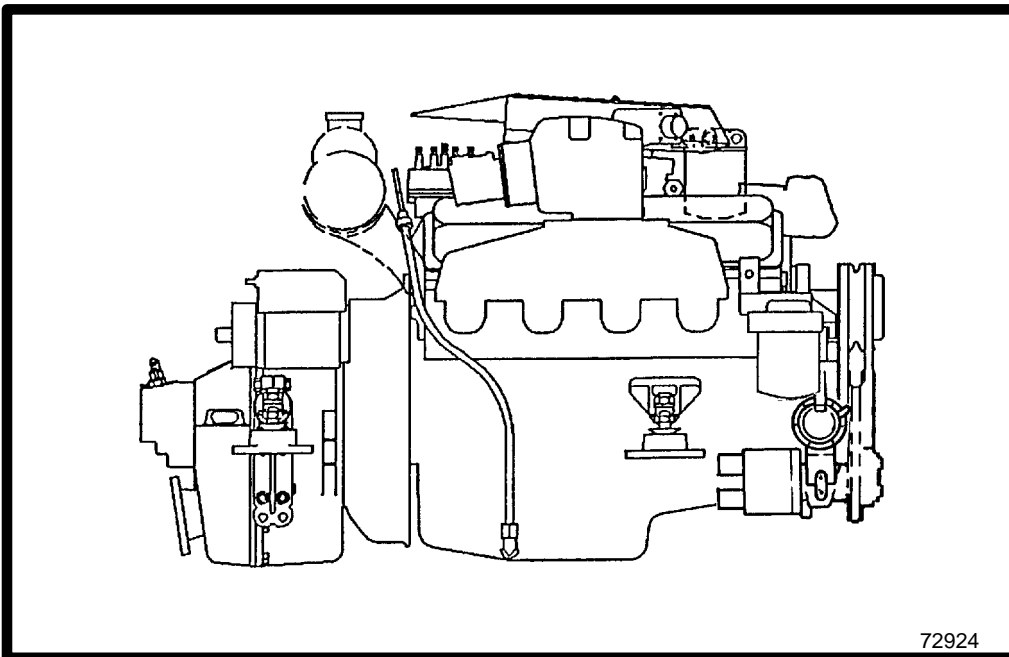


REMOVAL AND INSTALLATION

2

C



MIE - VELVET DRIVE TRANSMISSIONS

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Torque Specifications

Fastener Location		Lb. Ft.	N-m
Battery Cables		Securely	
Engine Mount Pads			
Hose Clamps			
Mount Locking Nut			
Propeller Shaft Coupler To Transmission Output Flange		50	68
Trunnion Clamping Screw / Nut			
Remote Control Shift Cable	Cable Barrel	Securely	
	Cable End Guide	NOTE 1	
Remote Control Throttle Cable	Cable Barrel	Securely	
	Cable End Guide	NOTE 1	

NOTE 1: Tighten, then back nut off one half turn.

NOTE 2: Bend tab against adjusting nut.

Lubricants / Sealants

Description	Part Number
Quicksilver 2-4-C Marine Lubricant With Teflon	92-825407A3
Quicksilver Liquid Neoprene	92-25711--2

Removal

Engine Removal

1. Disconnect battery cables from battery.
2. Remove instrument panel harness connector plug from engine harness receptacle after loosening clamp.

⚠ 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.

3. Using wrench to stabilize brass coupling at fuel inlet, loosen fuel line fitting, disconnect and suitably plug fuel line to prevent fuel in tank from leaking into bilge.
4. Disconnect throttle cable from carburetor and retain locknuts and hardware.
5. Disconnect shift cable from transmission.
6. Disconnect seawater inlet hose from engine.
7. Disconnect exhaust system hoses.
8. Disconnect any grounding wires and accessories that are connected to engine.
9. Disconnect propeller shaft coupler from transmission output flange.

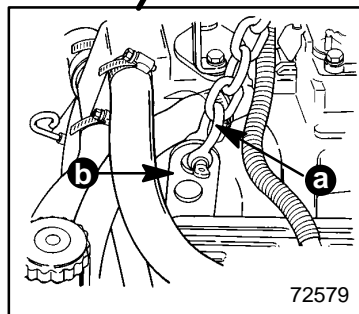
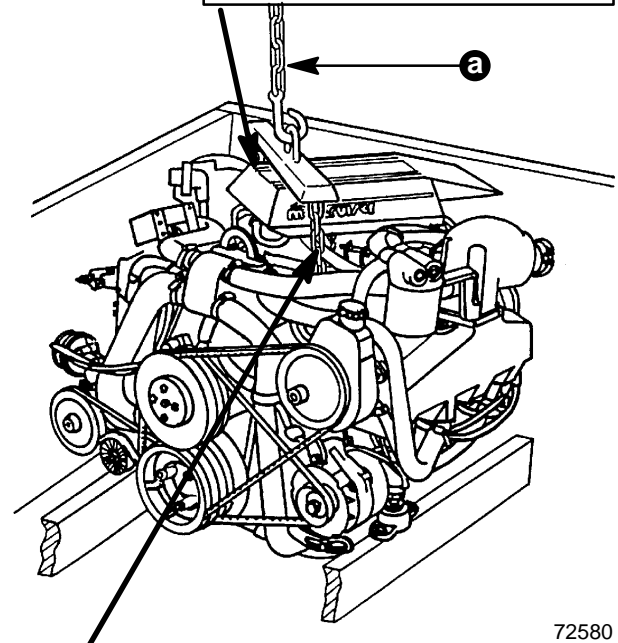
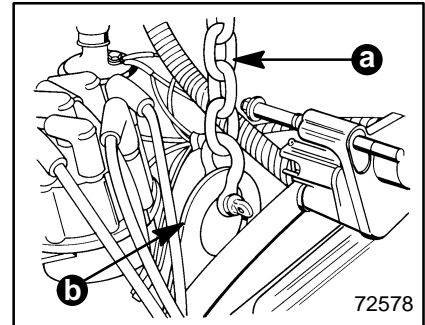
⚠ CAUTION

Center lifting eye (located on top of thermostat housing) is used for engine alignment only. DO NOT use to lift entire engine.

