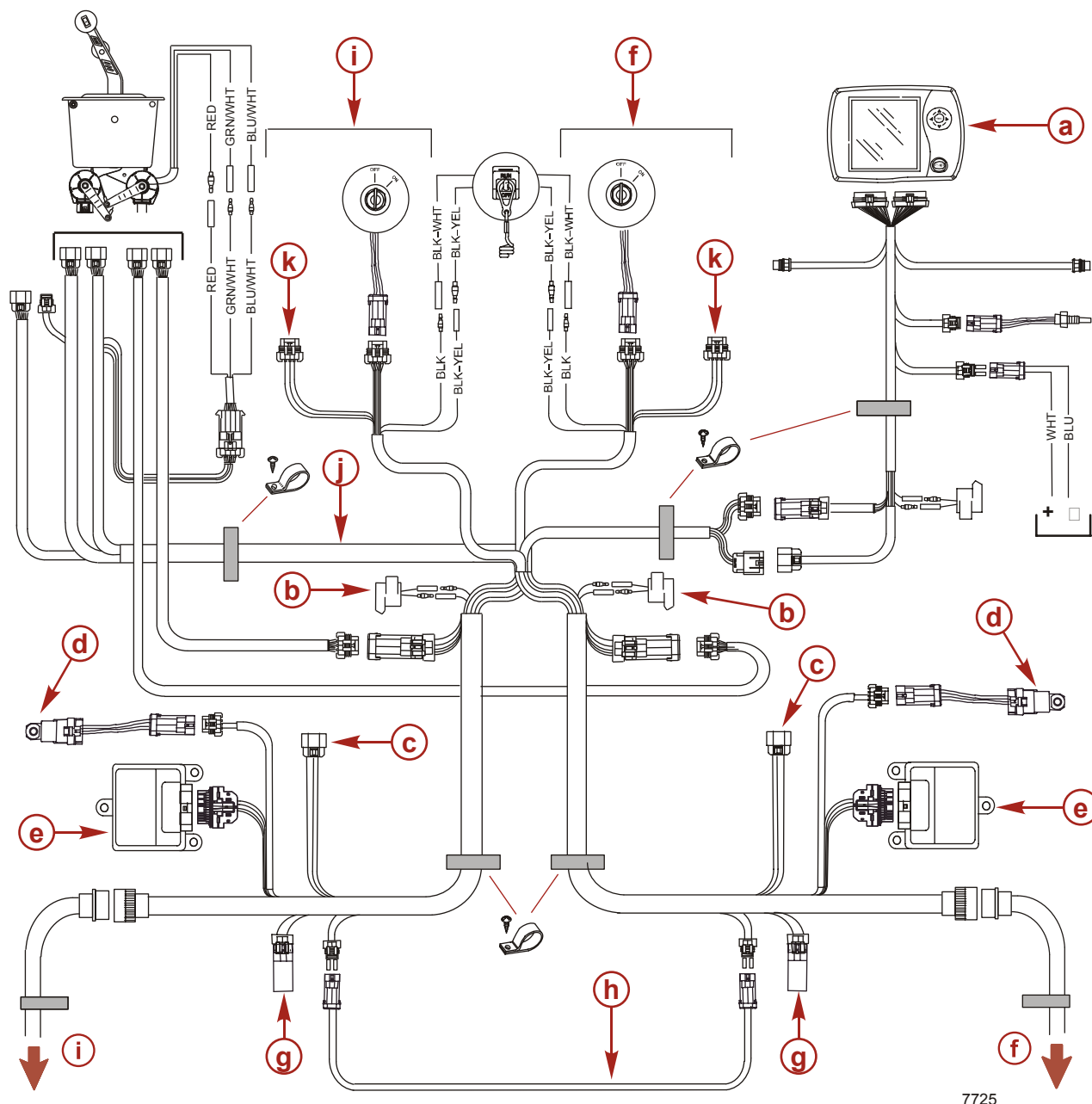
- |                                                       |                                                                 |
|-------------------------------------------------------|-----------------------------------------------------------------|
| <b>a</b> - Helm 1 (primary)                           | <b>l</b> - CAN link harness                                     |
| <b>b</b> - Helm 2 (auxiliary)                         | <b>m</b> - Horn                                                 |
| <b>c</b> - Remote control                             | <b>n</b> - DTS Command Module harness                           |
| <b>d</b> - Connector not used – seal with weather cap | <b>o</b> - Data harness                                         |
| <b>e</b> - Start/stop switch (required at helm #2)    | <b>p</b> - Key switch                                           |
| <b>f</b> - Lanyard stop switch                        | <b>q</b> - Start/stop switch (optional at helm 1)               |
| <b>g</b> - System View (optional)                     | <b>r</b> - Dual helm adaptor harness                            |
| <b>h</b> - Clamps (use as required)                   | <b>s</b> - Data harness to starboard engine                     |
| <b>i</b> - DTS Command Module                         | <b>t</b> - Accessory power relay                                |
| <b>j</b> - Junction box connection (optional)         | <b>u</b> - Remove terminator resistor and seal with weather cap |
| <b>k</b> - Terminator resistor (required at helm #2)  | <b>v</b> - Data harness to port engine                          |

## DTS Zero Effort Control Wiring - Single Engine



7731

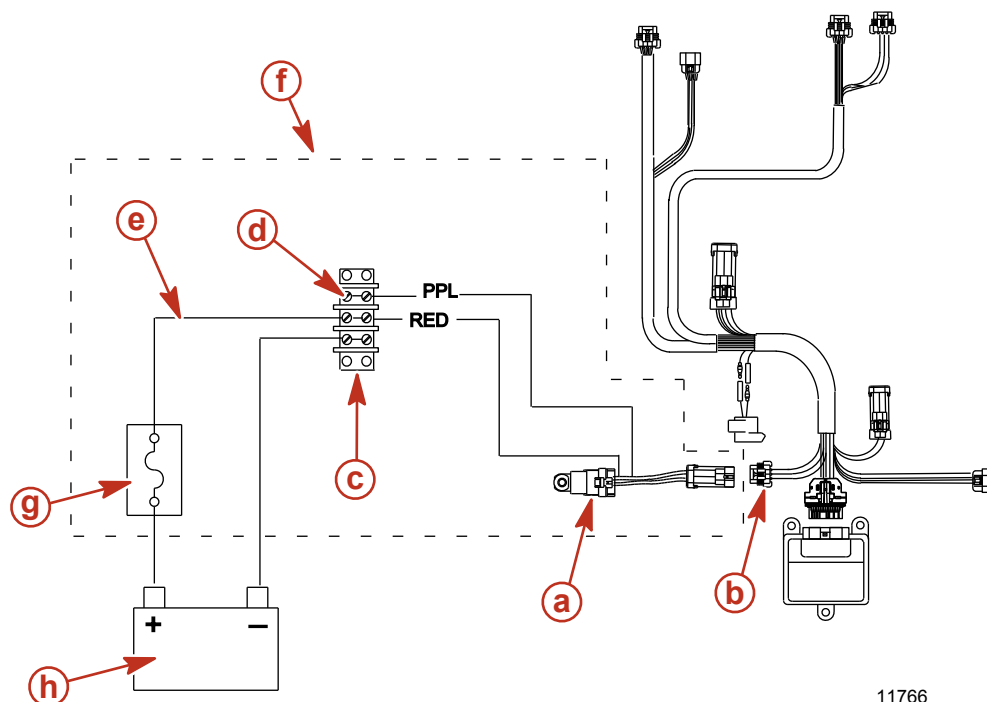
## DTS Zero Effort Control Wiring - Dual Engine



- |                                               |                                                     |
|-----------------------------------------------|-----------------------------------------------------|
| <b>a</b> - System View (optional)             | <b>g</b> - Terminator resistor                      |
| <b>b</b> - Horn                               | <b>h</b> - CAN link harness                         |
| <b>c</b> - Junction box connection (optional) | <b>i</b> - To port engine                           |
| <b>d</b> - Accessory power relay (optional)   | <b>j</b> - DTS Command Module harness               |
| <b>e</b> - DTS Command Module                 | <b>k</b> - Connector - Start/stop switch (optional) |
| <b>f</b> - To starboard engine                |                                                     |

# Typical 10 Pin DTS Wiring Diagrams

## Switched 12V Accessory Connection

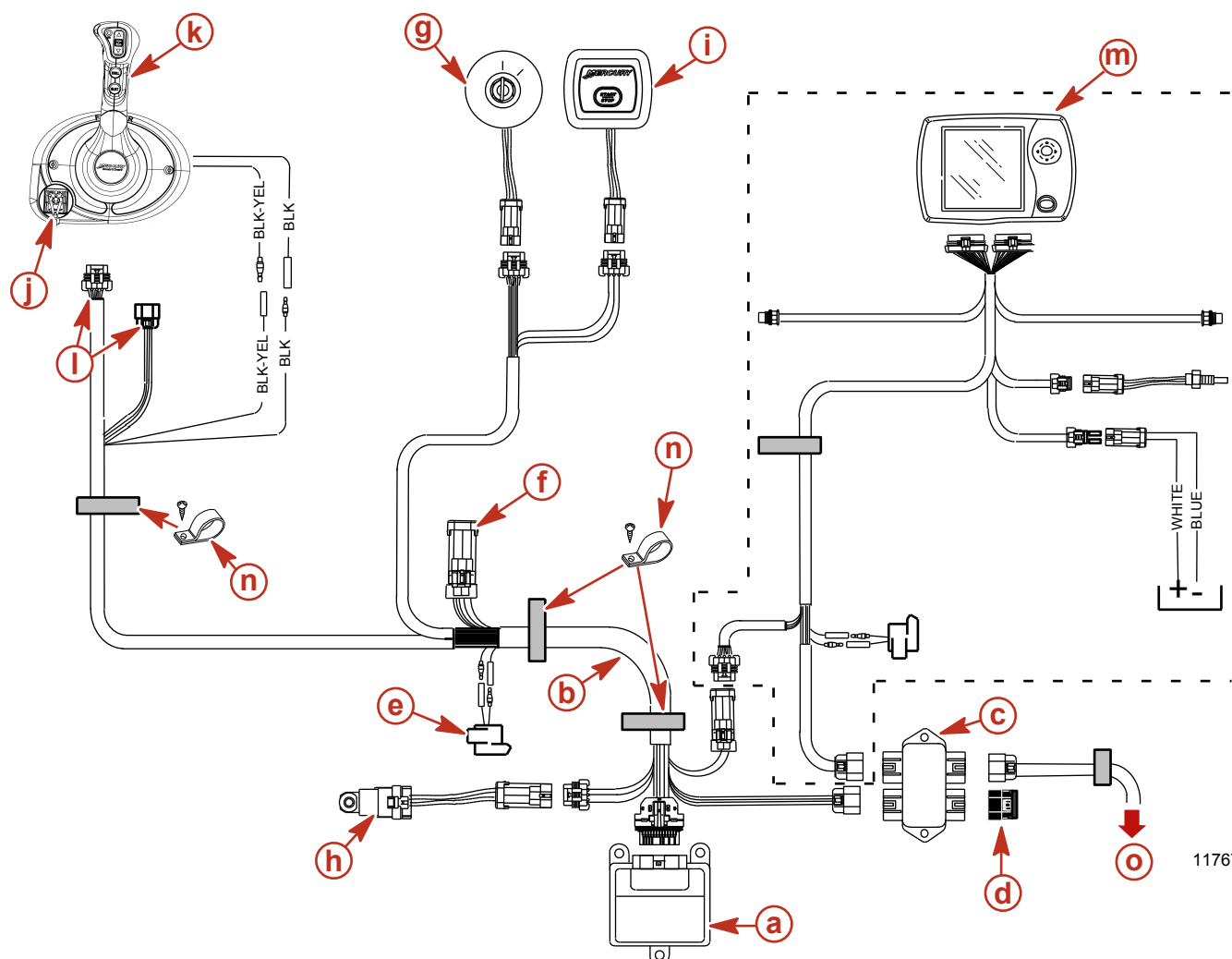


11766

- a** - Accessory power relay (84-888429K01)
- b** - DTS Command Module harness
- c** - Terminal block (86-889679)
- d** - Switched 12 volt

- e** - Power harness with 40 Amp fuse (84-889611K02)
- f** - Complete kit (84-889611K01)
- g** - Fuse
- h** - 12 volt battery

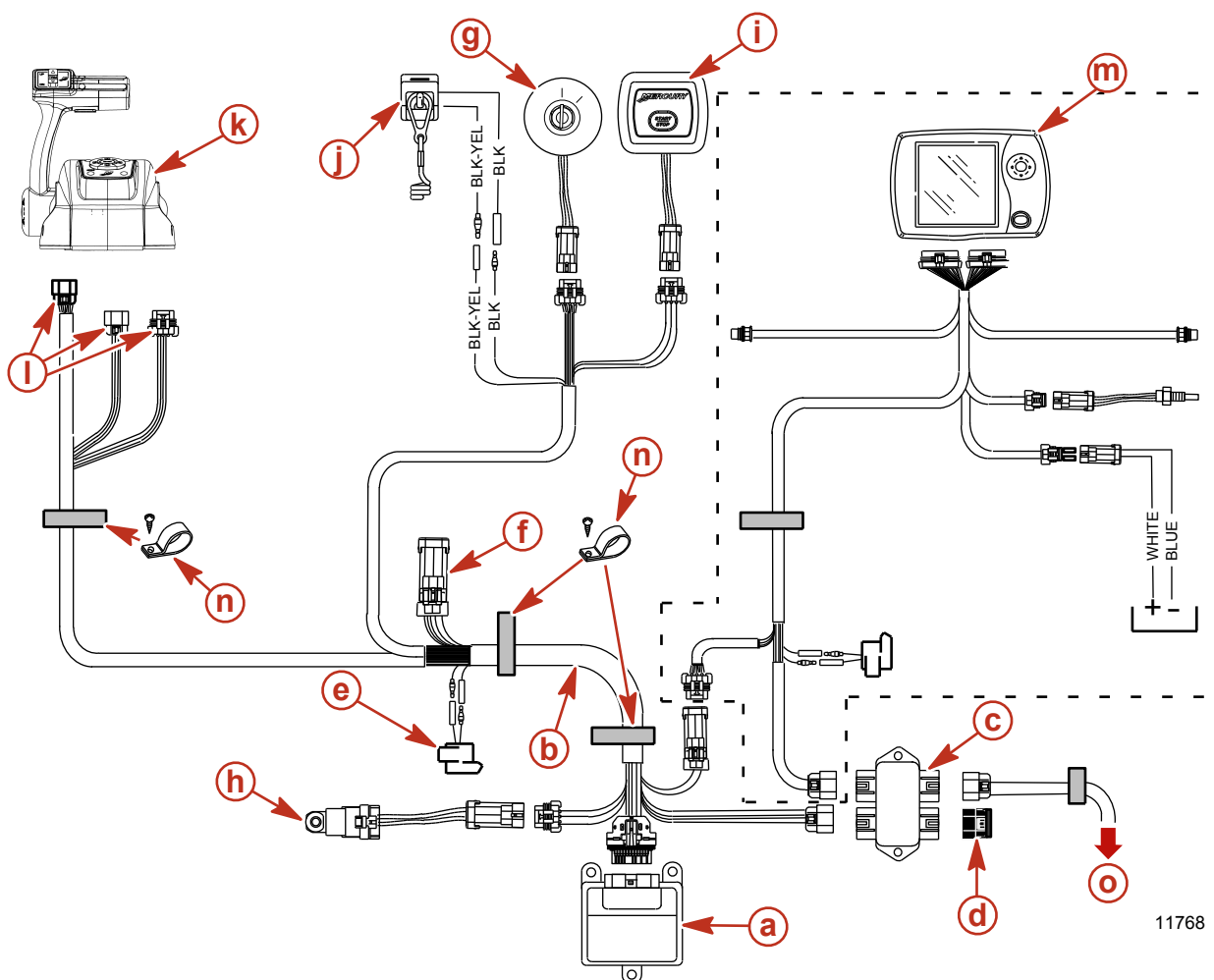
## Single Engine With Panel Control



11767

- |                                             |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>a</b> - DTS Command Module               | <b>i</b> - Start/stop switch (optional) |
| <b>b</b> - DTS Command Module harness       | <b>j</b> - Lanyard stop switch          |
| <b>c</b> - Junction box                     | <b>k</b> - Remote control               |
| <b>d</b> - Termination resistor             | <b>l</b> - Remote control connector     |
| <b>e</b> - Horn                             | <b>m</b> - System View (optional)       |
| <b>f</b> - Connector - foot throttle        | <b>n</b> - "D" clamps                   |
| <b>g</b> - Key switch                       | <b>o</b> - To engine                    |
| <b>h</b> - Accessory power relay (optional) |                                         |

