

# Removal And Installation

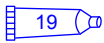

## Section 2B - Inboard Models

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B**

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## Lubricant, Sealant, Adhesives

Tube Ref No.	Description	Where Used	Part No.
 19	Perfect Seal	Engine mounting hardware threads and nuts	92-34227 1
 25	Liquid Neoprene	Exposed terminals and connections	92- 25711 3

## Engine Removal

### WARNING

Fuel vapors trapped in the engine compartment may be an irritant, cause difficulty breathing, or may ignite resulting in a fire or explosion. Always ventilate the engine compartment before servicing the power package.

### WARNING

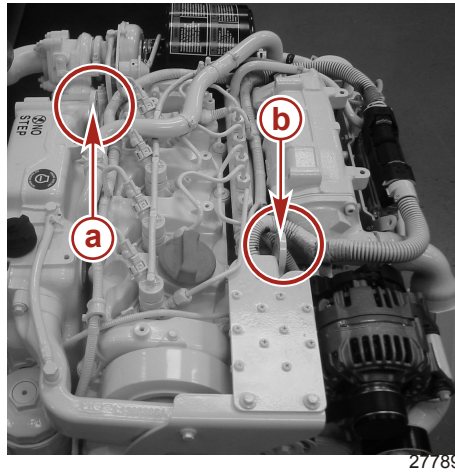
Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

1. Disconnect the negative (–) battery cable (usually black) from the negative (–) battery terminal.
2. Disconnect the positive (+) battery cable (usually red) from the positive (+) battery terminal.
3. Lift and detach the engine cover from the engine cover mounts.
4. Disconnect the engine to VIP harness from the engine wiring harness connectors.
5. Close the fuel shut-off valve, if equipped.
6. Disconnect and plug the fuel lines to prevent fuel from leaking into the bilge.
7. Disconnect the throttle cable and retain the fasteners.
8. Disconnect the shift cable from the transmission and retain the fasteners.
9. **If the boat is to remain in the water**, close the seacock, if equipped, or disconnect and plug the seawater inlet hose.
10. Disconnect the seawater inlet hose.
11. Disconnect the exhaust system hoses if the boat is to remain in the water. Plug the hoses and position them appropriately to prevent seawater from entering the boat.
12. Disconnect any grounding wires and accessories that are connected to the engine.
13. Disconnect the propeller shaft coupler from the transmission output flange.

### CAUTION

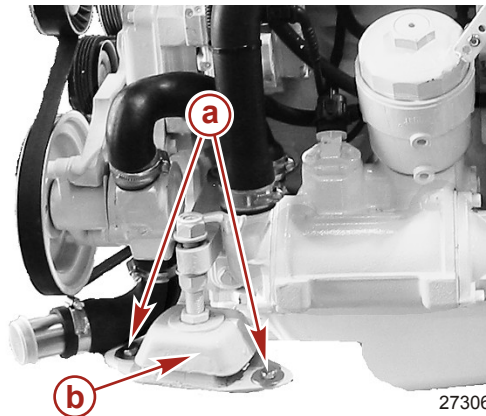
Improper lifting during removal or installation of the engine can cause injury or damage to engine components. Use a hoist, lifting arm, or other approved lifting device. Do not allow the lifting device to hook or compress any engine components.

14. Support the engine with a sling and lifting arm through the lifting eyes on the engine.



- a** - Starboard engine lifting eye  
**b** - Port engine lifting eye

15. Remove and retain the bolts and hardware that fasten the front and rear engine mounts to the engine bed.



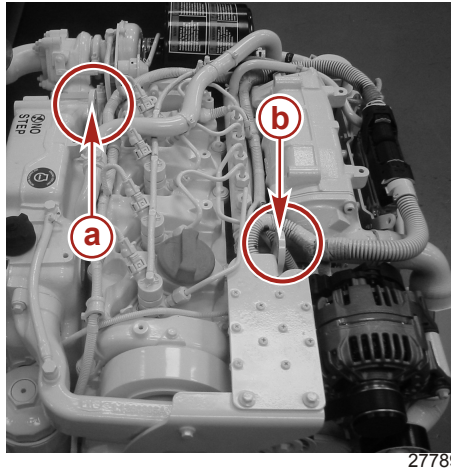
Front mount shown. Rear mount bolts and hardware are similar.

- a** - Bolts and hardware  
**b** - Front mount

16. Using an overhead hoist, carefully remove the engine and transmission.  
17. For transmission removal and installation procedures refer to the appropriate marine transmission manufacturer's service manual.

## Engine Installation

1. Remove the engine cover to gain access to the lifting eyes.



**a** - Starboard lifting eye

**b** - Port lifting eye

### ⚠ CAUTION

Improper lifting during removal or installation of the engine can cause injury or damage to engine components. Use a hoist, lifting arm, or other approved lifting device. Do not allow the lifting device to hook or compress any engine components.