⚠ CAUTION

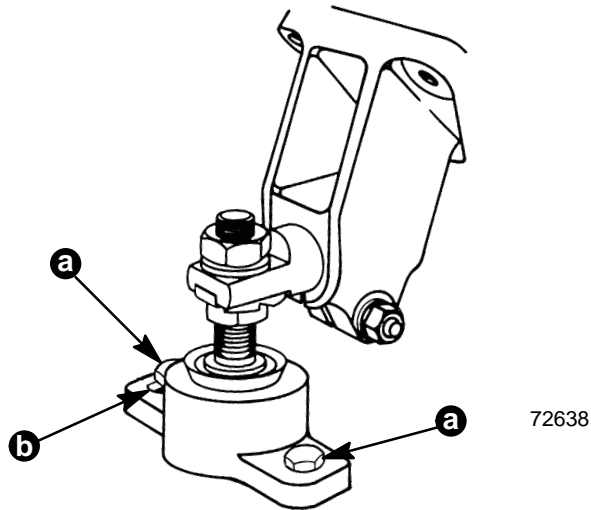
DO NOT allow lifting sling to hook or compress engine components or damage to them will occur.

10. Support engine with suitable sling through lifting eyes on engine.



- a - Suitable Sling
- b - Engine Lifting Eyes

- Remove front and rear engine mounting bolts. Retain hardware.



All Engines

- a - Bolts Or Lag Screws (With Washers)
- b - Slot Forward (If So Designed)

- Carefully remove engine.

Installation

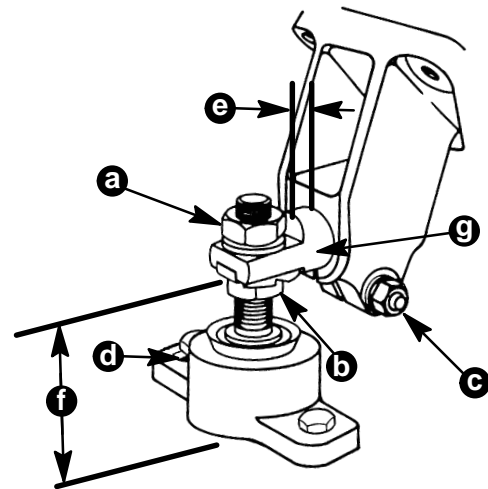
Engine Installation and Initial Alignment

- Follow instructions "a" or "b":
 - Engine mount(s) or adjustment **WAS NOT DISTURBED** during engine service: Proceed to following Step 2.
 - Engine mount(s) or adjustment **WAS DISTURBED** during engine service:

IMPORTANT: Engine mounts must be adjusted, as explained in the following, to center mount adjustment and establish a uniform height on all mounts.

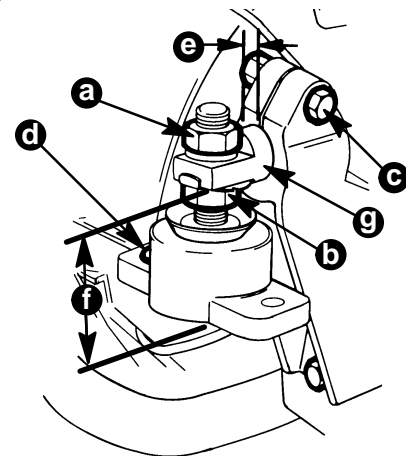
Ensure that all mounts are:

- In the center of their up-and-down adjustment.
- Mounting hole, which is a slot, is forward.
- Large diameter of mount trunnion extended as shown.
- Each mount base is downward. Tighten clamping screws and nuts slightly to prevent moving in or out. Mounts must be free to pivot when installing engine.



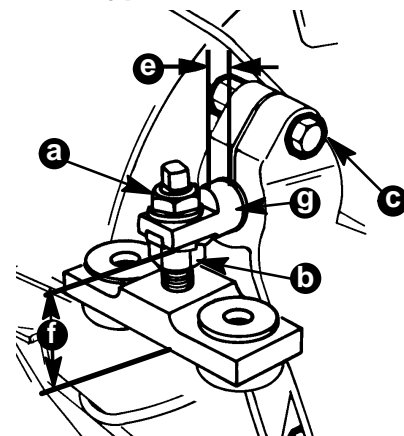
72638

All Engines



72594

Rear Mount - Typical



71182

Rear Mount - Typical

- a - Locking Nut
- b - Adjusting Nut
- c - Trunnion Clamp Screw and Nut, With Lockwasher
- d - Slot Forward
- e - 3/8 In. \pm 1/16 In. (10 mm \pm 2 mm)
- f - 2-5/8 In. \pm 1/16 In. (67 mm \pm 2 mm)
- g - Mount Trunnion

⚠ CAUTION

Center lifting eye (located on top of thermostat housing) is used for engine alignment only. DO NOT use to lift entire engine.

⚠ CAUTION

DO NOT allow lifting sling to hook or compress engine components or damage to them will occur.

2. Attach a suitable sling to lifting eyes on engine. Refer to “Removal” section for location of lifting eyes.

IMPORTANT: Engine bed must position engine so that a minimum of 1/4 in. (6 mm) up-and-down adjustment still exists on all four mounts after performing final alignment. This is necessary to allow for final engine alignment.

3. Lift engine into boat and position on engine bed so that transmission output flange and propeller shaft coupler are visibly aligned (no gap can be seen between coupling faces when butted together). **Adjust engine bed height**, if necessary, to obtain proper alignment. DO NOT use mount adjustments to adjust engine position at this time.
4. Check all four mounts to ensure that they are still positioned properly, then fasten mounts to engine bed with appropriate bolts or lag screws and hardware. Tighten lag bolts/screws securely.
5. Disconnect and remove sling. Proceed to “Engine Final Alignment” section following.