## Single Engine with Console Control

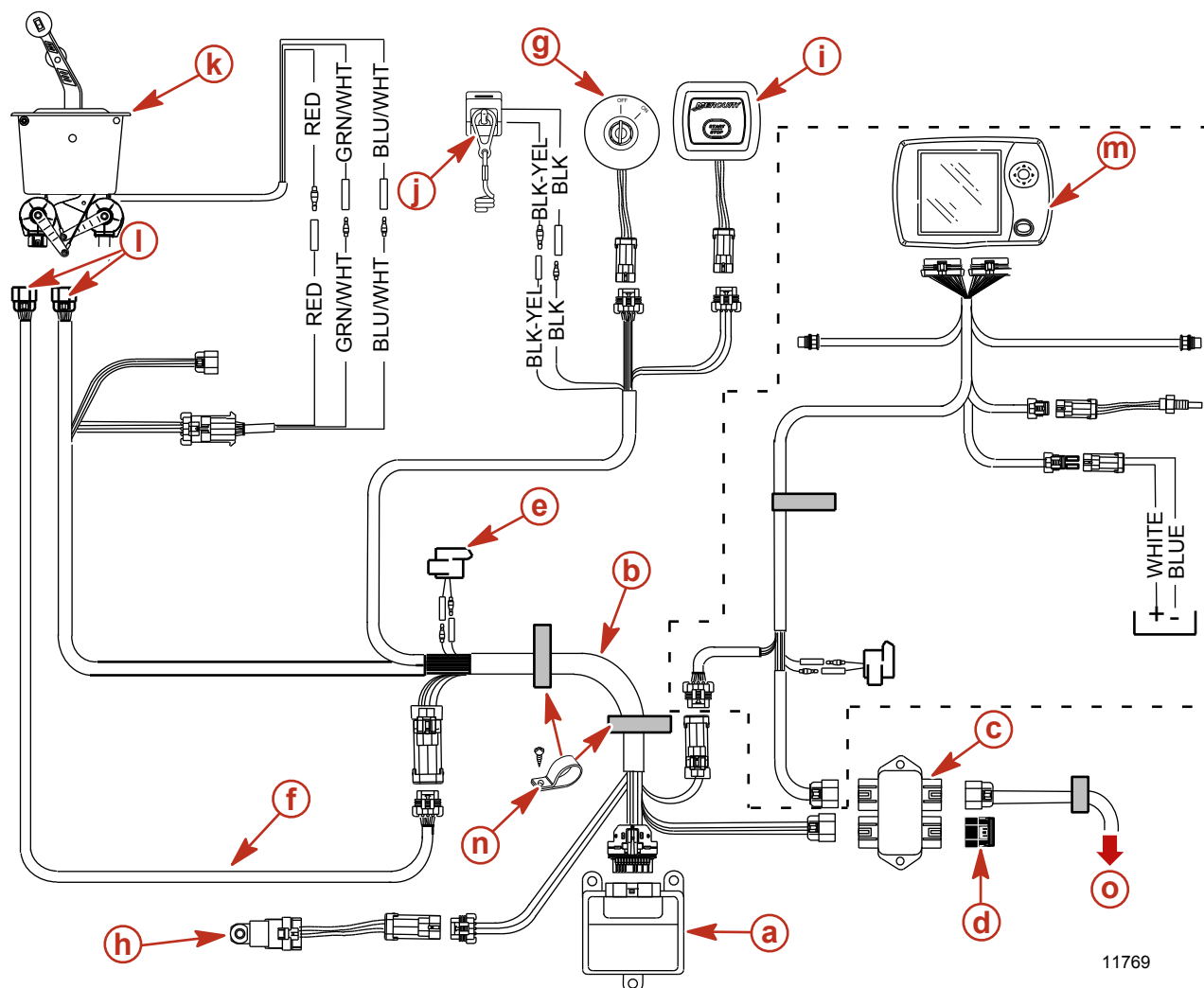


11768

- |                                             |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>a</b> - DTS Command Module               | <b>i</b> - Start/stop switch (optional) |
| <b>b</b> - DTS Command Module harness       | <b>j</b> - Lanyard stop switch          |
| <b>c</b> - Junction box                     | <b>k</b> - Remote control               |
| <b>d</b> - Termination resistor             | <b>l</b> - Remote control connections   |
| <b>e</b> - Horn                             | <b>m</b> - System View (optional)       |
| <b>f</b> - Connector - foot throttle        | <b>n</b> - "D" clamps                   |
| <b>g</b> - Key switch                       | <b>o</b> - To engine                    |
| <b>h</b> - Accessory power relay (optional) |                                         |



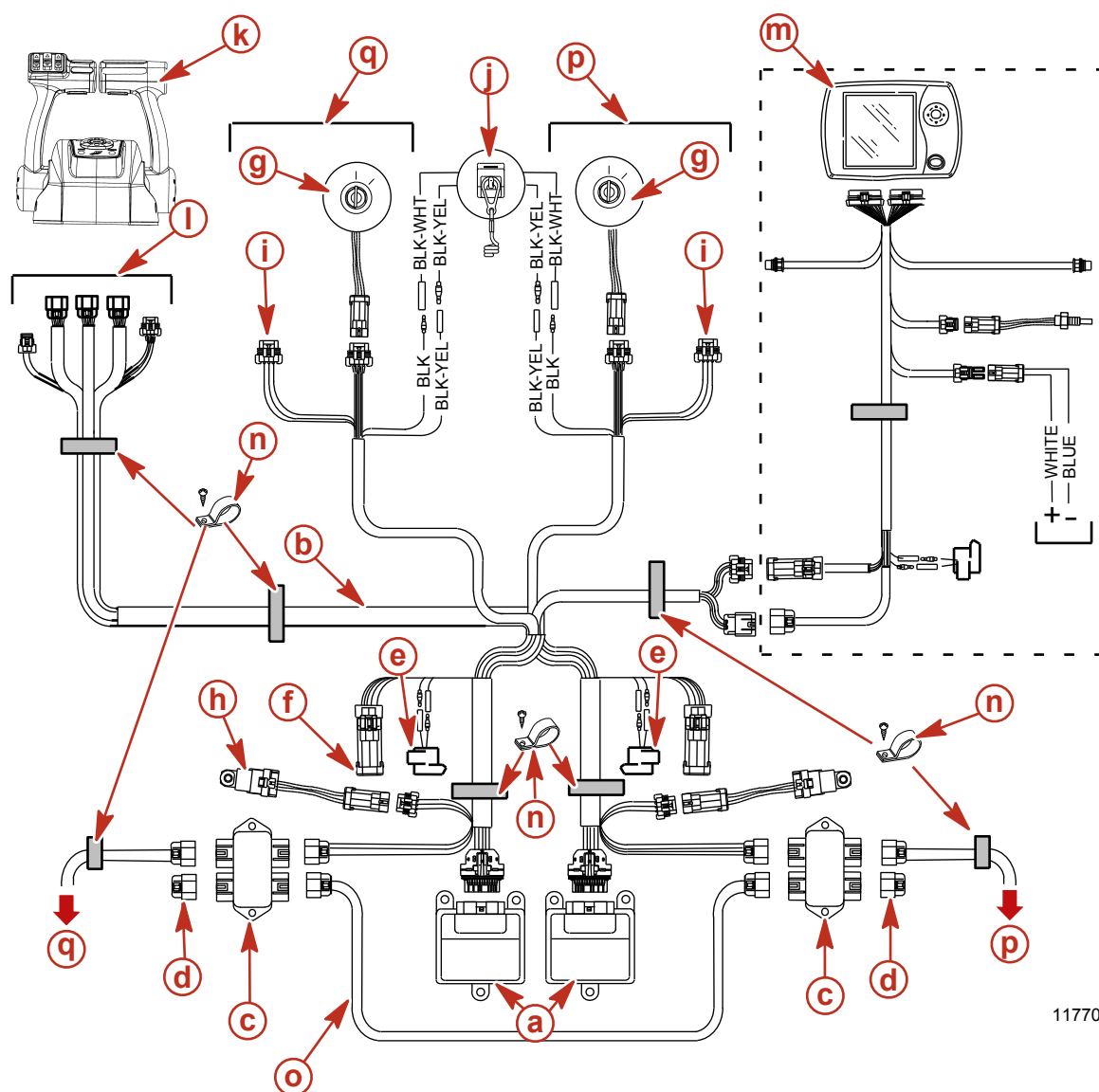
## Single Engine with Zero Effort Control



11769

- |                                             |                                             |
|---------------------------------------------|---------------------------------------------|
| <b>a</b> - DTS Command Module               | <b>i</b> - Start/stop switch (optional)     |
| <b>b</b> - DTS Command Module harness       | <b>j</b> - Lanyard stop switch              |
| <b>c</b> - Junction box                     | <b>k</b> - Remote control                   |
| <b>d</b> - Termination resistor             | <b>l</b> - Remote control connections       |
| <b>e</b> - Horn                             | <b>m</b> - System View (optional)           |
| <b>f</b> - Zero Effort adaptor              | <b>n</b> - "D" clamps                       |
| <b>g</b> - Key switch                       | <b>o</b> - Not used (seal with weather cap) |
| <b>h</b> - Accessory power relay (optional) | <b>p</b> - To engine                        |

## Twin Engine with Console Control

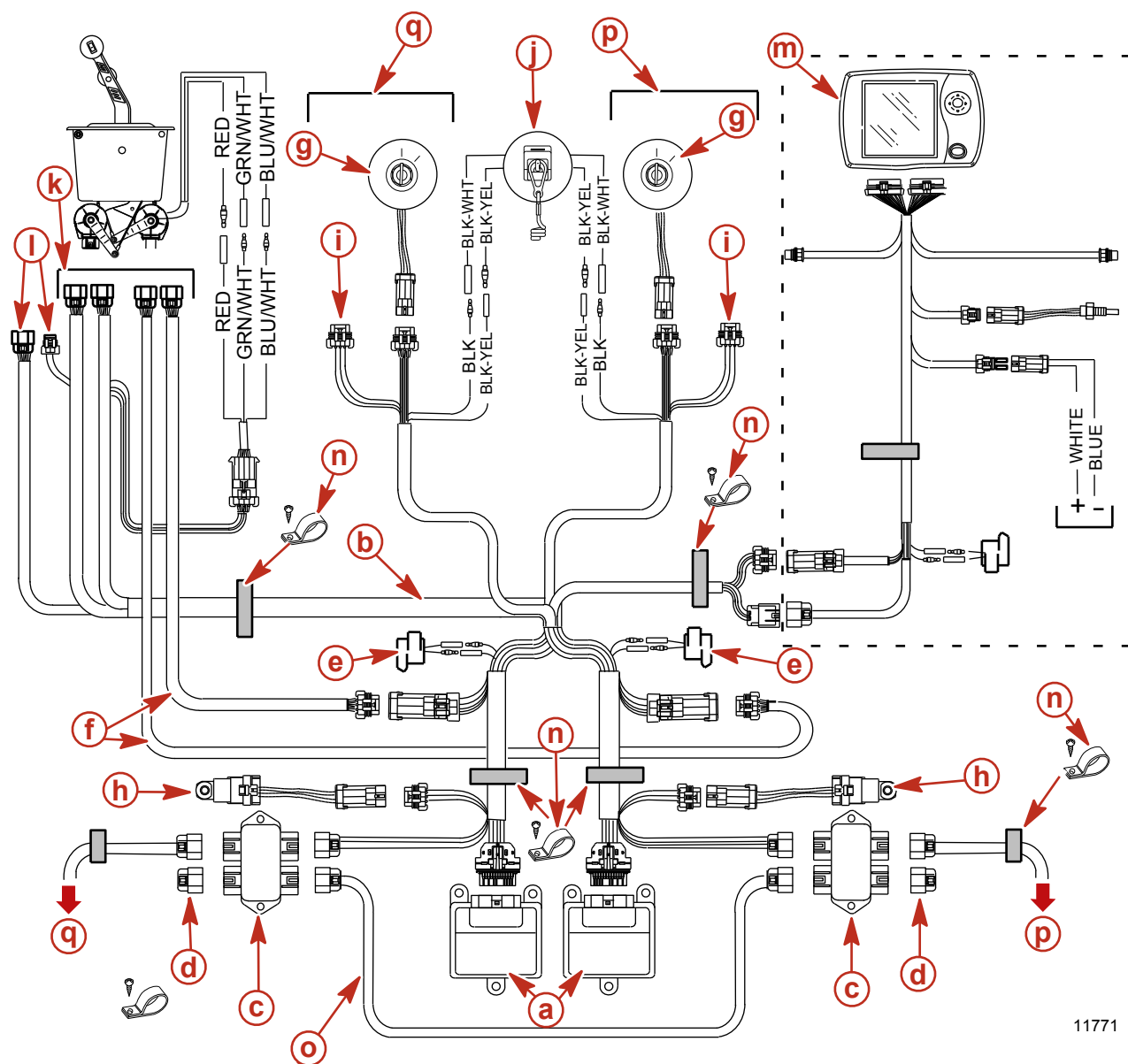


11770

- a** - DTS Command Module
- b** - DTS Command Module harness
- c** - Junction box
- d** - Weather cap
- e** - Horn
- f** - Connector - Zero Effort controls
- g** - Key switch
- h** - Accessory power relay (optional)
- i** - Connector - start/stop switch (optional)

- j** - Lanyard stop switch
- k** - Remote control
- l** - Remote control connections
- m** - System View (optional)
- n** - "D" clamps
- o** - CAN link harness
- p** - To starboard engine
- q** - To port engine

## Twin Engine with Zero Effort Control



- a** - DTS Command Module
- b** - DTS Command Module harness
- c** - Junction box
- d** - Weather cap
- e** - Horn
- f** - Zero Effort adaptor
- g** - Key switch
- h** - Accessory power relay (optional)
- i** - Connector - start/stop switch (optional)

- j** - Lanyard stop switch
- k** - Remote control connections
- l** - Not used (seal with weather cap)
- m** - System View
- n** - "D" clamps
- o** - CAN link harness
- p** - To starboard engine
- q** - To port engine

## System Wiring Installation Checklist

### DATA CABLE

- ☐ Verify the data harness is not routed near sharp edges, hot surfaces or moving parts.

- ☐ Verify data harness is not routed near ignition components (coils, spark plug leads, and spark plugs), high power VHF coax or radios.

#### **JUNCTION BOX (IF EQUIPPED)**

- ☐ Verify the data harness is not routed near sharp edges, hot surfaces or moving parts.
- ☐ Ensure the harness connections are fastened within 25.4 cm (10 in.) of the junction box.
- ☐ Verify that all unused receptacles are covered with a weather cap.

#### **NON-MERCURY MARINE SUPPLIED IGNITION KEY SWITCH**

- ☐ If a non-Mercury Marine ignition key is used, verify that it passes the ingress protection testing per IEC IP66 specification minimum. Ignition switches must pass this specification.

#### **ELECTRONIC REMOTE CONTROL**

- ☐ Ensure Electronic Remote Control (ERC) connections are completed following ERC installation instructions prior to engine operation.

#### **DTS COMMAND MODULE HARNESS**

- ☐ Verify that all connectors are properly inserted and locked in their receptacle (remote control, key switch, command module, lanyard stop switch and junction box, if equipped).
- ☐ Verify that while moving the remote control handle (full forward and full reverse) the harness has unobstructed movement (moves freely).
- ☐ Verify that the lanyard stop switch is wired into the system correctly.
- ☐ Verify that the harness is fastened along the routing path.
- ☐ Verify that all unused connectors have weather caps to prevent corrosion.

#### **BATTERY**

- ☐ Verify that wing nuts have been replaced with hex nuts, provided.
- ☐ Verify that all engine battery cables are connected to the correct terminals.
- ☐ Verify that the DTS power harness leads are connected to the starting battery and secured with locknuts.
- ☐ Ensure the 5 Amp fuse for the DTS power harness is accessible.

#### **LANYARD STOP SWITCH**

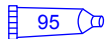
- ☐ Verify that the switch is installed.
- ☐ Verify that the switch is connected to the DTS command module harness.