2. Attach a suitable sling and lifting arm to the engine lifting eyes and adjust so that engine is level when suspended.

### ⚠ WARNING

Failure of the lifting eyes will cause the engine to fall suddenly from the hoist, resulting in serious injury, death, or property damage. Keep the engine level while it is hoisted. Do not tilt the engine more than 12° in any direction during installation.

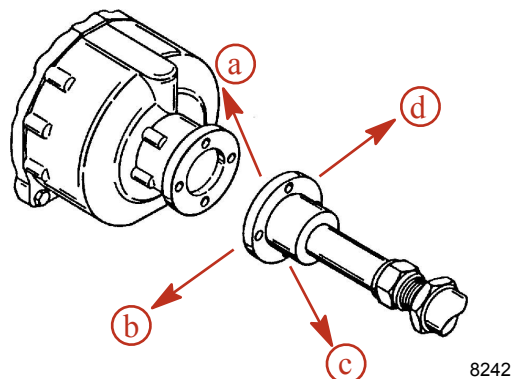
3. Lift the engine into position in the boat using an overhead hoist.  
**IMPORTANT:** When lowering engine into position do not set the engine on the shift cable.
4. Ensure that the mating faces on the transmission output flange and propeller shaft coupler are clean and flat.

## Centering the Propeller Shaft in the Shaft Log

Use the following method to center the propeller shaft in the shaft log.

1. Push down and then lift the shaft as far as it will move, then place the shaft in the middle of the movement.

2. Move the shaft to port then to starboard as far as the shaft will move. Then place the shaft in the middle of the movement.



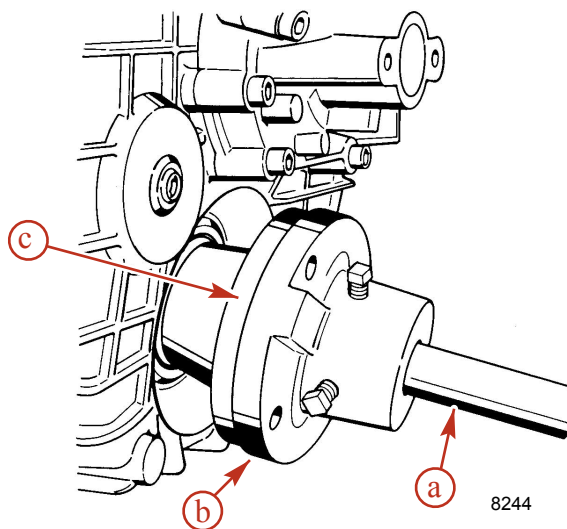
**a** - Up  
**b** - Down

**c** - Port  
**d** - Starboard

3. With the shaft in the center of the shaft log as determined by the preceding steps, align the engine to the shaft. See **Aligning the Engine to the Propeller Shaft**.

### Aligning the Technodrive Transmission to the Propeller Shaft

1. Position the engine on the engine bed with the transmission output flange and the propeller shaft coupler visibly aligned so that no gap is visible between the coupling faces when butted together.

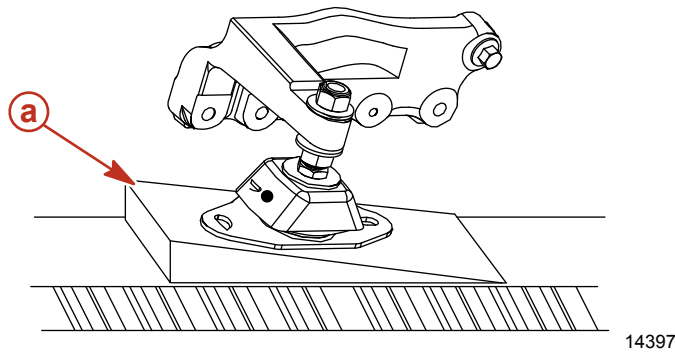


**a** - Propeller shaft  
**b** - Propeller shaft coupler

**c** - Transmission output flange

2. If necessary, adjust the engine bed height with wedges installed under the engine mounts to obtain proper alignment of the transmission with the propeller shaft. Do not use mount adjustments to adjust the engine position at this time.

**IMPORTANT:** To maintain uniform engine mount compression, install the engine mounts so that their bolt holes are aligned parallel to the engine centerline.



**a** - Typical wedge

3. Ensure that all four mounts are positioned properly and then fasten the mounts to the engine bed with 10 mm (3/8 in.) diameter lag bolts or thru-bolts of sufficient length with flat washers. Tighten the bolts securely.

**IMPORTANT:** Engine mount attachment to the boat must allow for a minimum of 6 mm (1/4 in.) up and down adjustment at all four engine mounts. This adjustment is necessary for final engine alignment.

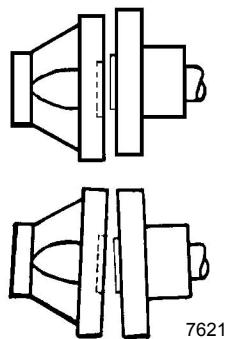
4. Disconnect the overhead hoist and remove the lifting arm and the sling.