Engine Final Alignment

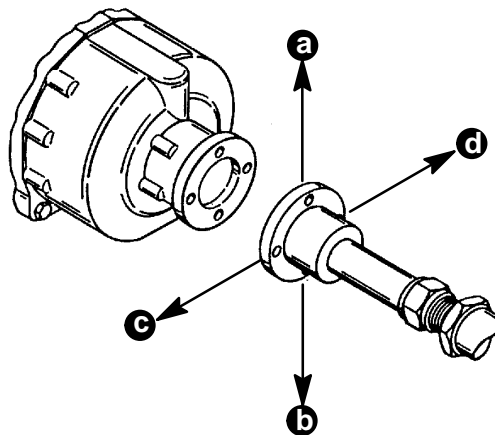
⚠ CAUTION

To avoid vibration, noise and damage to transmission output shaft oil seal and bearings, engine must be properly aligned.

IMPORTANT: Engine alignment MUST BE RE-CHECKED with boat in the water, fuel tanks filled and with a normal load on board.

Engine must be aligned so that transmission output flange and propeller shaft coupler centerlines are aligned and coupling faces are parallel within .003 in. (0.07 mm). This applies to installations with solid couplings, as well as flexible couplings.

1. Check mating surfaces on transmission output flange and propeller shaft coupler faces to make sure they are clean and flat.
2. Center propeller shaft in shaft log as follows:
 - a. Push down and then lift shaft as far as it will move. Then place shaft in the middle of the movement.
 - b. Move shaft to port and then to starboard as far as shaft will move. Then place shaft in the middle of the movement.
 - c. With shaft in center of shaft log, as determined by above procedures “a” and “b,” align engine to shaft.

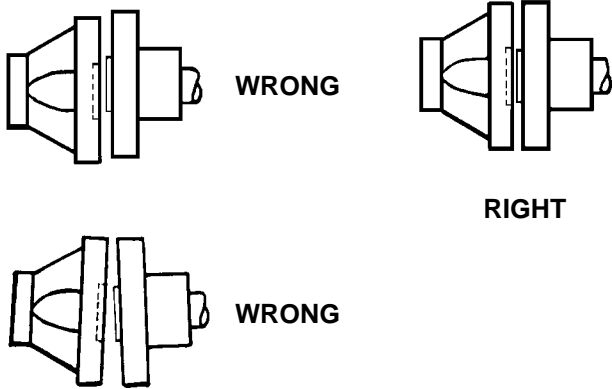


72595

- a - Up
- b - Down
- c - Port
- d - Starboard

3. Check that coupling centerlines align, by butting propeller shaft coupler against transmission output flange. Shoulder on propeller shaft coupler should engage recess on transmission output flange face with no resistance.

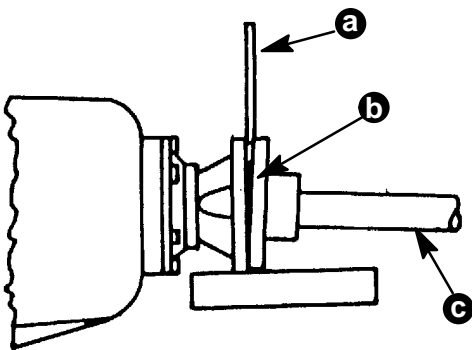
NOTE: Some propeller shaft couplers may not have a shoulder on mating face. On these installations, use a straight edge to check centerline alignment.



72597

IMPORTANT: Remote V-Drive Models: refer to remote V-drive manufacturer's instructions for drive shaft (between transmission and remote V-drive) alignment.

4. Check for angular misalignment, by hand holding coupling faces tightly together; check for a gap between faces with a .003 in. (0.07 mm) feeler gauge at 90° intervals.

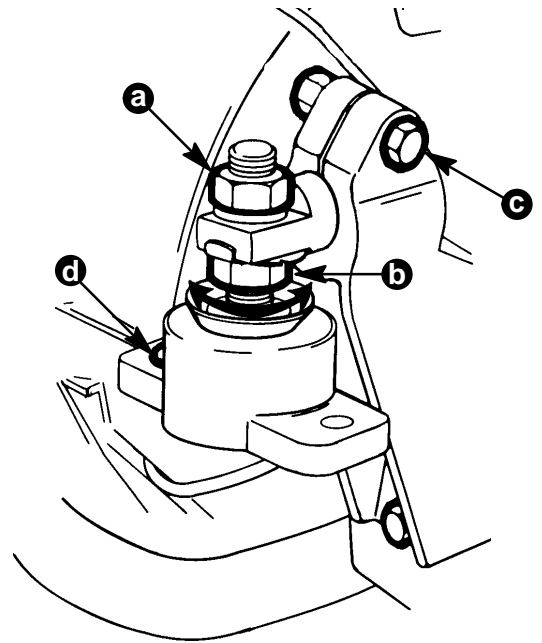


72598

- a - Feeler Gauge
- b - Transmission Coupling
- c - Propeller Shaft
- d - Straight Edge

5. If coupling centerlines are not aligned or if coupling faces are more than .003 in. (0.07 mm) out of parallel, adjust engine mounts as follows:
 - a. TO ADJUST ENGINE UP OR DOWN: Loosen locking nut on mounts requiring adjustment and turn both front mount or rear mount adjusting nuts equally.

IMPORTANT: Both front mount (or rear mount) adjusting nuts must be turned equally to keep engine level from side to side.