# SECTION 8 - REMOTE CONTROLS

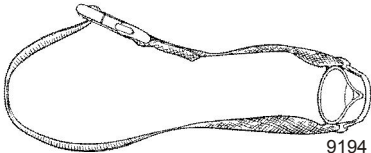
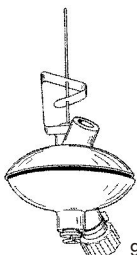
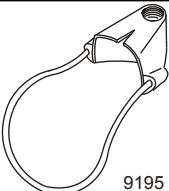
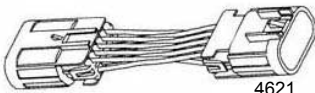
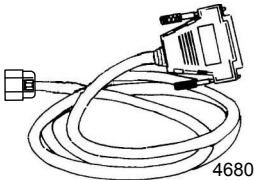
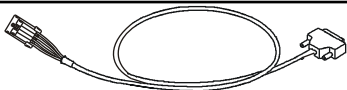
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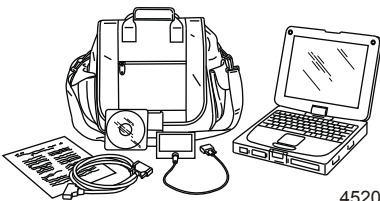
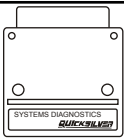
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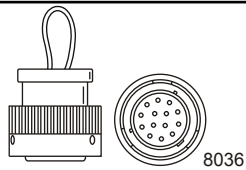
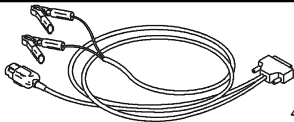
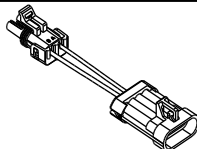
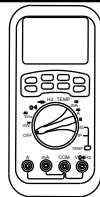
## Lubricant, Sealant, Adhesives

| Tube Ref No.                                                                         | Description                        | Where Used      | Part No.    |
|--------------------------------------------------------------------------------------|------------------------------------|-----------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Shift cable end | 92-802859A1 |

## Special Tools

|                                                                                          |                                                                                                                                       |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Dual Water Pick-up Flush Gearcase Seal Kit                                               | 91-881150K 1                                                                                                                          |
|  9194   | Blocks off the front water inlet holes on the dual water inlet gearcases.                                                             |
| Flushing Device                                                                          | 91-44357Q 2                                                                                                                           |
|  9192   | Attaches to the water intakes; provides a fresh water connection when flushing the cooling system or operating the engine.            |
| Flushing Kit                                                                             | 91-849996T 1                                                                                                                          |
|  9195 | Use for flushing gearcases with low water inlets.                                                                                     |
| Male to Male 10 Pin Adapter                                                              | 84-892452A01                                                                                                                          |
|  4621 | Allows connection between CAN 1 communications cable and Computer Diagnostic System in applications where a junction box is not used. |
| Can 1 Diagnostic Cable                                                                   | 84-892663                                                                                                                             |
|  4680 | Connects into a junction box or male to male adapter cable for Command Module configuration. Not for use with DDT.                    |
| Adapter Harness                                                                          | 84-822560A13                                                                                                                          |
|  5826 | Data link harness between engine and Computer Diagnostic System (CDS) or Digital Diagnostic Terminal (DDT).                           |

|                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Computer Diagnostic System (CDS)                                                                | Order through SPX                                                                                                                                                                                                                                                                                                                                                                       |
|  <p>4520</p>   | <p>Monitors all electrical systems for proper function, diagnostics, and calibration purposes. For additional information, pricing, or to order the Computer Diagnostic System contact:</p> <p>SPX Corporation<br/>28635 Mound Rd.<br/>Warren, MI 48092<br/>or call:<br/>USA - 1-800-345-2233<br/>Canada - 800-345-2233<br/>Europe - 49 6182 959 149<br/>Australia - (03) 9544-6222</p> |
| Breakout Box                                                                                    | SPX P/N MM-46225                                                                                                                                                                                                                                                                                                                                                                        |
|  <p>5974</p>   | <p>Connects to Propulsion Control Module (PCM) to test engine circuits and components without probing wires. May be used with Computer Diagnostic System (CDS).</p>                                                                                                                                                                                                                     |
| Terminal Test Probe Kit                                                                         | SPX P/N MM-46523                                                                                                                                                                                                                                                                                                                                                                        |
|  <p>7915</p>  | <p>Test probes adapt test meter leads to harness connections without damaging harness terminals. May be used with Computer Diagnostic System (CDS).</p>                                                                                                                                                                                                                                 |
| DDT Cartridge v1.3                                                                              | 91-880118A03                                                                                                                                                                                                                                                                                                                                                                            |
|  <p>4013</p> | <p>Contains a diagnostic program for the PCM, allowing technicians to access all diagnostic capabilities available through the engine's PCM. Used with Digital Diagnostic Terminal.</p>                                                                                                                                                                                                 |
| DDT Cartridge v1.31                                                                             | 91-880118A04                                                                                                                                                                                                                                                                                                                                                                            |
|  <p>4013</p> | <p>Contains a diagnostic program for the PCM, allowing technicians to access all diagnostic capabilities available through the engine's PCM. Used with Digital Diagnostic Terminal.</p>                                                                                                                                                                                                 |
| Digital Diagnostic Terminal (DDT)                                                               | 91-823686A2                                                                                                                                                                                                                                                                                                                                                                             |
|  <p>4011</p> | <p>Displays problem codes. Also monitors various sensors, circuits, and components. Performs self-test procedures on select engine electrical systems. Cartridges and harnesses to use on the engines are sold separately.</p>                                                                                                                                                          |

|                                                                                     |                                                                                                                                               |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 12 Volt Shunt Connector                                                             | Part number currently not available for this printing                                                                                         |
|    | Connects to data harness allowing operation of the DTS system with the Digital Diagnostic Terminal.                                           |
| Adapter Harness                                                                     | 84-822560A5                                                                                                                                   |
|    | Data link harness between engine and Digital Diagnostic Terminal (DDT).                                                                       |
| 2 to 4 Pin Harness Adapter                                                          | 84-822560A12                                                                                                                                  |
|    | Adapts the 2 pin Digital Diagnostic Terminal harness to the 4 pin connector on the engine.                                                    |
| DMT 2004 Digital Multimeter                                                         | 91-892647A01                                                                                                                                  |
|   | Measures RPM, ohms, amperes, AC and DC voltages; records maximums and minimums simultaneously, and accurately reads in high RFI environments. |
| DDT Diagnostic Reference Manual                                                     | 90-881204003                                                                                                                                  |
|  | Lists procedures, specifications and sensor outputs that can be monitored by using the Digital Diagnostic Terminal.                           |

## High Speed Or Twin Engine Applications Steering Recommendation

Mercury MerCruiser power packages come standard with Mercury MerCruiser's internal power steering. This durable system provides precise effortless steering control and is recommended for most sport boat applications. On certain applications, however, Mercury MerCruiser recommends the use of an external power steering system where the power steering cylinders connect directly to the sterndrive unit on the outside of the boat. This arrangement gives additional support for even tighter, more firm steering control, and is recommended for the following applications:

- High speed single or twin engine applications and/or boats with unusual handling characteristics.



**NOTE:** It is virtually impossible to give a specific recommendation as to when external power steering should be used, as this varies from boat design to boat design. Mercury MerCruiser recommends using external power steering on boats which operate in excess of 70 mph. There are boats which operate at 60 mph that would benefit from the use of external power steering. Because of the many variables involved, the final decision as to whether or not external power steering is required rests with the boat manufacturer and must be made after a thorough test and evaluation of each specific boat. If there is any question whether or not external power steering is necessary, Mercury MerCruiser recommends that it be installed.

- Any Hi-Performance sport boat powered by three or more engines.
- Offshore boats or other applications where the boat and sterndrive units may come out of the water occasionally.

External power steering systems are generally either mechanical cable actuated or hydraulic actuated.

External power steering and hydraulic helm systems can be obtained from the following after market suppliers:

Latham Marine, Inc.  
Ft. Lauderdale, FL 33315  
Phone: (305) 462-3055  
Fax: (305) 462-3081,  
Mayfair Marine Machine  
12890 N. W. 30th Avenue  
Opalocka, FL 33054  
Phone: (305) 681-1815,

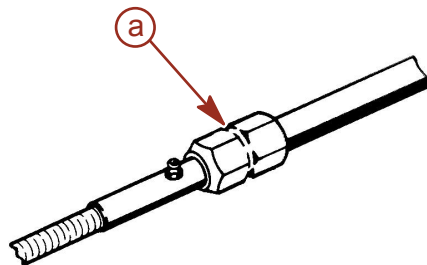
## Steering Helm and Cable

Transom assembly is shipped with the steering cable guide tube preset for cables with end dimensions that comply with ABYC standards as outlined in the NMMA certification handbook. The steering cable coupler nut must also have a means of locking it to the guide tube, as specified in ABYC requirements.

### WARNING

Failure to use a steering cable locking device could cause loss of steering, which could cause damage to the boat and/or injury.

**NOTE:** All current production Quicksilver RideGuide steering cables have a self-locking coupler nut and do not require an external locking device. (Other cable manufacturers also make cables with self-locking coupler nuts.)



7255

**a -** Quicksilver RideGuide steering cable self-locking coupler nut (identified by groove)

**IMPORTANT:** If using a steering cable that does not have a self-locking coupler nut, an external locking device such as a locking sleeve must be used.

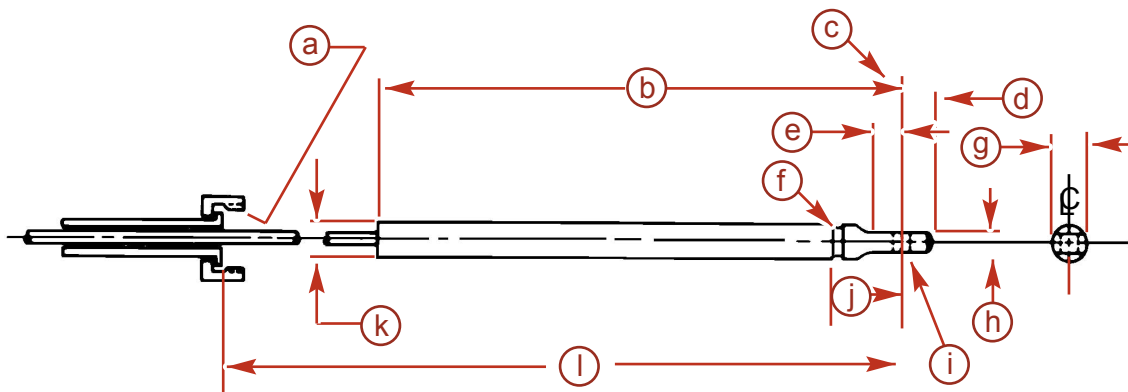
## ⚠ CAUTION

If steering cable with improper dimensions is installed, severe damage to transom assembly and/or steering system may result.

1. Steering cable must be the correct length, particularly when installed in larger boats.
2. Avoid sharp bends, kinks, or loops in cable.
3. Refer to Steering Cable Specifications for fully extended steering cable and dimensions.

## Steering Cable Specifications

**IMPORTANT:** Power steering pump lugging (squealing) in a hard right turn (against lock) may mean a steering cable has been installed that does not have the correct dimensions.

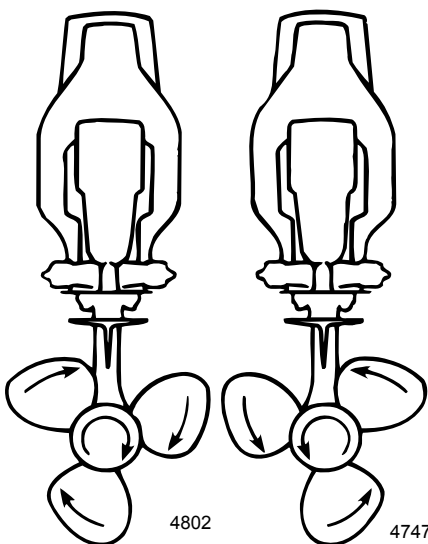


7254

- |                                                   |                                                                                                                                                                                                                                           |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>a</b> - Coupler nut - 7/8 - 14 UNF - 28 thread | <b>g</b> - 15.9 mm (5/8 in.) maximum diameter end fitting                                                                                                                                                                                 |
| <b>b</b> - 29.8 cm (11-3/4 in.) minimum           | <b>h</b> - 9.5 mm (3/8 in.)                                                                                                                                                                                                               |
| <b>c</b> - Interface point                        | <b>i</b> - 9.8 mm (3/8 in.) diameter through hole (chamfered each side)                                                                                                                                                                   |
| <b>d</b> - 12.7 mm (1/2 in.) maximum              | <b>j</b> - 34.9 mm (1-3/8 in.) maximum                                                                                                                                                                                                    |
| <b>e</b> - 10.7 mm (27/64 in.) minimum flat       | <b>k</b> - 15.9 mm (5/8 in.) diameter tube                                                                                                                                                                                                |
| <b>f</b> - 3.1 mm (7/64 in.) minimum radius       | <b>l</b> - Cable travel: mid-travel position - 42.9 cm (16-7/8 in.) total travel to be 20.3 cm (8 in.) minimum to 22.8 cm (9 in.) maximum travel each side of mid-travel position - 1.02 cm (4 in.) minimum to 114 mm (4-1/2 in.) maximum |

## Propeller Rotation

Propeller rotation for sterndrive can be right hand or left hand rotation as viewed from the aft end of the propeller.



Right hand rotation

Left hand rotation

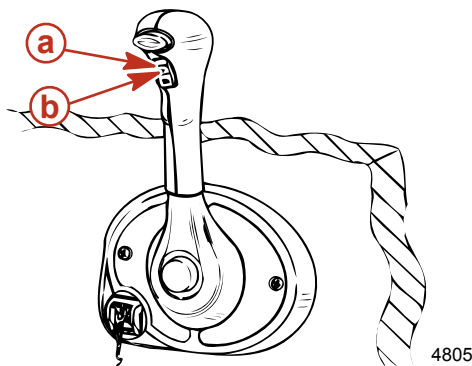
## Bravo Sterndrive Shift Check (Engine Running)

### ⚠ WARNING

Contact with moving sterndrive components and the propeller can cause personal injury or death. To avoid possible injury, remove the propeller and ensure that no people or animals are in the area of the sterndrive.

This test requires sufficient water supply to your engine and sterndrive.

1. Check sterndrive for proper gear shift with boat out of water.
2. Use the sterndrive tilt switch on the remote control handle to lower the sterndrive to DOWN/IN position. Do not allow the sterndrive skeg to contact the ground.



Typical single handle remote control shown

**a** - Drive trim switch

**b** - Drive trailer button

3. Connect a garden water hose between flushing attachment and water source.

|                                            |              |
|--------------------------------------------|--------------|
| Dual Water Pick-up Flush Gearcase Seal Kit | 91-881150K 1 |
| Flushing Device                            | 91-44357Q 2  |

|              |              |
|--------------|--------------|
| Flushing Kit | 91-849996T 1 |
|--------------|--------------|

4. Partially open water source until water continuously leaks out around the flushing device.

### ⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

**IMPORTANT:** Engines with the sterndrive water inlet blocked off at the gimbal housing and using a through the hull water inlet need a supply of cooling water available to both the sterndrive and to the engine during operation.

5. Place remote control handle in NEUTRAL, idle speed position and start engine.

### ⚠ CAUTION

Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure that the engine is operating in the normal range.

### ⚠ CAUTION

Sterndrive not shifting properly can cause engine and sterndrive damage. Contact your authorized Mercury MerCruiser dealer for proper adjustment.

**NOTE:** The sterndrive is shifting properly when the sterndrive shifts with minimal effort in and out of each gear FORWARD, NEUTRAL, and REVERSE, at idle speed position.

**NOTE:** The operator at the remote control handle should feel a slight detent before and after each gear. FORWARD-detent-NEUTRAL-detent-REVERSE

**IMPORTANT:** The sterndrive is not shifting properly if the sterndrive shifts after the engine throttle is engaged. Consult your authorized Mercury MerCruiser dealer/representative for proper adjustment.

6. Move the remote control handle to FORWARD, idle speed position.
7. Check that the sterndrive propeller shaft is turning in the FORWARD direction.
8. Shift the remote control handle to NEUTRAL, idle speed position.
9. Check that the sterndrive propeller shaft is not turning.
10. Shift the remote control handle to REVERSE, idle speed position.
11. Check that the sterndrive propeller shaft is turning in the REVERSE direction.
12. **If the sterndrive will not shift:**
  - a. Remove the sterndrive and check for proper shift hook ups.
  - b. Check that the shift cables are connected

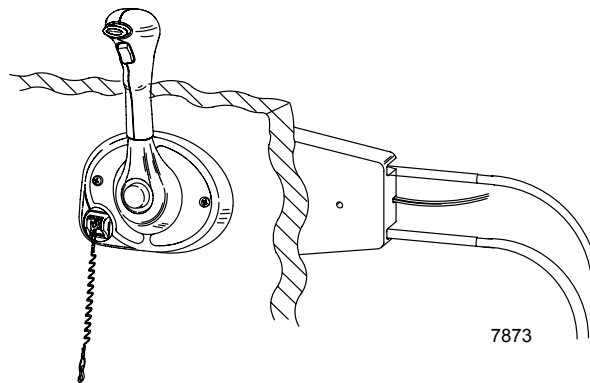
**IMPORTANT:** Be sure that the shift cables are routed in such a way as to avoid sharp bends and/or contact with moving parts. DO NOT fasten any items to shift cables.