## Final Engine Alignment

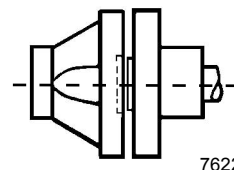
**IMPORTANT:** Engine alignment must be rechecked with the boat in the water, fuel tanks filled, and with a normal load on board.

The engine must be aligned so that the transmission and propeller shaft coupling centerlines are aligned and coupling faces are parallel to within specification. This requirement applies to both solid coupling and flexible coupling installations.

1. Check that the coupling centerlines align by butting the propeller shaft coupler against the transmission output flange. The shoulder on the face of the propeller shaft coupler should engage the recess on the transmission output flange face with no resistance.

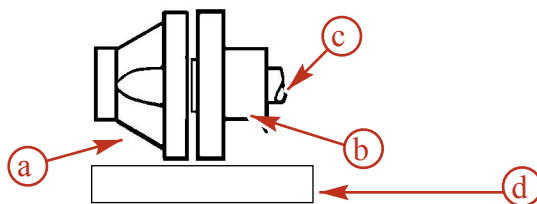


**Incorrect**



**Correct**

**NOTE:** Some propeller shaft couplers may not have a shoulder on the mating face. On these installations, use a straight edge to check centerline alignment.



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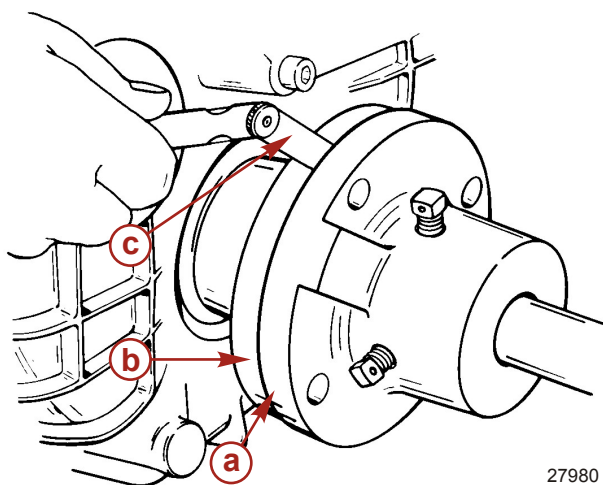
**a** - Transmission output flange

**b** - Propeller shaft coupler

**c** - Propeller shaft

**d** - Straight edge

2. Check the hub face alignment by holding the coupling faces together and checking the gap between mating faces at 90° intervals with a feeler gauge. None of the measurements should exceed specification.



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Typical

**a** - Propeller shaft coupler

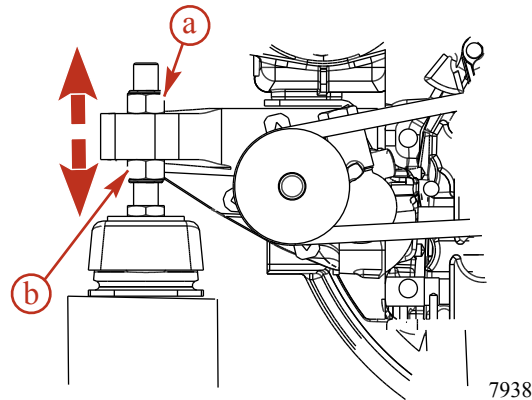
**b** - Transmission output flange

**c** - Feeler gauge

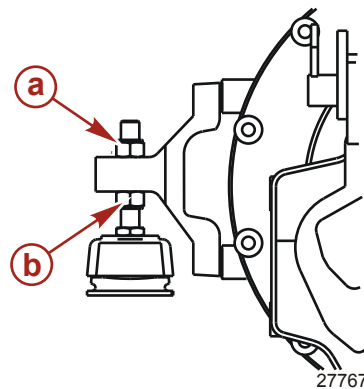
Coupling	
Hub face alignment	0.05 mm (0.0019 in.) maximum

3. If the transmission and propeller shaft couplers do not align, adjust the engine mounts.
  - a. **To adjust the engine up or down**, loosen the locking (jam) nuts on the mounts requiring adjustment. Turn the adjusting nuts as necessary.

**IMPORTANT:** Both front mounts or both rear mounts must be adjusted together so that the engine remains level from side to side.



Typical front mount



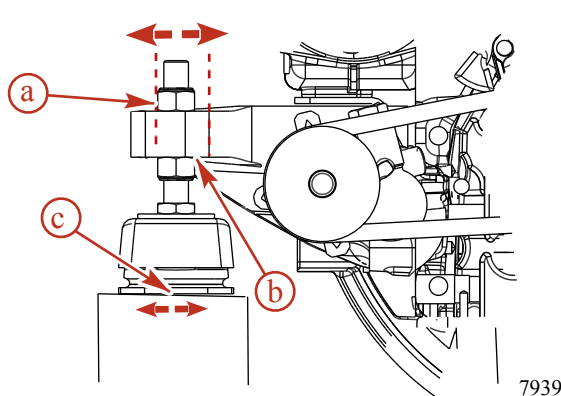
Technodrive transmission rear mount

**a** - Locknut

**b** - Adjusting nut

- b. **To move engine to the left or right**, loosen the locknuts on the front and rear engine mounts and move the engine as necessary in the mount bracket slotted holes.