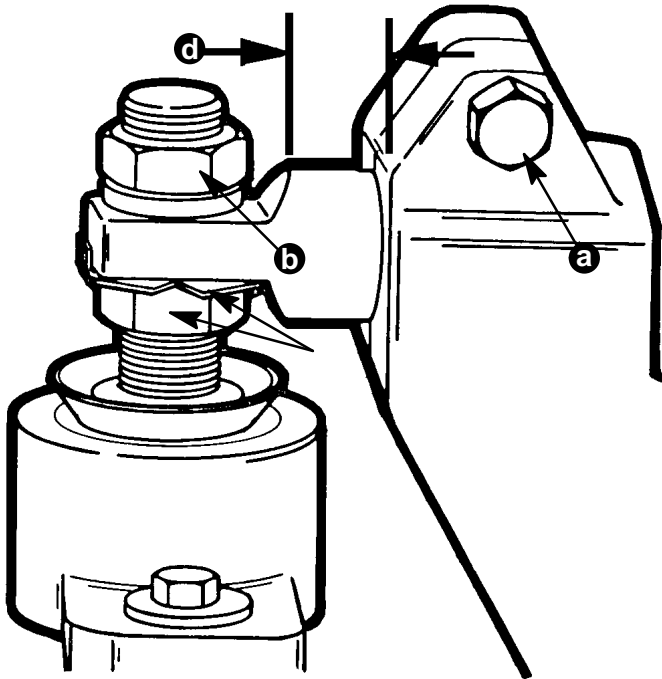
72594

Typical Mount

- a - Locking Nut
- b - Adjusting Nut
- c - Clamping Screws and Nuts, Wit Lockwashers (Two Each on Some Models)
- d - Slot Forward (If So Designed - NOT Slotted On This Style Rear Mount)

- b. TO MOVE ENGINE TO THE LEFT OR RIGHT: Loosen clamping screw and nut on all four mount brackets; move engine to the left or right as necessary to obtain proper alignment. On mounts which do have a slotted hole, a small amount of adjustment can be obtained with slot on front end of mounts. Loosen lag screws (which fasten mounts to engine bed) and move engine, as required. Tighten lag screws securely.
- c. After engine has been properly aligned: Tighten engine mount nuts securely, and be certain to bend one of the tabs on the tab washer down onto flat of mount adjusting nut. Torque clamping screws and nuts to 50 lb. ft. (68 N·m).

IMPORTANT: Large diameter of mount trunnion **MUST NOT** extend over 3/4 in. (20 mm) from mount brackets on any of the mounts.



72599

- a - Torque Clamping Screw and Nut On All Four Mount Brackets To 50 Lb. Ft. (68 N·m)
- b - Tighten Locking Nut On All Four Mounts Securely
- c - Bend One Of The Tab Washer Down Onto Flat Of Adjusting Nut
- d - Maximum Extension Of Large Diameter Of Trunnion - 3/4 In. (20 mm)

IMPORTANT: All coupler bolts must be SAE Grade 8 (Metric Grade 10.9) or better, with a shoulder (grip length) long enough to pass through the face mating plane of couplers.

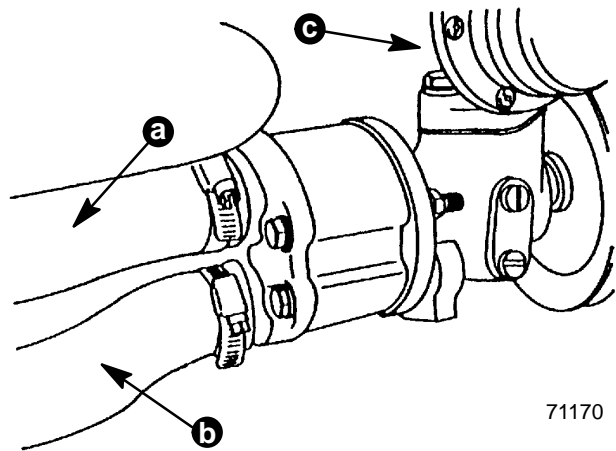
6. Connect propeller shaft coupler to transmission output flange. Attach couplers together with bolts, lockwashers and nuts. Torque to 50 lb. ft. (68 N·m).

NOTE: If propeller shaft coupler has setscrews, the shaft should be dimpled at setscrew locations. Setscrews should be safety wired after being tightened securely.

Engine Connections

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

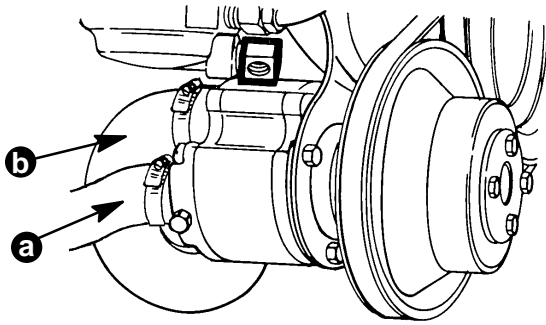
1. Connect seawater inlet hose to seawater pump as shown. Tighten hose clamp securely.
2. Connect water hoses to seawater pump.



71170

Engines With Combination Seawater / Fuel Pump

- a - Seawater Inlet Hose
- b - Hose To Cooler
- c - Fuel Pump

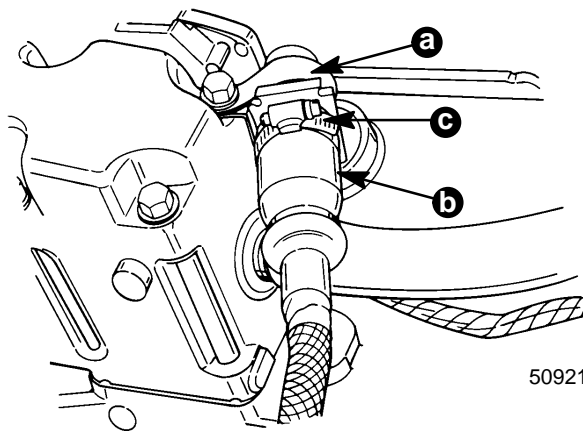


72352

Engines Without Mechanical Fuel Pump

- a - Seawater Inlet Hose
- b - Hose To Cooler

3. Connect instrument harness to engine harness with hose clamp. Tighten hose clamp securely.



50921

Harness Connection

- a - Engine Wiring Harness Receptacle Bracket
- b - Instrument Wiring Harness Plug
- c - Hose Clamp

FUEL SUPPLY CONNECTIONS

⚠ 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.