## Troubleshooting Shift Problems

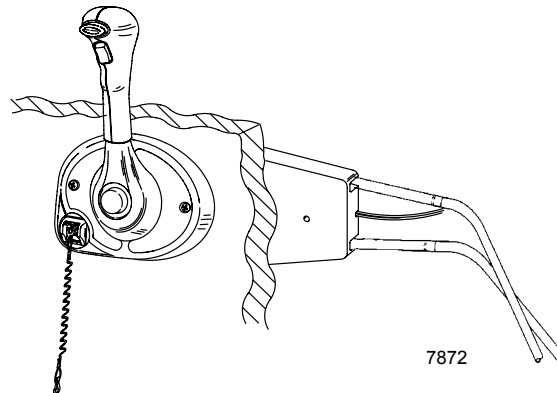
**NOTE:** The following information is provided to assist an installer in troubleshooting if hard shifting or chocking/racheting is encountered when shifting into FORWARD gear.

1. When installing the control box in the side panel of the boat, ensure that the cables have enough clearance to operate. This is necessary because the cables move up and down when the shift handle is moved. If the control box is mounted too far back toward any fiberglass structure, the cables will be interfered with; this will cause very hard shifting.

**NOTE:** The control box housing can be rotated in 30 degree increments to improve cable routing.



**Proper cable bend**



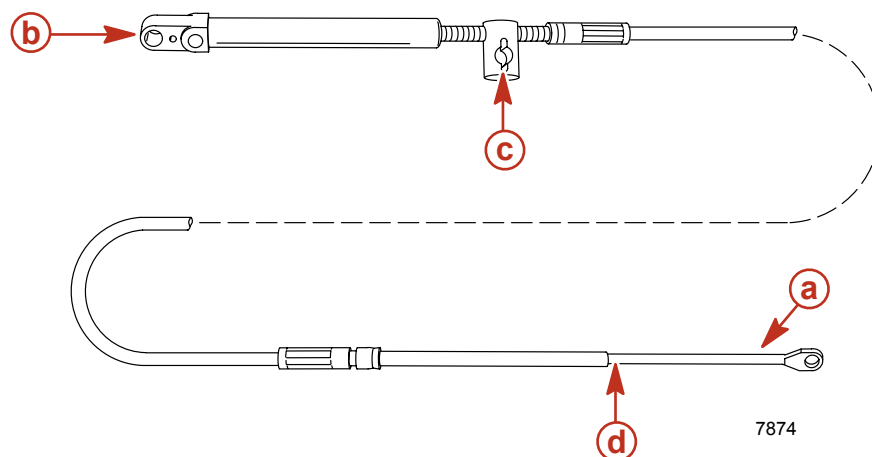
**Improper cable bend**

2. Ensure that when the shift cable from the control box is led through the side gunnel of the hull, it does not have any extremely sharp bends in it as this will cause stiff shifting.

**IMPORTANT:** Remote control cables **MUST BE THE CORRECT LENGTH**; sharp bends on too-short cables result in kinks and too-long cables require unnecessary bends or loops. Both conditions place extra stress on the cables.

**IMPORTANT:** Shift cable/throttle cable lubrication points use 2-4-C with Teflon.

3. Before installing the shift cable into the control box, extend the stainless rod eye end of the cable and lubricate it. Move it back and forth to allow even distribution of the lubricant.



**a** - Remote control end  
**b** - Engine end

**c** - Adjusting barrel  
**d** - Lubricating point

| Tube Ref No.                                                                         | Description                        | Where Used      | Part No.    |
|--------------------------------------------------------------------------------------|------------------------------------|-----------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Shift cable end | 92-802859A1 |

**NOTE:** Allow for clearance of cables directly behind panel mount remote control. The 4000 GEN II Series Panel Mount Remote Control mounting surface must not exceed 25 mm (1 in.) thickness. Cable radius at any one point must not be less than 305 mm (12 in.).

| 4000 GEN II Series Panel Mount Remote Control |                 |
|-----------------------------------------------|-----------------|
| Description                                   | Specification   |
| Mounting surface maximum thickness            | 25 mm (1 in.)   |
| Minimum cable bend radius at any point        | 305 mm (12 in.) |

4. Do not strap or clamp the control cables to any other cables or rigid structure within 91.4 cm (3 ft) of the control box.
5. Ensure that the cable is not permanently kinked.
6. Ensure that there is proper clearance for cable movement when the control box is installed in the side panel. The cables must have room to move up and down when the control handle is shifted into either FORWARD or REVERSE.
7. Ensure that the engine was not set down on the intermediate shift cable during installation, as this will crush the inner cable tubing and cause improper and / or stiff shifting.
8. Do not fasten the shift cable with straps or clamps to any other cable within 1.5 m (5 ft) of the shift plate.
9. Do not fasten the shift cable to the transom with any type of plastic clips or fasteners within 1.5 m (5 ft) of the shift plate.
10. Do not overtighten the throttle or shift cable attaching nuts at the engine end. Barrel and cable end must be free to rotate on the mounting stud.

**NOTE:** Lubricate attaching points with engine oil.

| Description        | Where Used               | Part Number    |
|--------------------|--------------------------|----------------|
| SAE 30W Engine Oil | Shift cable pivot points | Obtain Locally |

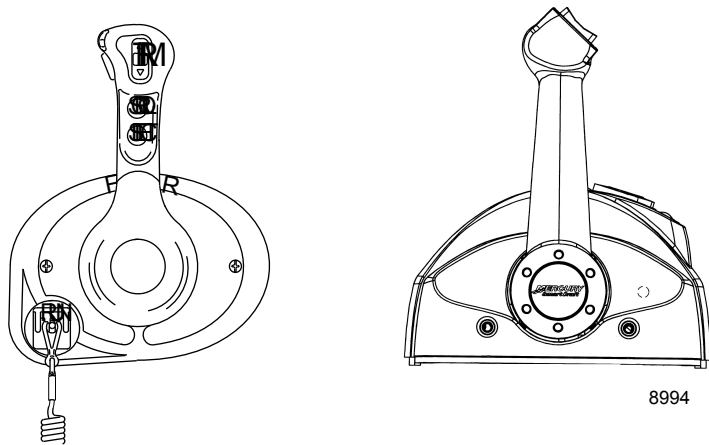
11. Check the intermediate shift cable routing from the transom assembly to the shift plate as follows:
  - a. The cable should come through the transom, above the exhaust pipe and make a turn toward the starboard side of the boat between the exhaust pipe and the engine flywheel housing.
  - b. The cable should then be routed under the starboard rear engine mount and turn toward the transom.
  - c. The cable should then go up behind the power steering valve and loop over to the shift plate on the engine, where it is connected to the anchor points on the shift plate.

Following this routing will prevent the engine coupler from damaging the cable.

**NOTE:** NOTE: A final check of the adjustments should be made with the boat in the water and engine running. If this cannot be done or is not done at your manufacturing facility, arrangement should be made with the dealer to do this as part of the pre-delivery inspection

# DTS Remote Control - Sterndrive

**IMPORTANT:** Boat must be equipped with Mercury electronic remote control. Start in gear protection is provided by this control system and prevents the engine from starting when the control is actuated in FORWARD or REVERSE.



The Digital Throttle and Shift System (DTS) required to operate this engine package provides start, stop, throttle, shift control, start in gear protection and emergency lanyard stop function. Refer to the Mercury Precision Parts/Quicksilver Accessories Guide.

The Digital Throttle and Shift system (DTS) works with specialized helm component, command module kit and electronic remote control. Refer to the Mercury Precision Parts/Quicksilver Accessories Guide.

## DTS Calibration

### Special Tools - DTS Calibration

|                                  |                   |
|----------------------------------|-------------------|
| Male to Male 10 Pin Adapter      | 84-892452A01      |
| Can 1 Diagnostic Cable           | 84-892663         |
| Adapter Harness                  | 84-822560A13      |
| Computer Diagnostic System (CDS) | Order through SPX |

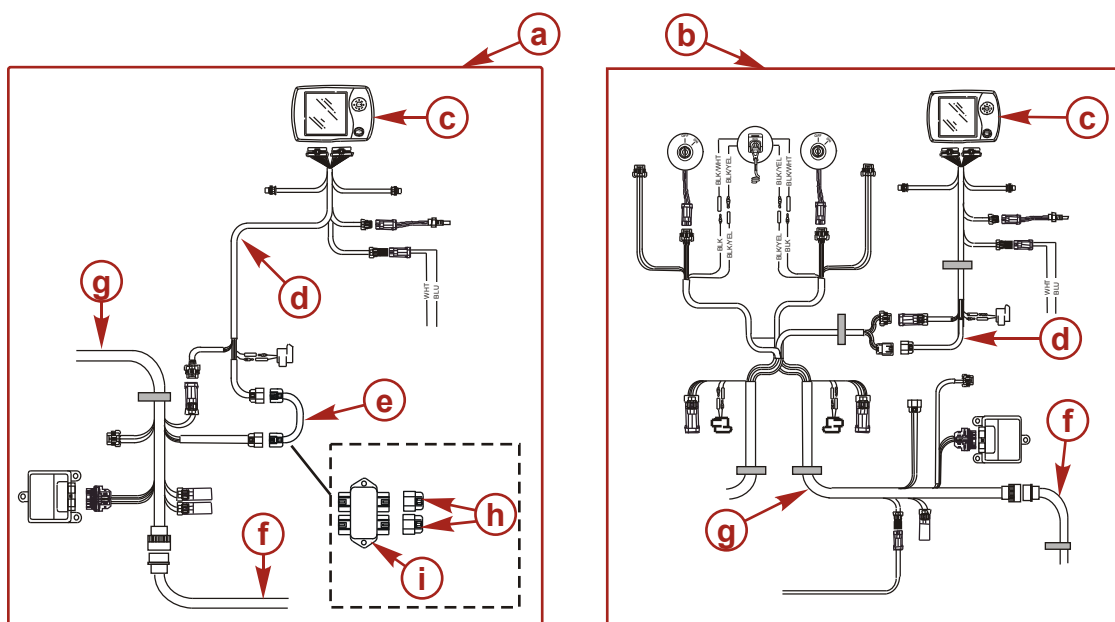
### Methods of Calibration

**NOTE:** DTS system calibration must be performed following complete system installation. It must also be completed after an accessory or replacement part is added to the system that requires new configuration codes. A DTS system reset must be performed prior to calibration, or if an error is made during the calibration setup.

- **Method 1 - Mercury Marine Computer Diagnostic System (CDS)** - Connect the CDS to the CAN bus circuit and follow the helm configuration setup on the computer diagnostic screen.
- **Method 2 - Mercury Marine SmartCraft System View display** - If the boat is not equipped with a System View display, temporarily connect a System View display to the helm harness shown in the following diagrams. Follow the System View calibration setup instructions for the DTS. If the DTS system was previously calibrated, perform a DTS system reset to restore the factory default settings.

## System View Display Connection

If the boat is not equipped with a System View display, temporarily connect a System View display to the DTS command module harness as shown. After calibration, remove System View and harness, seal harness connections with weather caps.



5003

- a** - Single engine connection
- b** - Dual engine connection
- c** - System View
- d** - Display harness
- e** - Cable adaptor (male to female)

- f** - 14 pin data harness from engine
- g** - DTS Command Module harness
- h** - Weather caps
- i** - Junction box

## DTS System Reset

The DTS system reset will restore the engine setup and remote control menus to factory default settings. DTS reset must be completed prior to system calibration, after an error is made during the calibration setup, or an accessory has been added or replaced.

**NOTE:** If the boat does not have a System View installed, temporarily connect a System View to the DTS command module harness.

1. Use the trackpad on the System View and highlight the "SETTINGS" directory on the home screen.
2. Press and hold in the bottom arrow on the trackpad for 10 seconds. Continue holding after 10 seconds then press in the top arrow. This will bring up the warning screen.
3. The warning screen will ask the question "DO YOU WANT TO CONTINUE", Highlight "YES" and press "SELECT" button to accept. This will bring up the reset screen.
4. Use the trackpad and highlight "RESTORE VESSEL CONFIGURATION TO FACTORY DEFAULTS" selection on the reset screen. Press "SELECT" button to accept. The reset screen will ask the question "ARE YOU SURE YOU WANT TO RESTORE VESSEL CONFIGURATION TO FACTORY DEFAULTS". Highlight "YES" and press "SELECT" button to accept.
5. DTS system reset is complete. The engine setup and remote control menus have been restored back to the factory defaults.



## Calibration Setup

### SPECIAL INSTRUCTIONS FOR DUAL HELM VESSELS

- Perform the calibration setup at each helm using the System View. After setup is complete at one helm, repeat setup on the second helm.
- If only one System View is installed in the vessel, the System View must be temporarily connected to the second helm. An extra System View can temporarily be connected at the second helm. This will eliminate the need to move the System View between helms.
- If one System View is used between helms for calibration setup, a DTS system reset will have to be performed each time it is moved to a different helm. Refer to DTS System Reset procedure.
- Calibration can be started at either helm. However, if one System View is being used, it is best to start at helm 2 (helm with the start/stop switch) and then move to helm 1.
- Calibration setup requires remote control lever movement at both helms.

**NOTE:** Helm 1 is always the helm with the ignition key switch. Helm 2 has the start/stop switch.

### CALIBRATION

**NOTE:** The following calibration procedure is for using method 2, using a System View display screen. If method 1, using a Mercury Marine Computer Diagnostic System is used, follow the on-screen instructions on the diagnostic computer to calibrate the system.

1. The first screen will ask if the module initialization has been completed on another station. Select "NO" on single helm vessels and on dual helm vessels if calibration has not yet been completed on the another helm. Select "YES" on dual helm vessels if calibration has already been completed on the other helm.

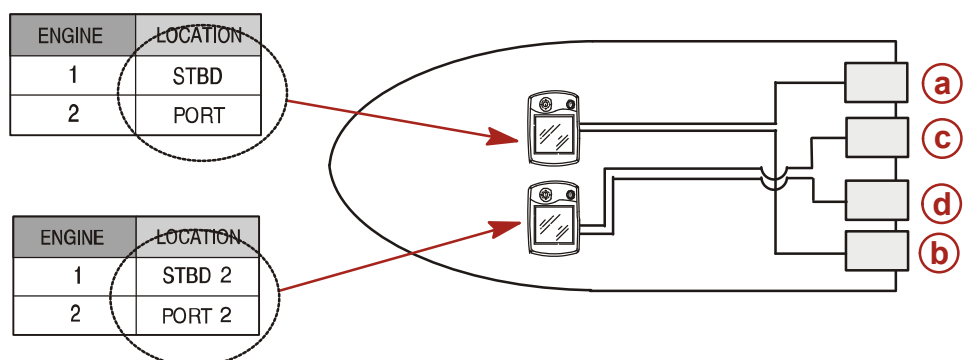
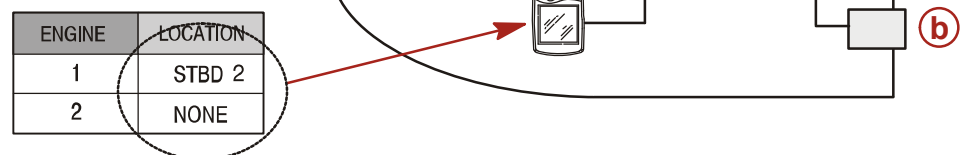
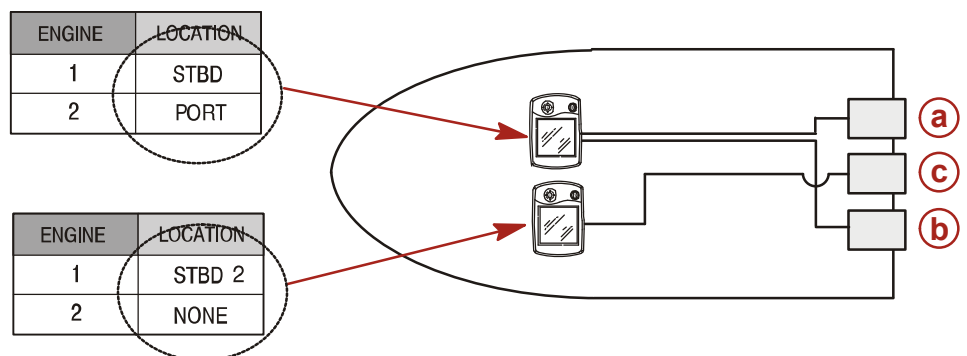
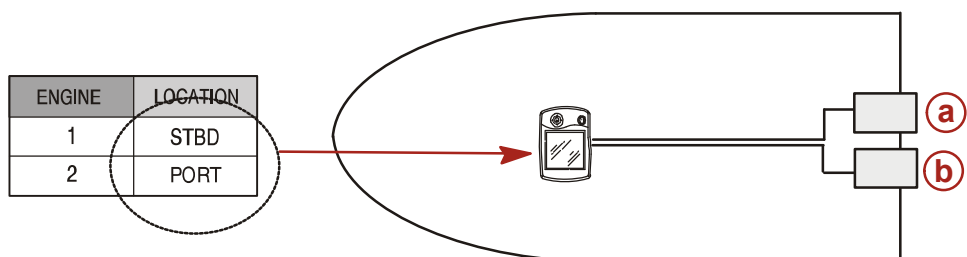
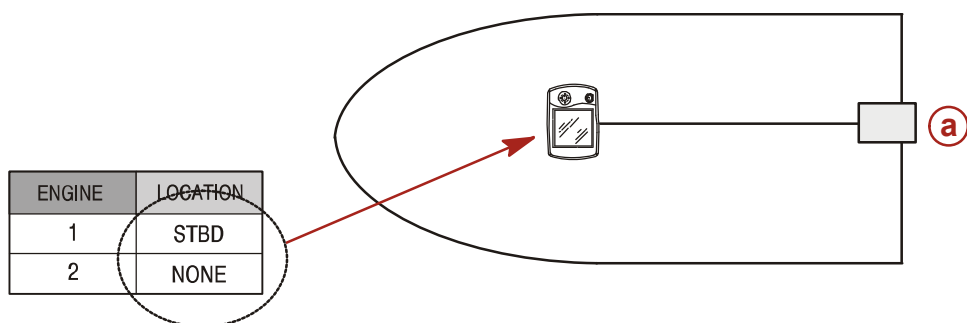
**NOTE:** If "YES" is selected, module initialization was completed at the other station. Calibration will advance to step 7.