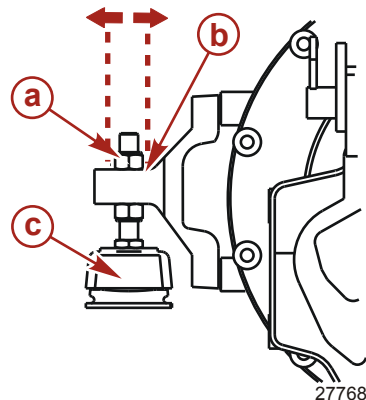
**NOTE:** A slot in the front of some engine mount brackets will permit some additional left and right adjustment.



Typical front mount

**a** - Locknut

**b** - Slotted hole in mount bracket



Typical rear mount

**c** - Mount pad



4. After the engine has been properly aligned, secure the engine mounts to the engine bed or boat stringer using the appropriate hardware.
5. Torque the engine mount locknuts on all mounts.

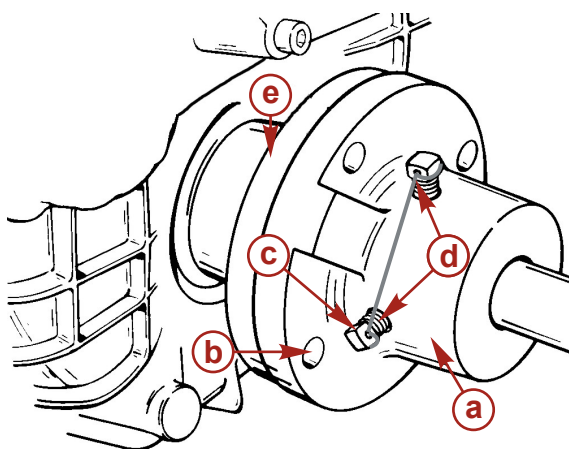
Description	Nm	lb. ft.
Engine mount locknut	80	59

6. Secure the coupling together with bolts, lockwashers, and nuts. Torque the bolts.

Description	Nm	lb. ft.
Coupling bolt and nut	68	50

- a. If the propeller shaft coupler has set screws, remove the set screws and mark dimple locations using a transfer punch.
- b. To drill dimples, remove the propeller shaft coupler and drill shallow dimples at locations marked with the transfer punch.
- c. Reinstall the propeller shaft coupler and torque the coupling bolts.
- d. Ensure that the coupler alignment is still within specifications.
- e. Install the set screws and tighten securely. Connect safety wire between the set screws to ensure that they do not loosen.

Description	Nm	lb. ft.
Coupling bolt and nut	68	50

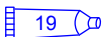


- a** - Propeller shaft coupler  
**b** - Flange bolt holes  
**c** - Set screw

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- d** - Safety wire  
**e** - Transmission output flange

7. Apply sealant to the threads and nuts of the engine mounting hardware to help protect against corrosion and to allow easier adjustment.

Tube Ref No.	Description	Where Used	Part No.
 19	Perfect Seal	Engine mounting hardware threads and nuts	92-34227 1

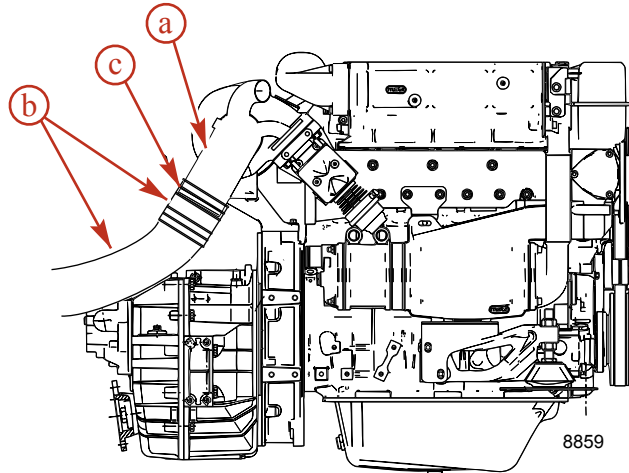
## Exhaust System Connections

### NOTICE

Hot spots in exhaust hoses can damage hoses and cause leaks. Ensure that discharge water from the exhaust elbow flows without restriction through all hoses and fittings.

**IMPORTANT:** Exhaust bellows, hoses, or tubes must be secured at each connection with at least two hose clamps.

1. Connect the exhaust hoses and tubes so that they do not restrict the flow of discharge water from the exhaust elbow.
2. Install at least two hose clamps on each exhaust hose and tube connection.
3. Tighten the exhaust system hose clamps securely.