- Apply #592 Loctite Pipe Sealant with Teflon to threads of brass fitting or plug. **DO NOT USE TEFLON TAPE.**
- Thread brass fitting or plug into fuel pump or fuel filter base until finger tight.
- Tighten fitting or plug an additional 1-3/4 to 2-1/4 turns using a wrench. **DO NOT OVER-TIGHTEN.**

- Install fuel line. To prevent over-tightening, hold brass fitting with suitable wrench and tighten fuel line connectors securely.
- Check for fuel leaks.

⚠ WARNING

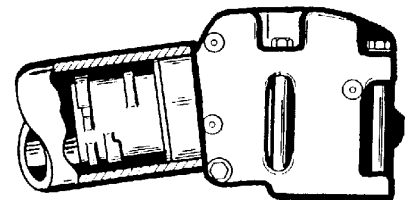
Be careful when working on fuel system. Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow spark or open flame in area. Wipe up any spilled fuel immediately.

4. Connect fuel line from fuel tank(s) to engine. Make certain connection is secure. Check for leaks.
5. Connect exhaust system tubes and hoses using at least two hose clamps at each connection. Tighten hose clamps securely.

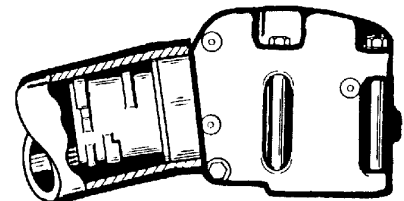
NOTICE

Exhaust hoses must be connected to exhaust elbows so that they do not restrict the flow of discharge water from exhaust elbow. If hoses are connected incorrectly, discharge water from exhaust elbow will not flow around entire inside diameter of hose. This will cause a hot spot in the hose which may eventually burn through.

CORRECT



INCORRECT



72538

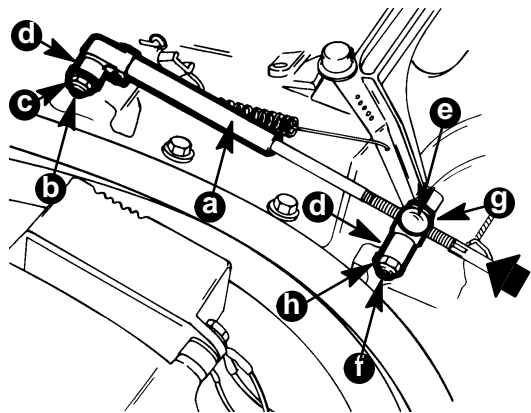
NOTE: Clamps not shown.

Throttle Cable Installation and Adjustment

Weber 4 Barrel Carburetor

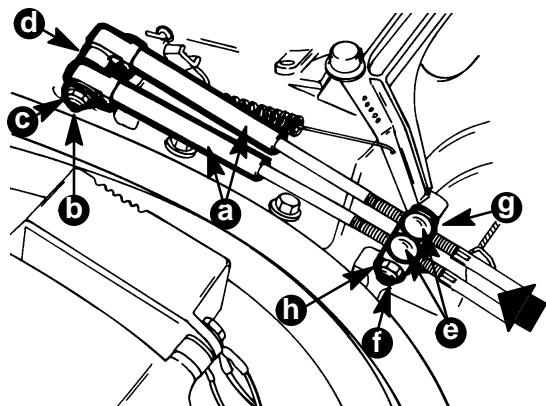
IMPORTANT: When installing throttle cable, be sure that cables are routed in such a way as to avoid sharp bends and/or contact with moving parts. **DO NOT** fasten any items to throttle cable.

1. Lubricate cable ends and barrels.
2. Place remote control throttle lever in idle position and attach cable end guide to carburetor throttle lever as shown.
3. Grasp cable behind barrel and push lightly as shown. Adjust cable barrel to align hole with anchor stud, then slide barrel onto stud.



22552

Single Station

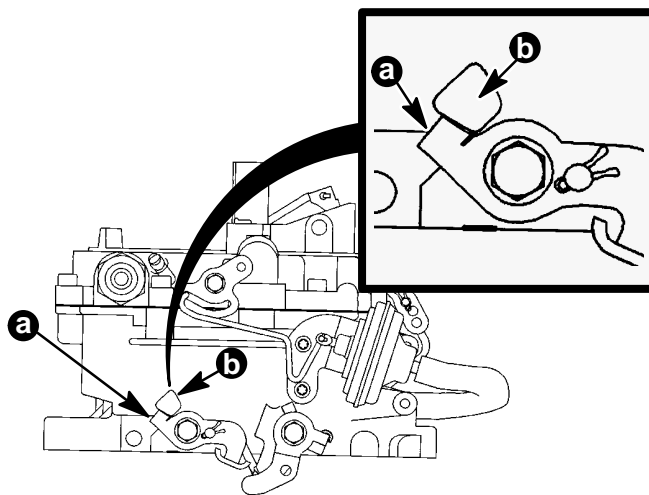


22553

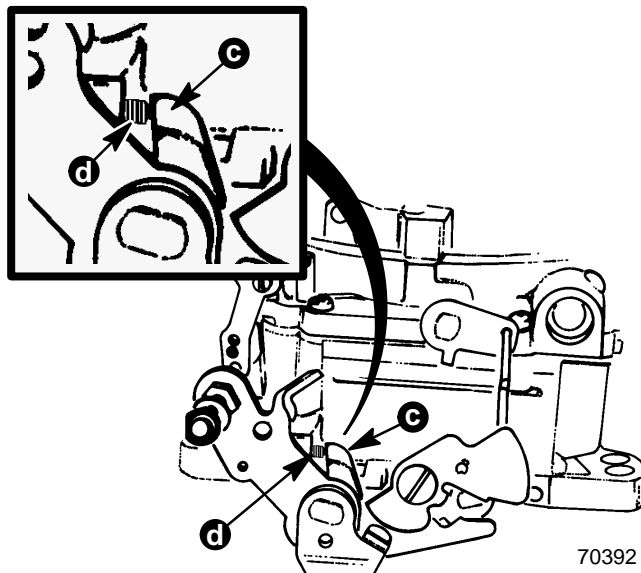
Dual Station

- a - Throttle Lever Stud
- b - Elastic Stop Nut and Washer
- c - Spacer
- d - Cable Barrel
- e - Anchor Stud
- f - Washer
- g - Elastic Stop Nut
- h - Cable End Guide