2. The next screen should read "HOW MANY HELMS AND ENGINES ARE THERE ON THE VESSEL?" Select the number of helms and engines the vessel has. Use the up and down arrows to change the number of engines or helms. Use the left or right arrow to change from the engine to helm selection. After making selections, press "SELECT" button to continue.
3. The next screen should read, "PLEASE MOVE ALL LEVERS ON ALL HELMS TO NEUTRAL IDLE". Press "SELECT" to continue.

**NOTE:** On dual helm vessels, helm identified as 1 is the helm with the ignition key switch. Helm identified as 2 is the helm with the start/stop switch. On dual engine installations, engine identified as 1 is the starboard engine, engine identified as 2 is the port engine.

4. The next screen should read, "PLEASE MOVE LEVER FOR HELM 1 ENGINE 1 TO REVERSE MAXIMUM". Press "SELECT" button when completed to continue.
5. The next screen should read, "HELM MODULE INITIALIZATION IS COMPLETE". Press "SELECT" button to continue calibration.
6. The next screen should read, "ASSIGN STATION IDENTIFICATION FOR THIS SYSTEM VIEW". Assign "1" for System View connected at helm 1. When applicable, assign "2" for System View connected at helm 2. Press "SELECT" button to continue.

7. The next screen should read, "SELECT THE ENGINE CONFIGURATION THE SYSTEM VIEW IS CONNECTED TO". Press "SELECT" button to continue.



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**a** - Engine 1 starboard "STBD"  
**b** - Engine 2 port "PORT"

**c** - Engine 1 starboard 2 "STBD 2"  
**d** - Engine 2 port 2 "PORT 2"

8. The next screen should read, "IS THIS AN ELECTRONIC THROTTLE AND SHIFT SYSTEM". Select "YES". Press "SELECT" button to continue.
9. The next screen should read, "DO YOU HAVE FOOT THROTTLE INSTALLED?" (single engines only). Press "SELECT" button to continue.

**IMPORTANT:** All Verado engines shift as a standard rotation, right hand. All OptiMax and MerCruiser engines must be selected as either standard rotation or counter rotation.

10. Depending on engine type, propeller rotation screen may be displayed. The screen should read, select prop shaft rotation for each engine. Consult engine installation manual for details. "STND/RH" = standard rotation/right hand, "CNTR/LH" = counter rotation/left hand. Press "SELECT" button to continue.
11. The next screen should read, "HOW MANY HELMS AND ENGINES ARE THERE ON THIS VESSEL?" Press "SELECT" button to continue.
12. The next screen should read, "PLEASE SELECT FROM THE FOLLOWING CONTROL TYPES": Select the control type used: 1) "PANEL MOUNT", 2) "CONSOLE MOUNT", 3) "ZERO EFFORT". Press "SELECT" button when completed to continue.

Calibration procedure will advance to adapting the type of control selected.

## CONSOLE MOUNT AND PANEL MOUNT CONTROLS

**NOTE:** On dual lever console controls, move and position both levers together.

Move the control lever to the selected positions as instructed on the System View display, in order for the command module to learn all the lever positions.

1. Move control lever to maximum reverse. Press "SELECT" when the lever is in position.
2. Move control lever to reverse detent. Press "SELECT" when lever is in position.
3. Move control lever to neutral. Press "SELECT" when lever is in position.
4. Move control lever to forward detent. Press "SELECT" when lever is in position.
5. Move control lever to maximum forward. Press "SELECT" when lever is in position.
6. Move control lever to neutral. Press "SELECT" when lever is in position.
7. You have successfully completed the adaptation process. Do you accept the results. Select "YES" and press "SELECT" to accept.
8. Initial calibration is complete. Turn the power off to the System View. Once the unit is turned off, turn the power back on again for the settings to take effect.

## CONSOLE MOUNT AND PANEL MOUNT CONTROLS WITH FOOT THROTTLE

Move the control lever and foot throttle to the selected positions as instructed on the System View display, in order for the command module to learn all the lever positions.

1. Move control lever to maximum reverse and push foot throttle to WOT. Press "SELECT" when lever is in position.
2. Move control lever to reverse detent and return foot throttle to idle. Press "SELECT" when lever is in position.
3. Move control lever to neutral and keep foot throttle at idle. Press "SELECT" when lever is in position.
4. Move control lever to forward detent and keep foot throttle at idle. Press "SELECT" when lever is in position.
5. Move control lever to maximum forward position and push foot throttle to WOT. Press "SELECT" when lever is in position.
6. Move control lever to neutral and return foot throttle to idle. Press "SELECT" when lever is in position.
7. You have successfully completed the adaptation process. Select "YES" and press "SELECT" to accept.
8. Initial calibration is complete. Turn the power off to the System View. Once the unit is turned off, turn the power back on again for the settings to take effect.

## ZERO EFFORT CONTROLS

**NOTE:** On multiple engine applications, move and position levers together.

Move the control levers to the selected positions as instructed on the System View display, in order for the command module to learn all the lever positions.

1. Move shift lever to reverse position and move throttle lever to WOT. Press "SELECT" when levers are in position.

2. Keep shift lever in reverse and move throttle lever to idle. Press "SELECT" when levers are in position.
3. Move shift lever to neutral and keep throttle lever at idle. Press "SELECT" when levers are in position.
4. Move shift lever to forward and keep throttle lever at idle. Press "SELECT" when levers are in position.
5. Move shift lever to forward and move throttle lever to WOT. Press "SELECT" when levers are in position.
6. Move shift lever to neutral and move throttle lever to idle. Press "SELECT" when levers are in position.
7. You have successfully completed the adaptation process. Select "YES" and press "SELECT" to accept.
8. Initial calibration is complete. Turn the power off to the System View. Once the unit is turned off, turn the power back on again for the settings to take effect.

## ZERO EFFORT CONTROLS WITH FOOT THROTTLE

Move the control lever and foot throttle to the selected positions as instructed on the System View display, in order for the command module to learn all the lever positions.

1. Move shift lever to reverse position and push foot throttle to WOT. Press "SELECT" when levers are in position.
2. Keep shift lever in reverse position and return foot throttle to idle. Press "SELECT" when levers are in position.
3. Move shift lever to neutral position and keep foot throttle at idle. Press "SELECT" when levers are in position.
4. Move shift lever to forward and keep foot throttle at idle. Press "SELECT" when levers are in position.
5. Move shift lever to forward position and push foot throttle to WOT. Press "SELECT" when levers are in position.
6. Move shift lever to neutral and return foot throttle to idle. Press "SELECT" when levers are in position.
7. You have successfully completed the adaptation process. Select "YES" and press "SELECT" to accept.
8. Initial calibration is complete. Turn the power off to the System View. Once the unit is turned off, turn the power back on again for the settings to take effect.

## Setting Trailer and Trim Limit

### Setting Trailer Limit with DDT

#### CAUTION

The trailer limit must be set before setting the trim limit. Failure to set the trailer limit prior to setting the trim limit, will create a programming error in the engine PCM. The PCM must be reprogrammed to correct the error. Contact Mercury Marine Technical Service Department for instruction on reprogramming the PCM.

The function of the trailer limit:

- **Outboard** - To limit the maximum tilt up position, preventing damage to the cowl.
- **MerCruiser** - To limit the maximum trailer up position, preventing damage to swim platforms etc.

**NOTE:** If the DDT display is blank, the interface and/or adaptor cables are not installed properly.

1. Connect the DDT to the DLC/Depth transducer connector on the engine.

2. Power up the DDT by turning the ignition to the ON position. On the "SELECT FUNCTION" screen, press 2 - "MANUAL TEST".
3. The "SELECT FUNCTION" screen will appear. Press 5 - "SPECIAL FUNCTIONS".
4. The "SELECT FUNCTION" screen will appear. Press 8 - "TRAILER LIMIT".
5. The "TRAILER LIMIT" screen will appear. To set the maximum trailer limit, press 1 - "YES".
6. Trim the engine/drive up to the desired trailer position. To "CONTINUE" press 1 "YES".
7. The maximum trailer limit setting is stored in the PCM. To "CONTINUE" press 1 "YES".
8. Turn key off for 10 seconds, then back to run, for the PCM to accept the new limit. Press "MODE" to exit the trailer limit calibration.

**NOTE:** If the trailer limit update failed, press 1 "TO RETRY", or "MODE" to exit.

## Setting Trailer Limit with CDS

### ⚠ CAUTION

The trailer limit must be set before setting the trim limit. Failure to set the trailer limit prior to setting the trim limit, will create a programming error in the engine PCM. The PCM must be reprogrammed to correct the error. Contact Mercury Marine Technical Service Department for instruction on reprogramming the PCM.

The function of the trailer limit:

- **Outboard** - To limit the maximum tilt up position, preventing damage to the cowl.
  - **MerCruiser** - To limit the maximum trailer up position, preventing damage to swim platforms etc.
1. Connect the CDS to the engine data link harness.
  2. Turn the ignition key to the "RUN" position.
  3. Select the correct engine location.
  4. Open the Tool Box icon in the CDS.
  5. Open the Active Diagnostics Icon.
  6. Scroll down the Active Diagnostics window and highlight "Trailer Limit".
  7. Run the trim system completely in (down) and hold the trim button in for 3-4 seconds. This will configure the PCM to recognize the maximum trim in position according to the trim position sensor.
  8. Run the test.
  9. The CDS screen will read "Adjust the engine/outdrive to the desired position. Select OK to store the current position in the ECU."
  10. Turn the ignition key "OFF", then to "RUN" for the PCM to accept new limit.

## Setting Trim Limit with DDT

### ⚠ CAUTION

The trailer limit must be set before setting the trim limit. Failure to set the trailer limit prior to setting the trim limit, will create a programming error in the engine PCM. The PCM must be reprogrammed to correct the error. Contact Mercury Marine Technical Service Department for instruction on reprogramming the PCM.

The trim limit configures the PCM to control the maximum up trim limit. The trim limit function is only supported if the PCM has input for the three wire trim sensor.

1. Power up the DDT by turning the ignition to the ON position. On the "SELECT FUNCTION" screen, press 2 - "MANUAL TEST".
2. Connect the DDT to the DLC/Depth transducer connector on the engine.
3. The "SELECT FUNCTION" screen will appear. Press 5 - "SPECIAL FUNCTIONS".

4. The "SELECT FUNCTION" screen will appear. Press 7 - "TRIM LIMIT".
5. The "TRIM LIMIT" screen will appear. To set the maximum up trim limit, press 1 - "YES".
6. Trim the engine/drive to the desired trim position. To "CONTINUE" press 1 - "YES".
7. The maximum trim limit setting is stored in the PCM. To "CONTINUE" press 1 "YES".
8. Turn key off for 10 seconds, then back to run, for the PCM to accept the new limit. Press "MODE" to exit the trailer limit calibration.

If the trim limit update failed, press 1 "TO RETRY", or "MODE" to exit.

## Setting Trim Limit with CDS

### CAUTION

The trailer limit must be set before setting the trim limit. Failure to set the trailer limit prior to setting the trim limit, will create a programming error in the engine PCM. The PCM must be reprogrammed to correct the error. Contact Mercury Marine Technical Service Department for instruction on reprogramming the PCM.

**IMPORTANT:** The engine must be running above 2000 RPM in gear to initiate the trim limit.

The trim limit configures the PCM to control the maximum up trim limit. The trim limit function is only supported if the PCM has input for the three wire trim sensor.

1. Connect the CDS to the engine data link harness.
2. Turn the ignition key to the "RUN" position.
3. Open the Tool Box icon in the CDS.
4. Open the Active Diagnostics Icon.
5. Scroll down the Active Diagnostics window and highlight "Trim Limit".
6. Run the test.
7. The CDS screen will read "Adjust the engine/outdrive to the desired position. Select OK to store the current position in the ECU."
8. Turn the ignition key "OFF", then to "RUN" for the PCM to accept new limit.

## Troubleshooting Procedure

### Troubleshooting Information

**NOTE:** All of the following are determined by the calibration of the PCM. Upgrading the calibration can result in changes to these settings.

### DEFAULT SENSOR VALUES

Default sensor values are preprogrammed amounts used by the PCM to calculate fuel and ignition values, when the sensor in question has exceeded its preprogrammed diagnostic limits. Default sensor values typically are used when the sensor has a circuit high or circuit low fault.

Most temperature sensors default to 0 °C (32 °F). This can be verified by unplugging the sensor in question and watching the data stream value with the CDS or the DDT.

Most pressure sensors default to a preprogrammed number also. MAP sensors usually default to 100 kPa (29.5 in. Hg). This can be verified by unplugging the sensor in question and watching the data stream value. Other pressure sensors will have their own default values which may be determined as described previously.

### FAULT CONDITIONS

Most faults can be detected with the engine running, or key-on, engine off. However, some faults require the presence of engine RPM, and cannot be detected key-on, engine off. Examples of this type of fault are EST (cylinders 1 through 8) shorted circuit and all injector faults (fuel and direct).

Some faults are only detected in the key-on, engine off mode. Examples of the type of fault would be EST (cylinders 1 through 8) open circuit.

In addition, some faults are programmed to ignore certain engine speeds. For example, the low block pressure sensor fault (sea pump pressure on a MerCruiser) is typically not enabled until enough RPM has been achieved to develop a reasonable amount of water pressure. Therefore, this fault will not be set at idle.

Faults also take a certain time to set. The time it takes to set a fault varies greatly and can also vary with engine RPM. Faults generally set faster at higher engine speed.

## STICKY/NON-STICKY FAULTS

All faults are classified as either sticky or non-sticky. Sticky means that the fault, once set, will continue to show up as active, even in the circuit or problem has corrected itself. A key switch cycle is required to reset a sticky fault.

A non-sticky fault is a fault that will change it's status from active to inactive without requiring a key switch cycle.

The diagnostic tools (CDS or DDT) will continue to display a sticky fault as active, even though the cause of the fault has been corrected. Cycle the key to reset all faults if there is difficulty correcting a fault.

## ENGINE GUARDIAN

Almost every fault will cause the guardian program (within the PCM) to become active. The amount of guardian protection is expressed as a percentage. The higher the percentage, the more power the engine is allowed to produce. If available power (on the CDS or DDT) is showing 100%, then guardian is not currently active and the engine is capable of producing full power. On a DTS engine, guardian closes the ETC to reduce engine power. Non-DTS engine reduce engine power by changing injector and ignition operation.

Guardian is always accompanied by another fault or faults that actually caused the guardian to become active. The more severe the fault, the more the guardian reduces available power. A small problem, such as a non-critical sensor going circuit high or circuit low, will result in available power of 90% depending on product line. A severe problem such as low oil pressure, or a DTS shift or throttle actuator failing, will result in forced idle which is usually displayed as 5-6% available power. Several minor faults occurring at the same time will cause the PCM to treat the faults as a more severe situation.

## WARNING HORN SIGNALS

Most faults will cause the warning horn circuit to activate. How the warning horn activates depends on how serious the problem is. There are four warning horn states:

- Caution - horn signal varies with product line and calibration. Minimal guardian.
- Warning - horn signal varies with product line and calibration.
- Severe - horn is beeping constantly.
- Critical - horn is beeping constantly and guardian will be at forced idle.