Typical

**a** - Exhaust elbow

**c** - Hose clamps

**b** - Exhaust tube or hose

## Fluid Connections

### Seawater Hoses

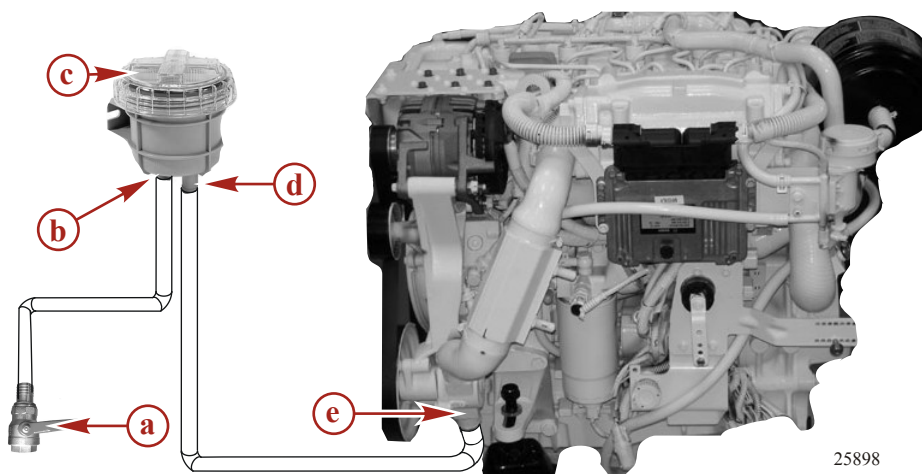
**IMPORTANT:** Before installation, ensure that the shipping dust cap is removed from the seawater pump inlet. Either an internal or external type of dust cap may be used. Inspect the seawater pump, seawater strainer and all seawater hoses for any foreign material. Blocked or significantly restricted seawater flow will cause engine damage.

**NOTE:** Seawater hoses must be wire-reinforced to avoid collapsing when suction is created by the seawater pump impeller.

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

1. Install the seawater hose from the seawater pickup, or seacock (if equipped), to seawater strainer.
2. Install the seawater hose from the seawater strainer to the seawater pump inlet.

3. Tighten the seawater hose clamps securely.



#### Seawater hose standard connections

- a** - Standard seawater pickup fitting or seacock hose connection (if equipped)
- b** - Seawater hose to seawater strainer
- c** - Seawater strainer
- d** - Seawater hose from strainer to seawater pump
- e** - Seawater pump inlet hose connection

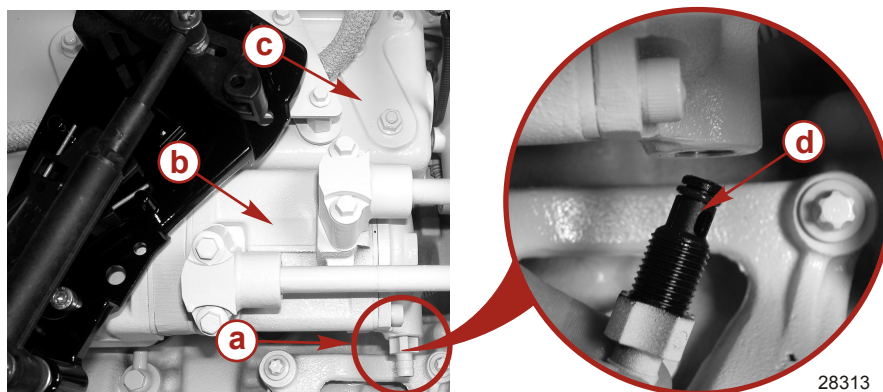
### Propeller Shaft Log Seal (Stuffing Box) Connections, If Equipped

#### NOTICE

Incorrectly installing the water supply hose to the shaft log seal can cause increased exhaust system corrosion or submersion or freeze damage due to siphoning. Position and securely fasten the water supply hose with a portion of the hose above the engine exhaust elbows.

Follow all instructions provided by the propeller shaft log seal manufacturer.

1. Remove the seawater drain plug from the bottom of the heat exchanger.



#### Seawater drain plug removal

- a** - Drain plug
- b** - Oil Cooler
- c** - Heat exchanger
- d** - Drain plug removed

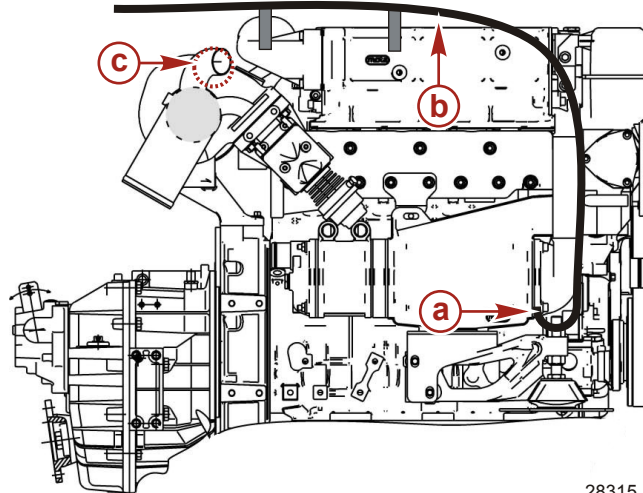
2. Install an appropriate fitting in the heat exchanger seawater drain. We recommend a 90° fitting be used along with a 90° elbow to prevent hose collapse and a restriction of seawater flow to the propeller shaft log seal.