4. Secure throttle cable with hardware as shown and tighten securely. **DO NOT OVERTIGHTEN**, as cable must pivot freely.
5. Place remote control throttle lever in the wide open throttle (W.O.T.) position. Check to ensure that throttle plates are completely open.
6. Return remote control throttle lever to idle position and check to ensure that throttle lever contacts idle speed adjustment screw.



71159



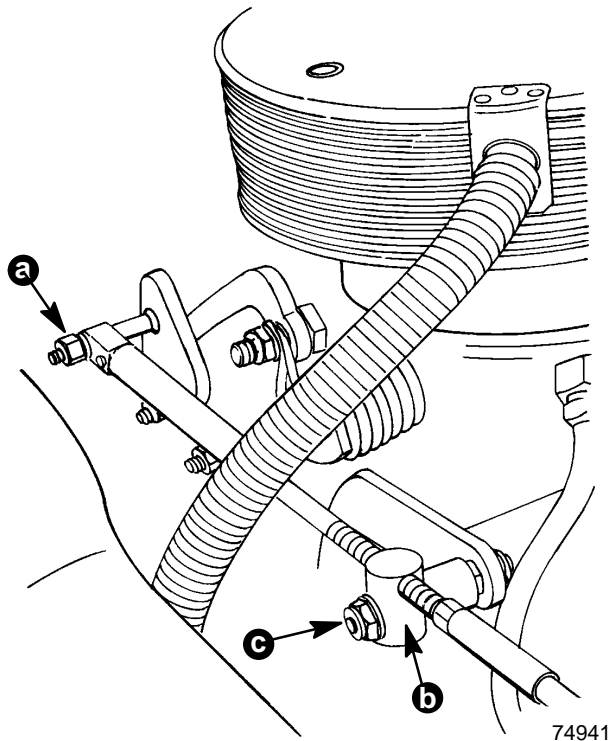
70392

- a - Throttle Shaft Lever [Contacts (b) at W.O.T. Position]
- b - Carburetor Body Casting
- c - Throttle Lever [Contacts (d) in Idle Position]
- d - Idle Speed Adjustment Screw

Throttle Body Injection

IMPORTANT: When installing throttle cable, be sure 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 throttle cable.

1. Place remote throttle lever in idle position and attach cable to throttle body, following cable manufacturer's instructions.
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 hole in barrel positions cable as shown.

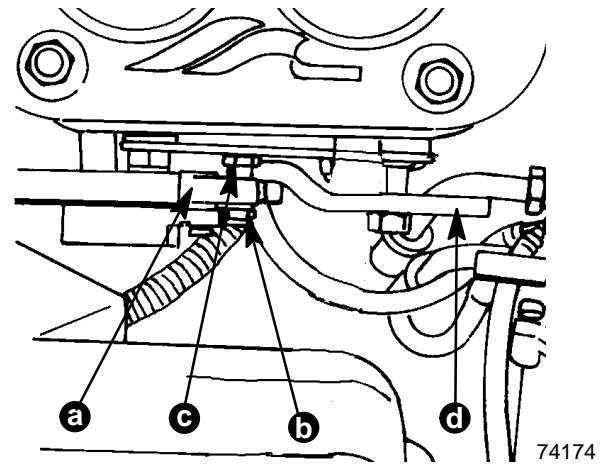


- 74941
- a - Cable End
 - b - Cable Barrel
 - c - Locknut and Flat Washer - Tighten Until Nut Bottoms Out Then Back Off One-Half Turn

Multi-Port Injection

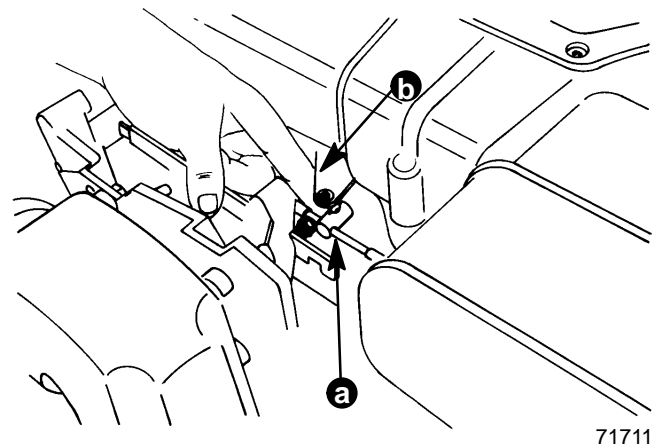
IMPORTANT: When installing throttle cable, be sure that cables are routed in such a way as to avoid sharp bends and/or contact with moving parts. **DO NOT** fasten any items to throttle cable.

1. Lubricate cable ends and barrels.
2. Place remote throttle lever in idle position and attach cable to throttle body, following cable manufacturer's instructions.



- 74174
- a - Cable End Guide
 - b - Throttle Lever Stud
 - c - Locknut and Flat Washer - Tighten Until Nut Bottoms Out Then Back Off One-Half Turn
 - d - Throttle Lever

3. 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 hole in barrel positions cable as shown.