In addition, depending on the gauge package, there will be warning icons and fault messages on the dash mounted gauges.

## Special Tools - DTS Troubleshooting

|                                   |                   |
|-----------------------------------|-------------------|
| Computer Diagnostic System (CDS)  | Order through SPX |
| Breakout Box                      | SPX P/N MM-46225  |
| Terminal Test Probe Kit           | SPX P/N MM-46523  |
| DDT Cartridge v1.3                | 91-880118A03      |
| DDT Cartridge v1.31               | 91-880118A04      |
| Digital Diagnostic Terminal (DDT) | 91-823686A2       |

|                                 |                                                       |
|---------------------------------|-------------------------------------------------------|
| 12 Volt Shunt Connector         | Part number currently not available for this printing |
| Adapter Harness                 | 84-822560A5                                           |
| 2 to 4 Pin Harness Adapter      | 84-822560A12                                          |
| Adapter Harness                 | 84-822560A13                                          |
| Male to Male 10 Pin Adapter     | 84-892452A01                                          |
| DMT 2004 Digital Multimeter     | 91-892647A01                                          |
| DDT Diagnostic Reference Manual | 90-881204003                                          |

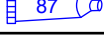
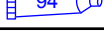
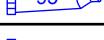
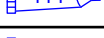
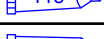


# SECTION 9 - PREDELIVERY PREPARATION AND STORAGE

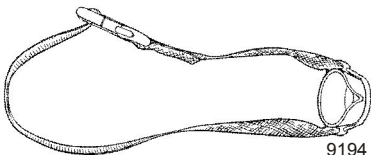
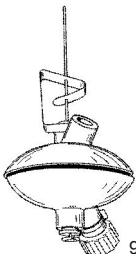
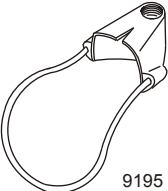
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## Lubricant, Sealant, Adhesives

| Tube Ref No.                                                                      | Description                              | Where Used                             | Part No.       |
|-----------------------------------------------------------------------------------|------------------------------------------|----------------------------------------|----------------|
|  | Dextron III Automatic Transmission Fluid | Power steering pump                    | Obtain Locally |
|  | Special Lubricant 101                    | Propeller shaft splines                | 92-802865A1    |
|  | SAE Engine Oil 30W                       | Power trim pump                        | Obtain Locally |
|  | High Performance Gear Lubricant          | Gear Lube Monitor                      | 92-802854A1    |
|  | Anti-Corrosion Grease                    | Propeller shaft splines                | 92-802867A1    |
|  | 2-4-C Marine Lubricant with Teflon       | Propeller shaft splines                | 92-802859A1    |
|  | Power Trim and Steering Fluid            | Power steering pump<br>Power trim pump | 92-802880A1    |
|  | Premium Plus 2-cycle TC-W3 Outboard Oil  | Fuel system                            | 92-802824A1    |
|  | Fuel System Treatment & Stabilizer       | Fuel system                            | 802875A1       |

## Special Tools

|                                                                                          |                                                                                                                            |
|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Dual Water Pick-up Flush Gearcase Seal Kit                                               | 91-881150K 1                                                                                                               |
|  9194  | Blocks off the front water inlet holes on the dual water inlet gearcases.                                                  |
| Flushing Device                                                                          | 91-44357Q 2                                                                                                                |
|  9192 | Attaches to the water intakes; provides a fresh water connection when flushing the cooling system or operating the engine. |
| Flushing Kit                                                                             | 91-849996T 1                                                                                                               |
|  9195 | Use for flushing gearcases with low water inlets.                                                                          |

## Predelivery Preparation

Once the power package installation is complete, the following final steps should be taken to prepare power package for delivery to the customer. It is the boat manufacturer's responsibility to perform these procedures, or to make arrangement with the dealer to have these procedures completed.

## Engine Oil

### ⚠ CAUTION

**ENVIRONMENTAL HAZARD!** Discharge of oil or oil waste into the environment is restricted by law. Do not spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

### CHECKING

1. Stop the engine. Allow approximately 5 minutes for the oil to drain into the oil pan. The boat must be at rest in the water.
2. Remove the dipstick. Wipe clean and reinstall fully into the dipstick tube. Wait 60 seconds to allow trapped air to vent.

**NOTE:** Ensure that dipstick is installed with oil level indication marks facing the rear of the engine (flywheel end).

**IMPORTANT:** Add the specified engine oil to bring the level up to, but not over, the full or OK range mark on the dipstick.

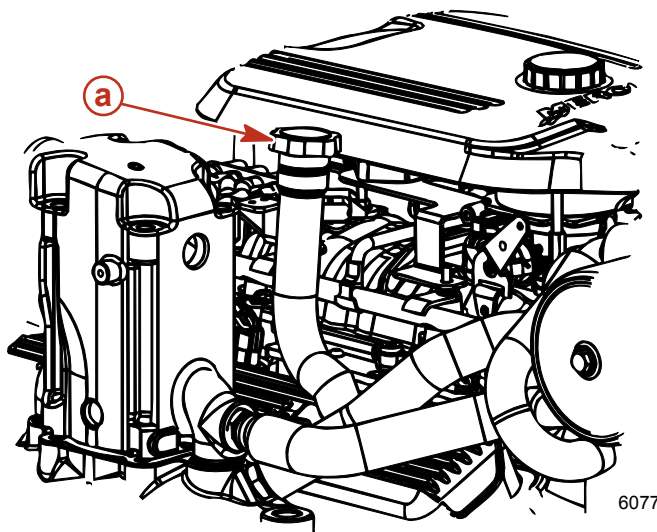
3. Remove the dipstick and observe the oil level. Oil level must be between full or OK range and add. Fill as necessary with specified fluid.

**NOTE:** Adding 0.95 liters (1 quart) of engine oil will raise the level from the ADD mark to the top of the OK range.

### ADDING ENGINE OIL

**IMPORTANT:** Do not overfill the engine with oil.

1. Remove oil fill cap.



**a -** Oil fill cap

**IMPORTANT:** Add the specified engine oil to bring the level up to, but not over, the full or OK range mark on the dipstick.

2. Add the specified engine oil to bring the level up to, but not over, the full or OK range mark on the dipstick.
3. Replace the fill cap.

## Power Steering Fluid

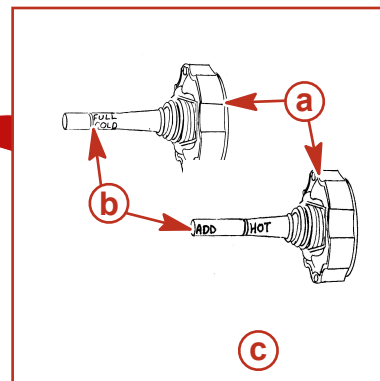
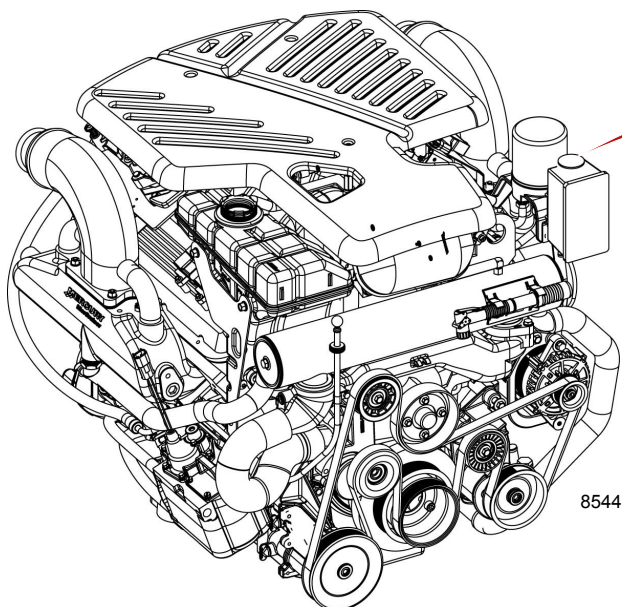
**IMPORTANT:** Use only Mercury Power Trim and Steering Fluid in power steering system.

**⚠ CAUTION**

**DO NOT RUN POWER STEERING DRY, or pump will be damaged.**

1. Center sterndrive unit.
2. Remove fill cap from power steering pump reservoir and check fluid level.
3. Add fluid as required.

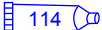
**NOTE:** When first starting engine, be prepared to add fluid to pump.



8544

**a -** Fill cap

**b -** Dipstick

| Tube Ref No.                                                                            | Description                   | Where Used          | Part No.    |
|-----------------------------------------------------------------------------------------|-------------------------------|---------------------|-------------|
|  114 | Power Trim and Steering Fluid | Power steering pump | 92-802880A1 |

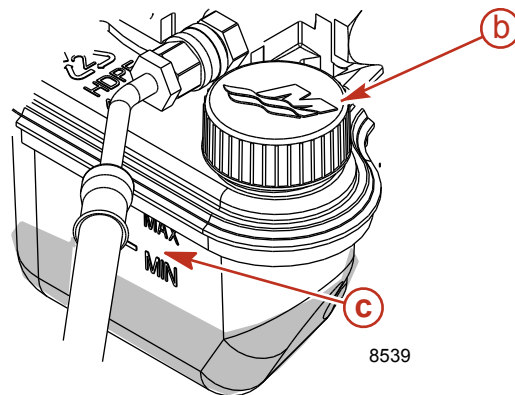
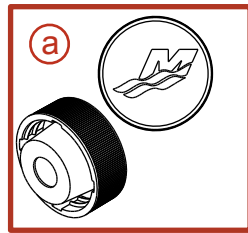
| Tube Ref No.                                                                        | Description                              | Where Used          | Part No.       |
|-------------------------------------------------------------------------------------|------------------------------------------|---------------------|----------------|
|  | Dextron III Automatic Transmission Fluid | Power steering pump | Obtain Locally |

## Power Trim Pump

1. Check oil level with sterndrive unit in the full DOWN/IN position.

**IMPORTANT:** Use only specified lubricant.

- Raise and lower sterndrive unit (to the full UP/OUT position) 6 to 10 times to purge air from system. Check oil level visually, (with drive unit in the full DOWN/IN position). Oil level should be maintained within the "MIN" and "MAX" lines on the reservoir.



**a** - Fill cap (top and underneath side views)

**b** - Reservoir fill neck

**c** - "MIN" and "MAX" lines

| Tube Ref No.                                                                          | Description                   | Where Used      | Part No.    |
|---------------------------------------------------------------------------------------|-------------------------------|-----------------|-------------|
|  114 | Power Trim and Steering Fluid | Power trim pump | 92-802880A1 |

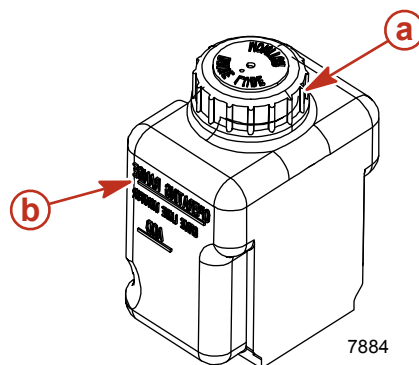
| Tube Ref No.                                                                          | Description        | Where Used      | Part No.       |
|---------------------------------------------------------------------------------------|--------------------|-----------------|----------------|
|  80 | SAE Engine Oil 30W | Power trim pump | Obtain Locally |

- Check the power trim pump hose fittings for leaks. If fluid is visible at the fittings, check connections.

## Drive unit gear lube monitor

**IMPORTANT:** Oil level in gear lube monitor will rise and fall during drive operation; always check oil level when drive is cool and engine is shut down.

- Remove the gear lube monitor cap.
- Fill the gear lube monitor to the Operating Range (full) line.



Typical

**a** - Gear lube monitor cap

**b** - Operating Range (full) line

| Tube Ref No.                                                                           | Description                     | Where Used        | Part No.    |
|----------------------------------------------------------------------------------------|---------------------------------|-------------------|-------------|
|  87 | High Performance Gear Lubricant | Gear Lube Monitor | 92-802854A1 |

3. Ensure that the rubber gasket is inside the gear lube monitor cap.
4. Install the gear lube monitor cap. Do not overtighten.
5. Recheck gear lube level after first use.

## Propeller Selection

### GENERAL INFORMATION

**IMPORTANT:** Installed propeller must allow engine to operate at its specified maximum WOT rpm. Use an accurate service tachometer to verify engine operating rpm.

It is the responsibility of the boat manufacturer and/or the selling dealer to equip the power package with the correct propeller. Refer to **Everything You Need To Know About Propellers** (90-8614492). Specified engine WOT and operating rpm range are listed in the Mercury MerCruiser Operation, Maintenance and Warranty Manual attached to the engine.

If full throttle operation is below the recommended range, the propeller must be changed to prevent loss of performance and possible engine damage. On the other hand, operating an engine above the recommended operating rpm range will cause higher than normal wear and/or damage.

After initial propeller selection, the following common problems may require that the propeller be changed to a lower pitch:

- Warmer weather and greater humidity cause an rpm loss.
- Operating in a higher elevation causes an rpm loss.
- Operating with increased load (additional passengers, pulling skiers, etc.).

For better acceleration, such as is needed for water skiing, use the next lower pitch propeller. However, do not operate at full throttle when using the lower pitch propeller but not pulling skiers.

Because of the many variables of boat design, only testing will determine the best propeller for a particular application. Available propellers are listed in the **Mercury Precision Part/ Quicksilver Accessories Guide**.

See BOAT IN THE WATER TESTS, Maximum RPM Test at the back of this manual.

### ENGINE REV-LIMITER

**IMPORTANT:** The engines listed in the following chart are equipped with a rpm rev-limiter that is set to an upper (or limited) rpm amount. This limit is slightly above the normal operating range of the engine and is designed to help prevent damage from excessive engine rpm. When the engine reaches the rev-limit rpm, the horn will sound. Once the rpm drop into the recommended operating rpm range, normal engine operation resumes.

| Engine Rev-Limiter |                                        |                       |
|--------------------|----------------------------------------|-----------------------|
| Model              | Engine Recommended Operating RPM Range | Rev-Limit RPM Setting |
| 496 MAG            | 4400-4800                              | 4950                  |
| 496 MAG DTS        |                                        |                       |
| 496 MAG HO         | 4600-5000                              | 5150                  |
| 496 MAG HO DTS     |                                        |                       |

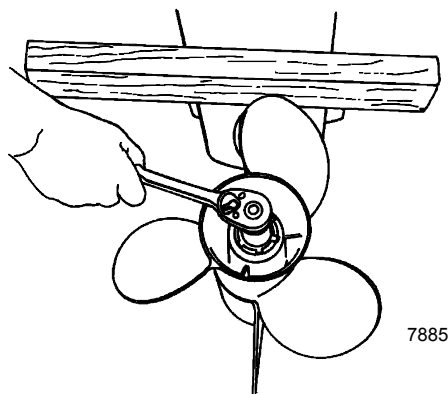
## Bravo Sterndrive Propeller Installation

### WARNING

Ensure that remote control is in NEUTRAL position and ignition key is removed from switch prior to installing propeller.

**⚠ WARNING**

Place a block of wood between the anti-ventilation plate and propeller to protect hands from propeller blades and to prevent propeller from turning when tightening propeller nut.

**BRAVO ONE MODELS**

**IMPORTANT:** Correct rotation propeller **MUST** match direction of rotation of propeller shaft.

1. Liberally coat the propeller shaft spline with one of the following Quicksilver lubricants.

| Tube Ref No.                                                                         | Description           | Where Used              | Part No.    |
|--------------------------------------------------------------------------------------|-----------------------|-------------------------|-------------|
|  34 | Special Lubricant 101 | Propeller shaft splines | 92-802865A1 |

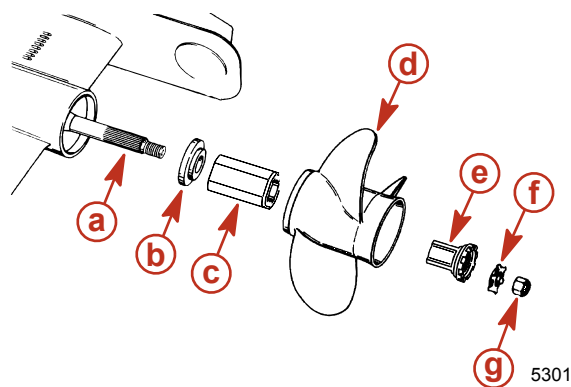
| Tube Ref No.                                                                          | Description                        | Where Used              | Part No.    |
|---------------------------------------------------------------------------------------|------------------------------------|-------------------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Propeller shaft splines | 92-802859A1 |

| Tube Ref No.                                                                           | Description           | Where Used              | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|-------------------------|-------------|
|  94 | Anti-Corrosion Grease | Propeller shaft splines | 92-802867A1 |

**NOTE:** Anti-corrosion grease is for salt water applications only.

2. Install propeller with attaching hardware as shown.

3. Torque the propeller nut, then continue to tighten until 3 tabs on the tab washer align with grooves on spline washer. Bend the 3 tabs down into grooves.