3. Connect the propeller shaft log seal (stuffing box) cooling hose to the fitting on the heat exchanger.

**NOTICE**

Incorrectly installing the water supply hose to the shaft log seal can cause increased exhaust system corrosion or submersion or freeze damage due to siphoning. Position and securely fasten the water supply hose with a portion of the hose above the engine exhaust elbows.

4. Route the propeller shaft log seal hose so that a portion of the hose is higher than the top of the engine exhaust elbow. Ensure that the hose does not contact any hot or moving engine components.



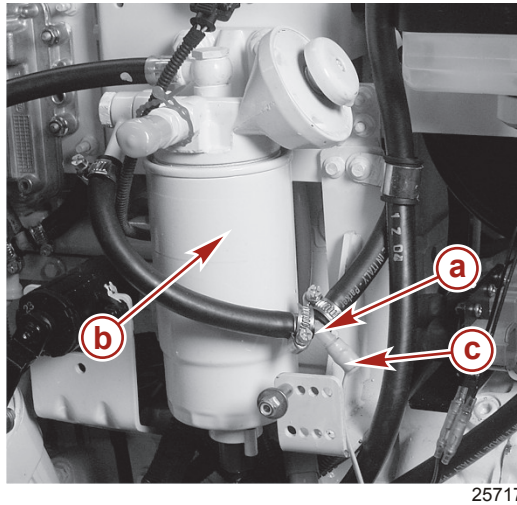
**Typical hose routing**

- a** - Seawater connection at heat exchanger
- b** - Propeller shaft log seal hose routed and anchored
- c** - Top of exhaust elbow seawater inlet

5. Securely anchor the propeller shaft log seal seawater supply hose to both the engine and boat. Allow enough play in the hose to accommodate normal engine movement during operation.

## Fuel Supply Line

1. Remove the protective cap or plug, and connect the flexible fuel supply hose to the fuel inlet fitting. Secure with hose clamps.



**QSD 2.0L Fuel Supply**

**a** - Fuel tee-fitting

**c** - Fuel inlet

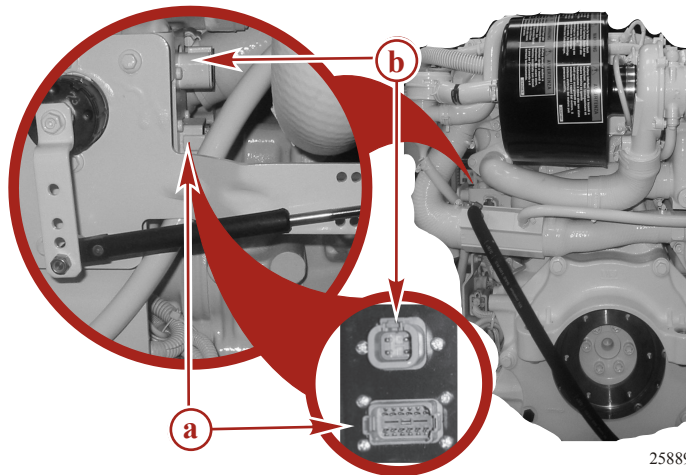
**b** - Water-separating fuel filter

## Electrical Connections

### Engine-to-VIP Connections

1. Route the harness so that it meets the following conditions:
  - Route the harness so that it does not contact any hot or moving parts.
  - Ensure that the harness does not rub or get pinched.
  - Minimize the harness and harness connections exposure to moisture.
  - Mount the harness in the most direct route possible to minimize voltage drop due to wire resistance.
  - Fasten the harness to the boat at least every 460 mm (18 in.) using appropriate fasteners.
  - Follow all ABYC guidelines that govern the installation of signal and DC power wiring in marine vessels.

2. Connect the extension harness connectors to the engine wiring harness connectors.



Engine wiring harness connectors

**a** - Engine to VIP harness connector    **b** - Power connector

3. Ensure that the harness connectors are securely connected.
4. Connect the engine to VIP harness to the Vessel Integration Panel (VIP). See **Vessel Integration Panel (VIP) Connections**.