- 71711
- a - Cable Barrel
 - b - Anchor Plate

Shift Cable Installation And Adjustment

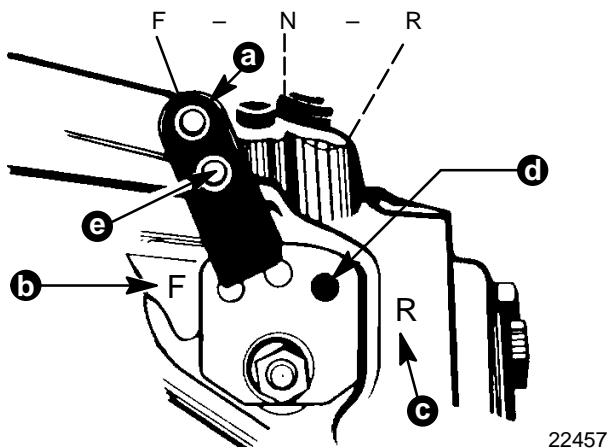
IMPORTANT: When installing shift cables, be sure that cables are routed in such a way as to avoid contact with moving parts and/or sharp bends [all bends must make greater than an 8 inch (203 mm) radius]. **DO NOT** fasten any items to shift cables.

Shift cable must be hooked up to remote control before starting installation and adjustment procedures. Refer to "Transmission - Propeller Rotation", as previously outlined in the front of this manual, for transmission shift lever direction of movement versus propeller shaft output direction of rotation.

Velvet Drive Transmissions

IN-LINE AND REMOTE V-DRIVE

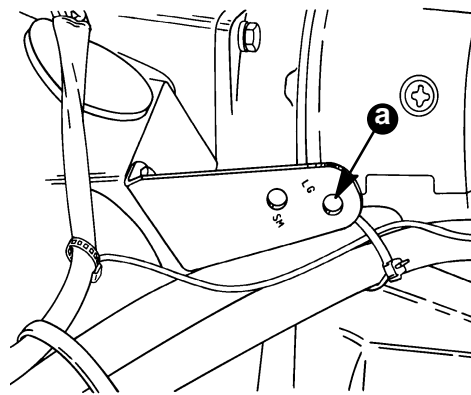
IMPORTANT: Velvet Drive Transmission Warranty is jeopardized if the shift lever poppet ball or spring is permanently removed, if the shift lever is repositioned or changed in any manner or if remote control and cable do not position shift lever correctly.



22457

- a - Transmission Shift Lever
- b - Shift Lever MUST BE Over This Letter When Propelling Boat FORWARD
- c - Shift Lever MUST BE Over This Letter When Propelling Boat IN REVERSE
- d - Poppet Ball MUST BE Centered in Detent Hole for Each F-N-R Position (Forward Gear Shown)
- e - Install Shift Lever Stud in This Hole, If Necessary, To Center Poppet Ball in Forward and Reverse Detent Holes

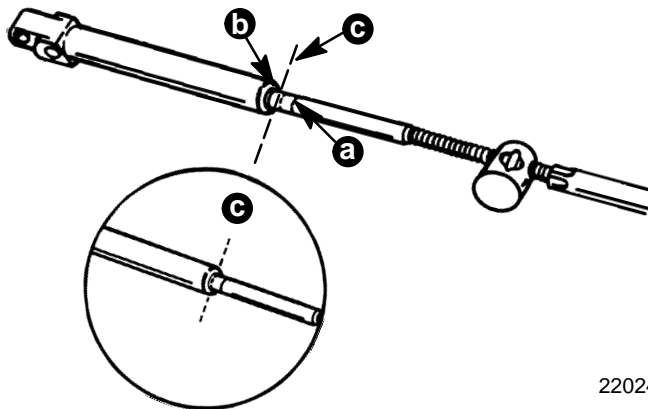
1. Verify shift cable stud is in appropriate stud hole as indicated. Tighten elastic stop nut securely.



50947

a - Anchor Stud Hole

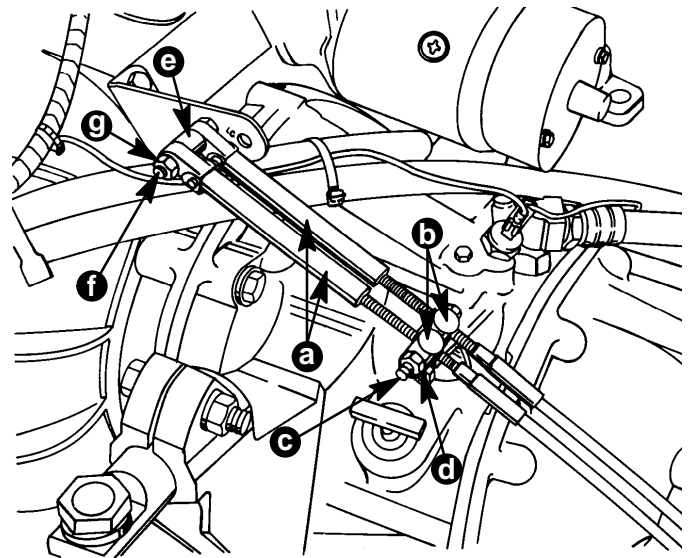
2. Place remote control shift lever, and transmission shift lever in neutral position.
3. Remove nuts and washers from shift cable attaching studs.
4. Locate center of remote control and control shift cable play (backlash), as follows:
 - a. Check that remote control is in neutral position.
 - b. Push in on control cable end with enough pressure to remove play, and mark position "a" on tube.
 - c. Pull out on control cable end with enough pressure to remove play, and mark position "b" on tube.
 - d. Measure distance between marks "a" and "b," and mark position "c," half-way between marks "a" and "b."