#### Bravo One

- |                                    |                                 |
|------------------------------------|---------------------------------|
| <b>a</b> - Propeller shaft splines | <b>e</b> - Drive sleeve adapter |
| <b>b</b> - Forward thrust hub      | <b>f</b> - Tab washer           |
| <b>c</b> - Flo-Torque II drive hub | <b>g</b> - Propeller nut        |
| <b>d</b> - Propeller               |                                 |

| Description             | Nm                           | lb. in. | lb. ft. |
|-------------------------|------------------------------|---------|---------|
| Bravo One propeller nut | 75                           |         | 55      |
|                         | Then align tabs with grooves |         |         |

**NOTE:** The propeller torque stated is a minimum torque value.

#### BRAVO TWO MODELS

**IMPORTANT:** Correct rotation propeller **MUST** match direction of rotation of propeller shaft.

1. Liberally coat the propeller shaft spline with one of the following Quicksilver lubricants.

| Tube Ref No.                                                                           | Description           | Where Used              | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|-------------------------|-------------|
|  34 | Special Lubricant 101 | Propeller shaft splines | 92-802865A1 |

| Tube Ref No.                                                                           | Description                        | Where Used              | Part No.    |
|----------------------------------------------------------------------------------------|------------------------------------|-------------------------|-------------|
|  95 | 2-4-C Marine Lubricant with Teflon | Propeller shaft splines | 92-802859A1 |

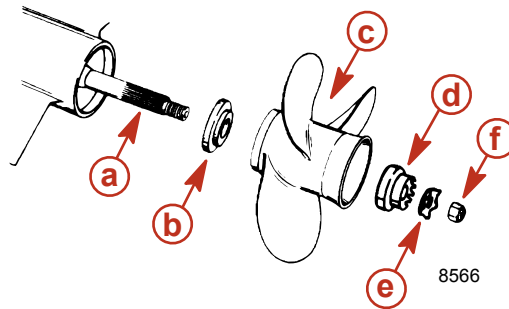
| Tube Ref No.                                                                           | Description           | Where Used              | Part No.    |
|----------------------------------------------------------------------------------------|-----------------------|-------------------------|-------------|
|  94 | Anti-Corrosion Grease | Propeller shaft splines | 92-802867A1 |

**NOTE:** Anti-corrosion grease is for salt water applications only.

2. Install propeller with attaching hardware as shown.



- Torque the propeller nut, then continue to tighten until 3 tabs on the tab washer align with grooves on spline washer. Bend the 3 tabs down into grooves.



### Bravo Two

- |                             |                   |
|-----------------------------|-------------------|
| a - Propeller shaft splines | d - Spline washer |
| b - Forward thrust hub      | e - Tab washer    |
| c - Propeller               | f - Propeller nut |

| Description             | Nm                           | lb. in. | lb. ft. |
|-------------------------|------------------------------|---------|---------|
| Bravo Two propeller nut | 81                           |         | 60      |
|                         | Then align tabs with grooves |         |         |

**NOTE:** The propeller torque stated is a minimum torque value.

## BRAVO THREE

- Liberally coat the propeller shaft spline with one of the following Quicksilver lubricants.

| Tube Ref No. | Description           | Where Used              | Part No.    |
|--------------|-----------------------|-------------------------|-------------|
| 34           | Special Lubricant 101 | Propeller shaft splines | 92-802865A1 |

| Tube Ref No. | Description                        | Where Used              | Part No.    |
|--------------|------------------------------------|-------------------------|-------------|
| 95           | 2-4-C Marine Lubricant with Teflon | Propeller shaft splines | 92-802859A1 |

| Tube Ref No. | Description                        | Where Used              | Part No.    |
|--------------|------------------------------------|-------------------------|-------------|
| 95           | 2-4-C Marine Lubricant with Teflon | Propeller shaft splines | 92-802859A1 |

**NOTE:** Anti-corrosion grease is for salt water applications only.

- Slide forward thrust hub onto propeller shaft, with tapered side toward propeller hub.
- Align splines and place front propeller on propeller shaft.
- Install front propeller locknut and torque.

| Description              | Nm  | lb. in. | lb. ft. |
|--------------------------|-----|---------|---------|
| Front dual propeller nut | 136 |         | 100     |

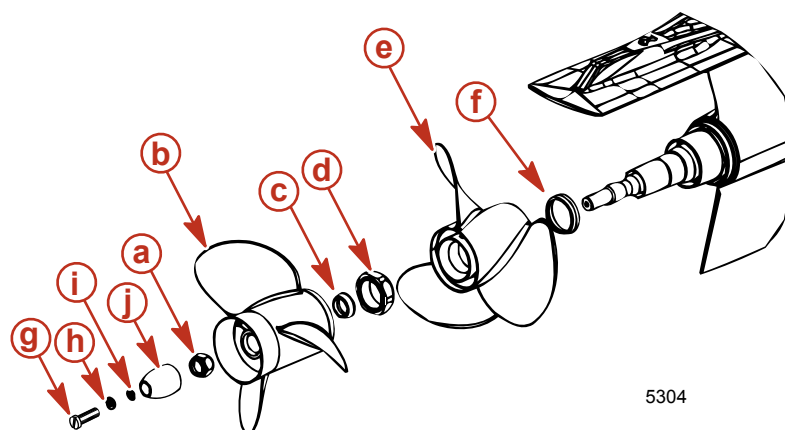
**NOTE:** The propeller torque stated is a minimum torque value.

- Slide aft thrust hub onto propeller shaft with tapered side toward propeller hub
- Align splines and install aft propeller.
- Install propeller nut and torque.

| Description             | Nm | lb. in. | lb. ft. |
|-------------------------|----|---------|---------|
| Rear dual propeller nut | 81 |         | 60      |

**NOTE:** The propeller torque stated is a minimum torque value.

8. Install propeller shaft anode and screw and torque.



**Bravo Three**

- |                                      |                                        |
|--------------------------------------|----------------------------------------|
| <b>a</b> - Rear propeller nut        | <b>f</b> - Front propeller thrust hub  |
| <b>b</b> - Rear propeller            | <b>g</b> - Propeller shaft anode screw |
| <b>c</b> - Rear propeller thrust hub | <b>h</b> - Flat washer                 |
| <b>d</b> - Front propeller nut       | <b>i</b> - Star washer                 |
| <b>e</b> - Front propeller           | <b>j</b> - Propeller shaft anode       |

| Description                 | Nm | lb. in. | lb. ft. |
|-----------------------------|----|---------|---------|
| Propeller shaft anode screw | 19 | 168     |         |

## Battery Connection

**IMPORTANT:** Engine electrical system is negative (-) ground.

1. Ensure that all battery terminal connections are tight.

## Priming The Fuel System

**IMPORTANT:** Use a portable fuel tank with a primer bulb fuel line.

### **⚠ WARNING**

Be careful when working on fuel system. Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow spark or open flame in area. Wipe up any spilled fuel immediately.

1. Disconnect the fuel line from the fuel tank to the fuel inlet fitting and plug the line, if attached to the engine.
2. Attach portable fuel tank to the fitting and secure tightly.
3. Squeeze the primer bulb until the bulb becomes firm.
4. Turn the ignition switch to the "RUN" position for 3 seconds and then turn OFF.

**NOTE:** Do not turn the key switch to the "START" position during the priming.

5. Repeat Step 3. and Step 4. three more times.

**IMPORTANT:** Before disconnecting the fuel line primer bulb, ensure that the bulb is soft and does not still have fuel in it to prevent spilling fuel.

6. Disconnect the primer bulb fuel line from the fuel inlet fitting.
7. Remove the plug from the fuel tank fuel line.
8. Attach the fuel line from the fuel tank to the fuel inlet and tighten securely.

## Test Running Engine

### WARNING

Avoid Injury: If engine is to be tested with the boat out of the water, the propeller must be removed to avoid injury.

### CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

## BOAT OUT OF THE WATER

For engine operation tests with the boat out of the water:

**IMPORTANT:** If using a flushing attachment over the water inlet holes with a water hose, do not use full water source pressure.

1. Install a flushing attachment over the sterndrive water inlet holes.
2. Connect a hose between the flushing attachment and a water source.
3. Open the water source about 1/2 maximum. Do not use full water pressure.

**IMPORTANT:** Engines with the sterndrive water inlet blocked off at the gimbal housing and using a through the hull water inlet, need a supply of cooling water available to both the sterndrive unit and to the engine during operation.

4. On Engines With Through The Hull Water Inlet, supply sufficient cooling water to the engine.
5. Proceed to Testing Preparation.

## BOAT IN THE WATER

For engine operation tests with the boat in the water:

**IMPORTANT:** If using a test tank the water level must be above the water inlet holes on the sterndrive unit or the through the hull pickup.

1. Ensure that the water level is above the water inlet holes on the sterndrive or the through the hull pickup.
2. Proceed to Testing Preparation.

## TESTING PREPARATION

### WARNING

Do not leave the helm unattended when performing tests with the boat in the water.

1. Ensure that cooling system drain plugs, petcocks and hoses are installed and tight.

**NOTE:** Refer to appropriate Mercury MerCruiser Operation, Maintenance and Warranty Manual for operating specifications. Refer to appropriate Mercury MerCruiser Service Manual for fluid capacity information.

2. Check crankcase oil level.

**IMPORTANT:** Oil level in monitor will rise and lower during sterndrive operation. Always check oil level when sterndrive is cool and engine is shut down.

3. Check sterndrive unit oil level in the monitor.
4. Check drive belt tension.
5. Test Audio Warning system in accordance with instructions on instrumentation panel decal.
6. Supply water to the engine either by putting boat in the water or by using the correct flush device.

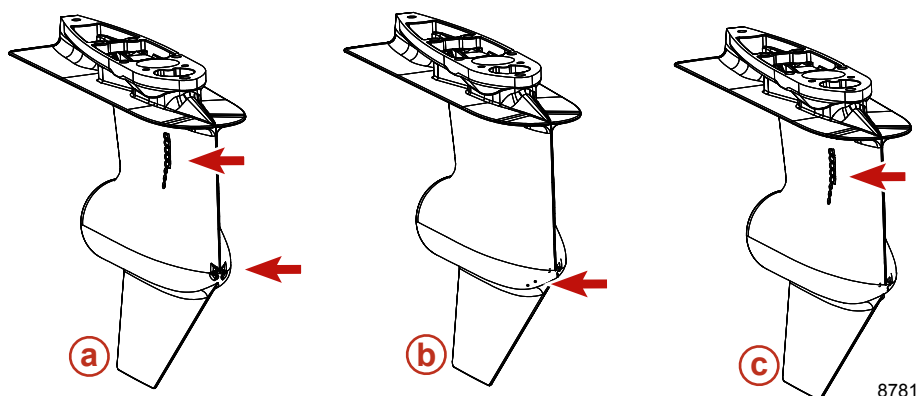
**IMPORTANT:** If using a test tank, ensure water level is above water intake holes.

**⚠ CAUTION**

If using flush test device, install over water intake holes and connect a water hose as shown. Do not use full water tap pressure. Also, do not operate engine above 1500 rpm, as suction created could cause water hose to collapse causing water supply to be cut off.

**⚠ WARNING**

If engine is to be tested with boat out of water, the propeller must be removed to avoid injury.



a - Dual water pickup  
b - Low water pickup

c - Side pickup

**IMPORTANT:** Engines may also use a through the hull or through the transom inlet. If so, water must be provided to these inlets or air flow must be blocked. If a block-off plate is used, the through the transom or through the hull fitting is the only water inlet to the engine.

|                                            |              |
|--------------------------------------------|--------------|
| Dual Water Pick-up Flush Gearcase Seal Kit | 91-881150K 1 |
| Flushing Device                            | 91-44357Q 2  |
| Flushing Kit                               | 91-849996T 1 |

**TESTING**

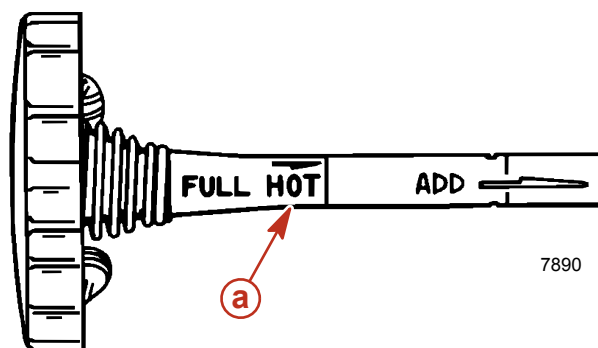
1. Place sterndrive in neutral , idle speed and start engine.
2. Slowly advance throttle until engine reaches 1300 rpm (+/-100 rpm).

**⚠ CAUTION**

Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure that the engine is operating in the normal range.

3. Watch all gauges for normal readings.
4. Turn steering wheel RIGHT/STARBOARD, then LEFT/PORT, and ensure drive unit turns the correct way.
5. Inspect engine compartment for water, oil, fuel, and exhaust leaks.
6. Turn steering wheel PORT until it stops and continue to apply pressure. If pump lugs (engine rpm drops and/or power steering pump tone changes):
  - a. Check for an obstruction between gimbal ring and gimbal housing and all moving steering components
  - b. Ensure that steering lever is not contacting cutout in transom. If contact is being made, modify cutout
  - c. Check steering cable end dimension with cable FULLY EXTENDED.

7. Turn steering wheel STARBOARD until it stops and continue to apply pressure. If pump lugs (engine rpm drops and/or power steering pump tone changes):
  - a. Turn off engine.
  - b. Remove cap/dipstick from power steering pump. Check fluid level and add if necessary.



**a** - Dipstick (full when hot line)

## Boat In The Water Tests

### ENGINE IDLE SPEED

Engine should idle at RPM as specified in appropriate Mercury MerCruiser Operation, Maintenance, and Warranty Manual with boat in the water, drive unit in FORWARD gear and engine at normal operating temperature. If idle speed is incorrect, proceed as follows:

1. Ensure that throttle cable has been adjusted properly.
2. If idle is still not correct, it may be necessary to perform EFI System Diagnostic Tests on the idle circuit. Refer to the appropriate Mercury MerCruiser Service Manual for procedures.

### WIDE OPEN THROTTLE TEST

**IMPORTANT:** To operate engine at full throttle before the break-in period is complete, follow this procedure.

1. Place remote control in neutral , idle speed and start engine.
2. Slowly advance throttle until engine reaches 1300 rpm (+/-100 rpm).

#### **⚠ CAUTION**

**Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure that the engine is operating in the normal range.**

3. Watch all gauges for normal readings.
4. When engines reaches mornal operating temperature, run the boat up on plane.
5. Advance engine RPM (in 200 RPM increments) until engine reaches its maximum rated RPM.
6. To test if the correct propeller has been installed, operate boat (with normal load on board) at WOT and check RPM with an accurate tachometer. Engine RPM should be near top of the specified range so that, under a heavy load, engine speed will not fall below specifications. If engine speed is too high, replace propeller with a higher pitch propeller. Normally a 25 mm (1 in.) propeller pitch change causes an RPM change of 150 RPM.
7. Return to idle speed.
8. Shut off engine.
9. Check coolant level and add coolant if necessary.

# Cold Weather or Extended Storage Draining Instructions

## Cold Weather or Extended Storage

### ⚠ CAUTION

Stern drive unit should be stored in full down position. Universal Joint bellows may develop a set if unit is stored in raised position and may fail when unit is returned to service.

## Seawater Section

**IMPORTANT:** Drain seawater section of closed cooling system only.

**IMPORTANT:** Boat must be as level as possible to ensure complete draining of cooling system.

### ⚠ CAUTION

Seawater section of cooling system must be completely drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing is not covered by the Mercury MerCruiser Limited Warranty.

**IMPORTANT:** Mercury MerCruiser recommends that propylene glycol antifreeze (a nontoxic and environmentally safe) antifreeze be used in the seawater section of the cooling system for cold weather or extended storage. Ensure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Follow the propylene glycol manufacturer's recommendations.

## Closed Cooling Section

### ⚠ CAUTION

If engine will be exposed to freezing temperatures, ensure closed cooling section is filled with an ethylene glycol antifreeze and water solution properly mixed to protect engine to lowest temperature to which it will be exposed.