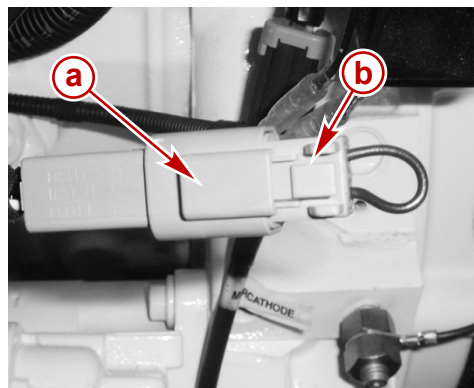
## Neutral Safety Switch Connection

The neutral safety switch connection prevents the engine from starting while the remote control is in either the forward or reverse gear.

### ⚠ WARNING

Improperly installing the remote control can result in serious injury or death. Always remove the jumper plug from the neutral safety connection on the engine and install it correctly to the remote control.

1. Disconnect the jumper plug from the neutral safety switch connector located on the engine.

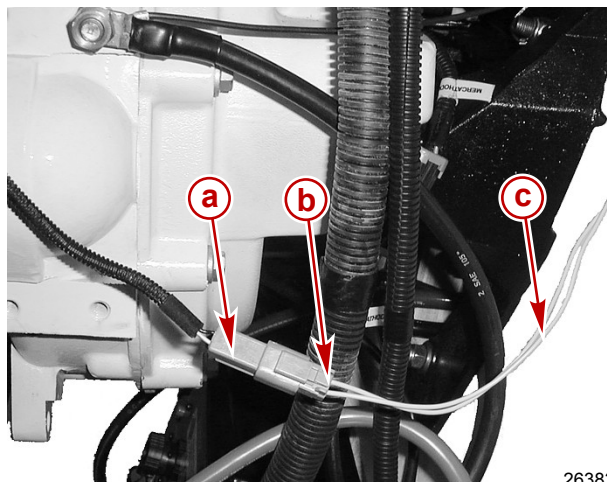


**a** - Neutral safety switch connector  
**b** - Jumper plug

2. Install a proper connector to the neutral switch wires leading to the remote control.



3. Connect the neutral switch wires from the remote control to the neutral safety switch connector on the engine.




- a** - Neutral safety switch connector  
**b** - Proper connector for wires from the remote control  
**c** - Neutral switch wires leading to the remote control

## Battery Cable Connection

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

1. Ensure that the accessory wiring (if equipped) is properly connected to the battery terminals.
2. Connect the battery cables to the battery by first connecting the positive (+) battery cable (usually red) to the positive (+) battery terminal. Tighten the clamp securely.
3. Connect the negative (–) battery cable (usually black) to the negative (–) battery terminal. Tighten the clamp securely.
4. Ensure that all of the battery terminal connections are tight. Spray the terminals with a battery connection sealant to help retard corrosion.
5. Apply sealant to the exposed terminals and electrical connections.

Tube Ref No.	Description	Where Used	Part No.
 25	Liquid Neoprene	Exposed terminals and connections	92- 25711 3

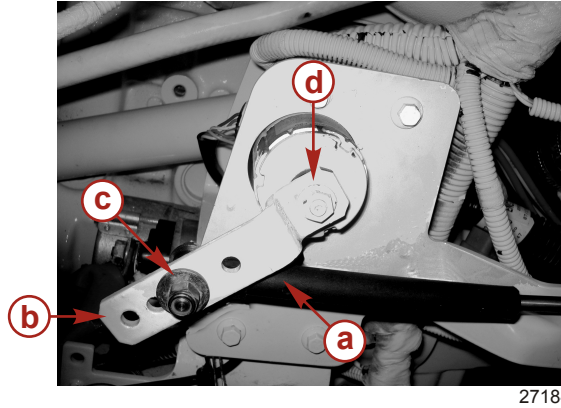
## Throttle And Shift Cable Installation and Adjustment

### Throttle Cable Installation and Adjustment

**IMPORTANT:** When installing throttle cables, route the cables to avoid sharp bends and to avoid contact with moving parts. Do not attach any items to the throttle cables.

1. Place the remote control lever in the neutral and idle position.
2. Place the engine throttle lever in the idle position.

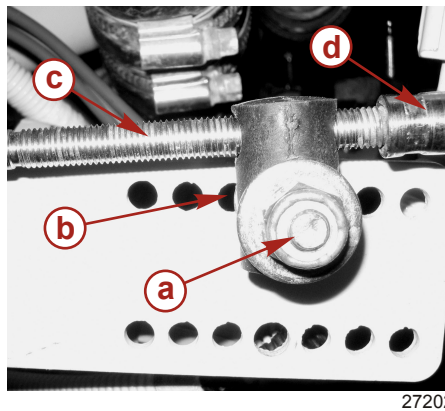
3. Install the end guide of the throttle cable anchor stud in the third hole from the end of the throttle lever. Hand-tighten the locknut only.