**IMPORTANT:** Closed cooling section must be kept filled year-round with recommended coolant.

**IMPORTANT:** Do not use Propylene Glycol Antifreeze in the closed cooling section of the engine.

**NOTE:** If recommended coolant is unavailable, any type of ethylene glycol based antifreeze may be used, but it will require replacement every two years.

### ⚠ CAUTION

Ensure that boat is out of the water or seacock is closed and that bilge pump is operating. Excess water in the bilge can damage engine or cause boat to sink.

## Preparing Power Package For Storage

1. Fill the fuel tanks with fresh gasoline (that does not contain alcohol) and a sufficient amount of Quicksilver Gasoline Stabilizer for Marine Engines to treat the gasoline. Follow instructions on the container.
2. **If the boat is to be placed in storage with fuel containing alcohol in fuel tanks (if fuel without alcohol is not available):** Fuel tanks should be drained as low as possible and Quicksilver Gasoline Stabilizer for Marine Engines added to any fuel remaining in the tank. Refer to Fuel Requirements for additional information.

**NOTE:** A portable fuel tank must be used to perform the remainder of the power package lay up procedures. Be sure to add an appropriate amount of Gasoline Stabilizer to the portable tank.

3. Flush the cooling system.

4. Operate the engine sufficiently to bring it up to normal operating temperature and allow fuel with Quicksilver Gasoline Stabilizer to circulate through the fuel system. Shut off engine.
5. Store boat with drive unit in full down/in position.
6. For additional assurance against freezing and rust, after draining fill the cooling system with a mixture of propylene glycol and tap water mixed to manufacturer's recommendation to protect engine to the lowest temperature to which it will be exposed during cold weather or extended storage.

## FUEL SYSTEM

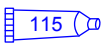
### WARNING

The fuel injection system is pressurized. Avoid serious injury from an explosion. Use care when removing water separating fuel filter. Allow engine to cool down before removing the water separating fuel filter. Also, hold a clean shop towel over the water separating fuel filter when removing it, to help avoid fuel spraying on the engine.

### WARNING

Fuel vapors can be present in the engine compartment. Avoid injury or power package damage caused by fuel vapors or explosion. Always ventilate the engine compartment prior to servicing the power package.

1. In a 23 liter (6 U.S. gal.) remote fuel tank mix:
  - a. 19 liter (5 U.S. gal) regular unleaded 87 octane (90 RON) gasoline
  - b. 1.89 liter (2 U.S. qts.) Premium Plus 2-Cycle TC-W3 Outboard Oil
  - c. 150 ml (5 ounces) Fuel System Treatment and Stabilizer or 30 ml (1 ounce) Fuel System Treatment and Stabilizer Concentrate.

| Tube Ref No.                                                                            | Description                             | Where Used  | Part No.    |
|-----------------------------------------------------------------------------------------|-----------------------------------------|-------------|-------------|
|  115 | Premium Plus 2-cycle TC-W3 Outboard Oil | Fuel system | 92-802824A1 |
|  124 | Fuel System Treatment & Stabilizer      | Fuel system | 802875A1    |

2. Allow the engine to cool down.

**IMPORTANT: Immediately wipe up any fuel spills or sprays.**

3. Close the fuel shut off valve, if equipped. Disconnect and plug the fuel inlet fitting if not equipped with a fuel shut off valve.
4. Connect the remote fuel tank (with the fogging mixture) to the fuel inlet fitting.

**IMPORTANT: Supply cooling water to the engine.**

5. Start and operate the engine at 1300 rpm for 5 minutes.
6. After specified operating time is complete, slowly return throttle to idle rpm and shut engine off.

**IMPORTANT: Ensure that some fogging mixture remains in the engine. Do not allow the engine's fuel system to run dry.**

7. Remove and discard the water separating fuel filter.
8. Install a new filter.

## BATTERY

Follow the battery manufacturer's instructions for storage.



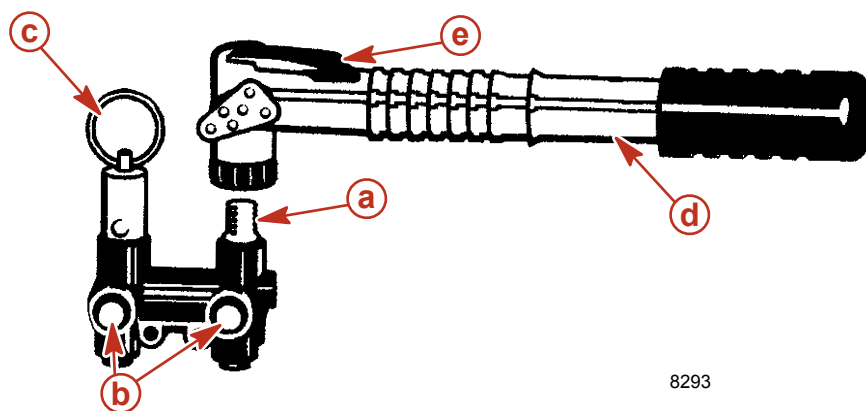
## Single Point Drain System

### ⚠ CAUTION

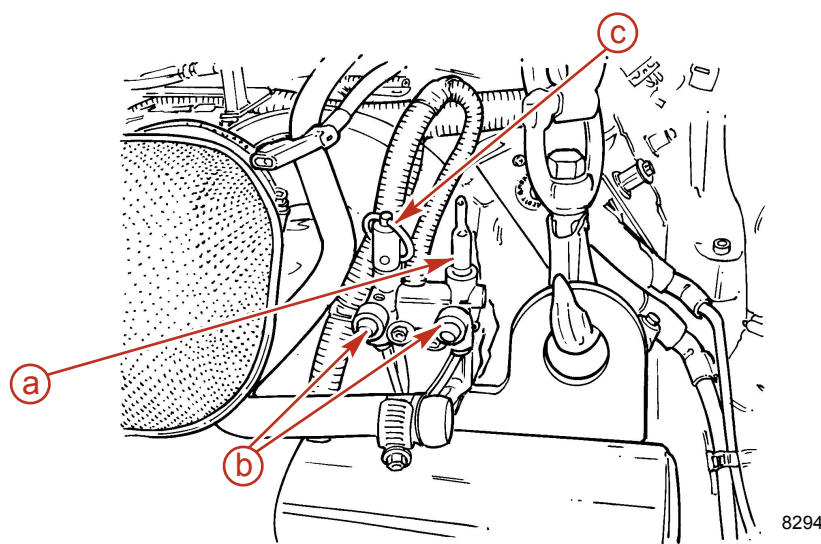
Freeze damage can occur if operating where temperatures are below 0° C (32° F). Use Manual Drain System to ensure heat exchanger is completely drained.

**NOTE:** This procedure is written for the air pump that is attached to the engine. However, any air source can be used.

1. Remove air pump from engine.
2. Ensure that locking lever on top of pump is flush with the handle (horizontal).
3. Install air pump on the actuator fitting.



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- |                          |                    |
|--------------------------|--------------------|
| a - Actuator fitting     | d - Air pump       |
| b - Green indicators     | e - Locking handle |
| c - Manual release valve |                    |

4. Pull locking lever on air pump up (vertical) to lock pump on actuator fitting.
5. Pump air into the system until both green indicators extend and water drains from both sides of the engine.
6. Most water will drain from the engine in 3-4 minutes, however, some will remain trapped in the heat exchanger. In order to prevent freeze damage, leave system pressurized while transporting boat or during other maintenance items to allow the remaining water to drain.
7. Crank engine over slightly with starter motor to purge any water trapped in seawater pickup pump. **DO NOT ALLOW ENGINE TO START.** Pull stop lanyard or remove fuse marked **C D** to prevent engine from starting.



**IMPORTANT:** Before launching boat, pull up on manual release valve. Verify that green indicators are no longer extended.

### ⚠ CAUTION

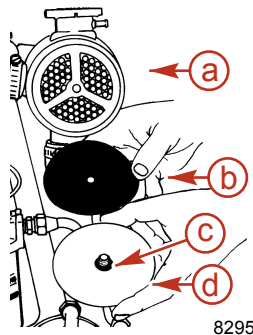
Manual release valve may not close completely. Ensure valve is completely seated.

## Manual Drain System - 496 Models

**NOTE:** If air actuated drain system fails, use the blue drain plugs to drain engine.

**NOTE:** It may be necessary to lift, bend or lower hoses to allow water to drain completely when hoses are disconnected.

1. Remove blue drain plugs from the seawater pump
2. Remove end caps, sealing washers and gaskets from heat exchangers.



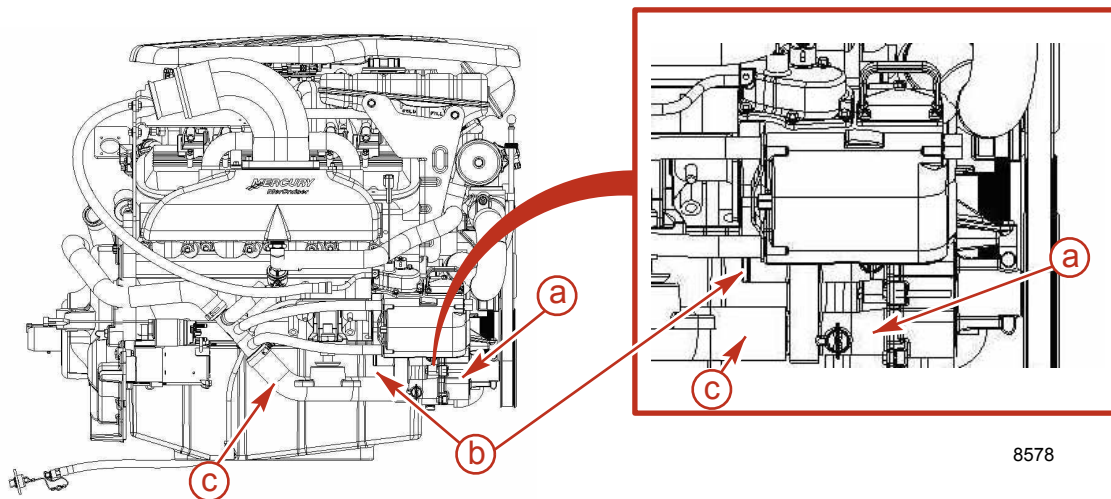
**a** - Heat exchanger

**b** - Gaskets

**c** - Sealing washer

**d** - End cap

3. Repeatedly clean out drain holes using a stiff wire. Do this until entire system is drained.
4. Remove both hoses from seawater pump.

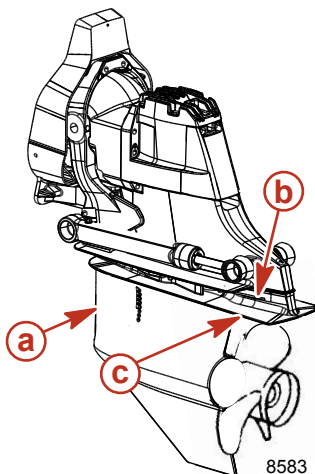


**a** - Seawater pump

**b** - Seawater inlet hose fitting

**c** - Seawater (out) hose to cooler.

5. Insert a small wire (repeatedly) to ensure speedometer pitot tube, trim tab cavity vent hole, and trim tab cavity drain passage are unobstructed and drained.



Typical Bravo drive unit

- a** - Speedometer pitot tube                      **c** - Anode cavity drain passage  
**b** - Anode cavity vent hole

6. Crank engine over slightly with starter motor to purge any water trapped in seawater pickup pump. DO NOT ALLOW ENGINE TO START
7. Store boat with sterndrive unit in full DOWN/IN position.

## Power Package Recommissioning

1. Ensure that all cooling system hoses are connected properly and hose clamps are tight.

### ⚠ CAUTION

Avoid electrical system damage. When installing the battery, be sure to connect the negative (-) battery cable to the negative (-) battery terminal and the positive (+) battery cable to the positive (+) battery terminal.

2. Install a fully-charged battery. Clean the battery cable clamps and terminals and reconnect cables (see CAUTION listed above). Tighten each cable clamp securely when connecting.
3. Coat the terminal connections with a battery terminal anti-corrosion agent.
4. Perform all the checks in the BEFORE STARTING column of the Operations Chart.

### ⚠ CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes during operation.

5. Start the engine and closely observe instrumentation to ensure that all systems are functioning correctly.
6. Carefully inspect the engine for fuel, oil, fluid, water and exhaust leaks.
7. Inspect the steering system, shift and throttle control for proper operation.

## Predelivery Inspection

| Not Applicable           | Check<br>Adjust          | / CHECK BEFORE RUNNING                                           | Not Applicable           | Check<br>Adjust          | / ON THE WATER TEST                                         |
|--------------------------|--------------------------|------------------------------------------------------------------|--------------------------|--------------------------|-------------------------------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Drain plug in and petcocks closed                                | <input type="checkbox"/> | <input type="checkbox"/> | Engine alignment (Inboards only)                            |
| <input type="checkbox"/> | <input type="checkbox"/> | Seawater inlet valve open                                        | <input type="checkbox"/> | <input type="checkbox"/> | Starter neutral safety switch operation                     |
| <input type="checkbox"/> | <input type="checkbox"/> | Engine mounts tight                                              | <input type="checkbox"/> | <input type="checkbox"/> | Water pump operation                                        |
| <input type="checkbox"/> | <input type="checkbox"/> | Engine alignment                                                 | <input type="checkbox"/> | <input type="checkbox"/> | Instruments(s) operation                                    |
| <input type="checkbox"/> | <input type="checkbox"/> | Drive unit fasteners torqued                                     | <input type="checkbox"/> | <input type="checkbox"/> | Fuel leaks                                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | Power trim cylinders fasteners tight                             | <input type="checkbox"/> | <input type="checkbox"/> | Oil leaks                                                   |
| <input type="checkbox"/> | <input type="checkbox"/> | Battery fully charged and secured                                | <input type="checkbox"/> | <input type="checkbox"/> | Water leaks                                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | All electrical connections tight                                 | <input type="checkbox"/> | <input type="checkbox"/> | Exhaust leaks                                               |
| <input type="checkbox"/> | <input type="checkbox"/> | Exhaust system hose clamps tight                                 | <input type="checkbox"/> | <input type="checkbox"/> | Ignition timing                                             |
| <input type="checkbox"/> | <input type="checkbox"/> | All fuel connections tight                                       | <input type="checkbox"/> | <input type="checkbox"/> | Idle _____ rpm, within specifications                       |
| <input type="checkbox"/> | <input type="checkbox"/> | Correct rotation propeller (installed and torqued)               | <input type="checkbox"/> | <input type="checkbox"/> | Forward - Neutral - Reverse gear operation                  |
| <input type="checkbox"/> | <input type="checkbox"/> | Throttle, shift and steering system fasteners tightened properly | <input type="checkbox"/> | <input type="checkbox"/> | Steering operation throughout range                         |
| <input type="checkbox"/> | <input type="checkbox"/> | Throttle plates open and close completely                        | <input type="checkbox"/> | <input type="checkbox"/> | Acceleration from idle rpm                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | Crankcase oil level                                              | <input type="checkbox"/> | <input type="checkbox"/> | WOT _____ rpm within specifications (in FORWARD gear)       |
| <input type="checkbox"/> | <input type="checkbox"/> | Power trim oil level                                             | <input type="checkbox"/> | <input type="checkbox"/> | Power trim operation                                        |
| <input type="checkbox"/> | <input type="checkbox"/> | Sterndrive unit oil level                                        | <input type="checkbox"/> | <input type="checkbox"/> | Trim tab adjustment Boat handling                           |
| <input type="checkbox"/> | <input type="checkbox"/> | Power steering fluid level                                       |                          |                          | <b>AFTER ON WATER TEST</b>                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | Closed cooling level                                             | <input type="checkbox"/> | <input type="checkbox"/> | Propeller nut torque                                        |
| <input type="checkbox"/> | <input type="checkbox"/> | Transmission fluid level                                         | <input type="checkbox"/> | <input type="checkbox"/> | Fuel, oil, coolant, water and fluid leaks                   |
| <input type="checkbox"/> | <input type="checkbox"/> | Alternator belt tension                                          | <input type="checkbox"/> | <input type="checkbox"/> | Oil and fluid levels                                        |
| <input type="checkbox"/> | <input type="checkbox"/> | Seawater pickup pump belt tension                                | <input type="checkbox"/> | <input type="checkbox"/> | Apply Quicksilver Corrosion Guard to engine package         |
| <input type="checkbox"/> | <input type="checkbox"/> | Power steering pump belt tension                                 | <input type="checkbox"/> | <input type="checkbox"/> | C.A.R.B. Hang Tag and Owners Manual in boat <sup>1</sup> .  |
| <input type="checkbox"/> | <input type="checkbox"/> | Audio warning system operation                                   | <input type="checkbox"/> | <input type="checkbox"/> | C.A.R.B. Decal properly affixed to boat hull <sup>1</sup> . |

1. If registered to a CA resident.