Engine throttle lever (idle)

- |  |   |
|--|---|
| <b>a</b> - Throttle cable                | <b>c</b> - Throttle lever locknut           |
| <b>b</b> - Throttle cable mounting holes | <b>d</b> - Throttle lever in idle position. |

4. Install the throttle cable barrel anchor bolt in the fourth hole from the left on the top row of the anchor bracket. Hand-tighten the locknut only.



Throttle cable anchor bracket

- |                                       |   |
|---------------------------------------|---|
| <b>a</b> - Throttle cable anchor bolt | <b>c</b> - Throttle barrel adjustment threads |
| <b>b</b> - Mounting holes             | <b>d</b> - Throttle cable                     |

**IMPORTANT:** Adjust the throttle cable so that the throttle position sensor (TPS) does not contact the sensor's internal mechanical stop at wide open throttle (WOT). Repeated operation of the TPS at the limits of its range of travel could result in TPS failure.

5. If using the CDS tool to adjust the throttle cable:

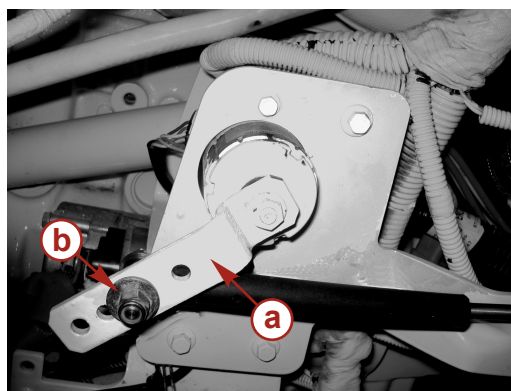
**NOTE:** Use of the CDS tool to monitor TPS output is the preferred method of throttle cable adjustment.

- a. Move the throttle lever forward until the CDS tool indicates that the TPS is at wide open throttle (WOT).
- b. Adjust the throttle cable so that the throttle lever can travel past the WOT position but stops short of the TPS's internal mechanical stop.

6. If the CDS tool is unavailable, then adjust the throttle cable as follows:



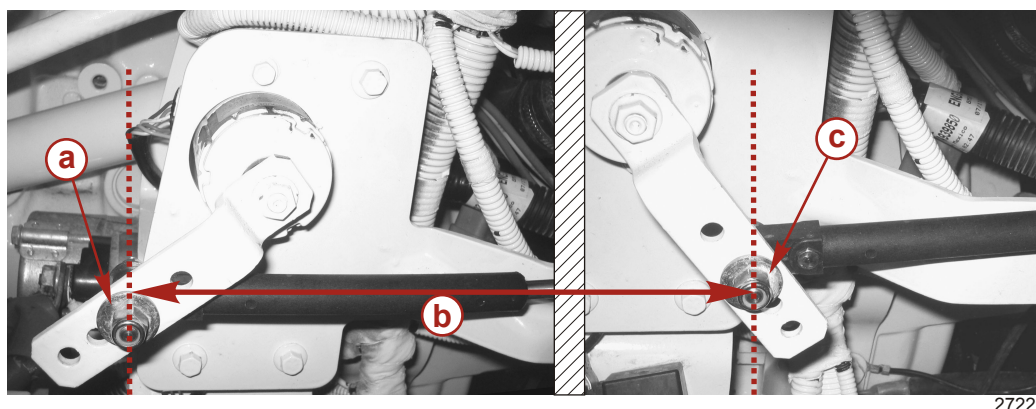
- a. Set the throttle lever at its idle position.



**Engine throttle linkage (idle)**

- a** - Throttle lever cable locknut      **b** - Throttle lever in idle position

- b. Move the throttle lever toward its WOT position.
- c. Using the center of the throttle lever cable locknut as a reference, measure the distance the throttle lever travels (throttle range of motion) as it moves from idle toward WOT.



**Throttle adjustment measurements**

- a** - Throttle lever cable locknut - idle position      **c** - Throttle lever cable locknut - WOT position  
**b** - Throttle range of motion

- d. The throttle lever's range of motion (**Measurement - b**) between idle and WOT should measure between 70 mm (2 3/4 in.) and 79 mm (3 1/8 in.).
- e. Adjust the throttle cable so that the throttle's range of motion measures within the specified 70 mm (2 3/4 in.) and 79 mm (3 1/8 in.).
7. Tighten the locknuts until they contact the washers, then loosen 1/2 turn.
8. Place the remote control lever in the neutral and idle position. Adjust the throttle cable barrel if the throttle position sensor does not return to the idle position.
9. Place the remote control lever in the forward gear, WOT position.
10. Confirm that the throttle lever range of motion remains within specification.
11. Operate the remote control to ensure proper shift and throttle operation.

## Technodrive Shift Cable Installation and Adjustment

Refer to the appropriate transmission service manual accompanying this particular application's gear for shift cable installation and adjustment procedures.

## **Technodrive Trolling Valve Cable Installation and Adjustment**

Refer to the appropriate transmission service manual accompanying this application's particular gear for trolling valve cable installation and adjustment procedures.