22024

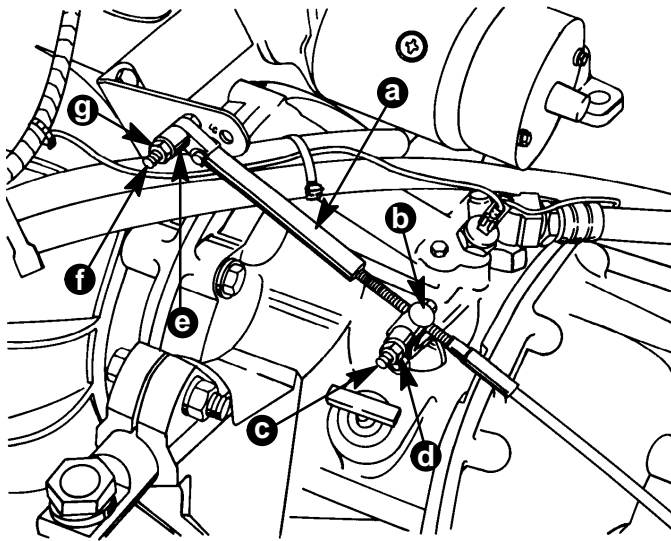
5. Center cable-end play, then adjust cable barrel to align holes in barrel, and in cable end guide, with attaching points on transmission.
6. Temporarily install shift cable. Do not secure at this time.

7. Place remote control shift lever in forward gear position and check position of transmission shift lever. Shift lever must be positioned as previously indicated.
8. Place remote control lever in reverse gear position and again check shift lever position. Lever must be positioned as previously indicated.
9. If transmission shift lever will position properly in one gear, but not in the other, recheck shift cable adjustment. If transmission shift lever will not position properly in both gears, move transmission shift lever stud (a), from top hole in shift lever, to bottom hole, and recheck for proper positioning. If proper positioning is still not obtained, remote control does not provide sufficient shift cable travel and must be replaced.
10. Reattach nut and washer to cable end guide stud. Tighten until snug, then back off one-half turn.
11. Reattach nut and washer to cable barrel stud. Tighten until they bottom out. Tighten securely, but do not overtighten.



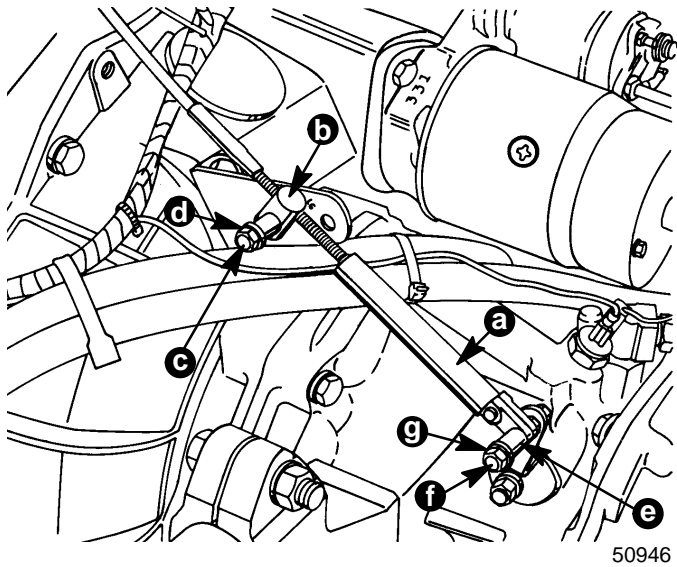
Rear Entry Dual Station Installation In-Line And V-Drive

- a - Cable End Guide
- b - Cable Barrel
- c - Cable Barrel Stud
- d - Elastic Stop Nut and Washer
- e - Spacer
- f - Cable End Guide Stud
- g - Elastic Stop Nut and Washer



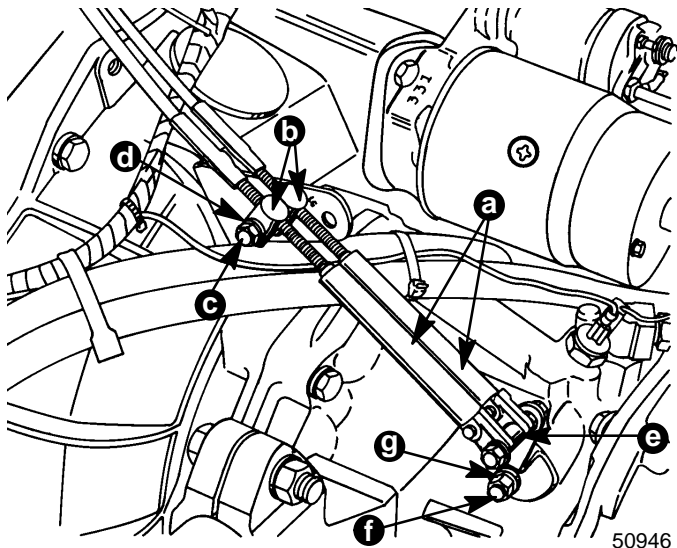
Rear Entry Single Station Installation In-Line And Remote V-Drive

- a - Cable End Guide
- b - Cable Barrel
- c - Cable Barrel Stud
- d - Elastic Stop Nut and Washer
- e - Spacer
- f - Cable End Guide Stud
- g - Elastic Stop Nut and Washer



50946

Front Entry Single Station Installation In-Line And V-Drive

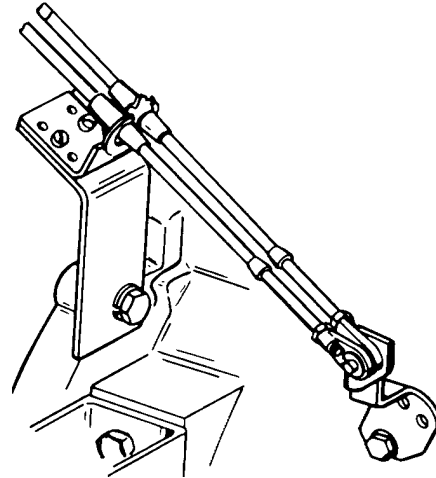


50946

Front Entry Dual Station Installation In-Line And V-Drive

- a - Cable End Guide
- b - Cable Barrel
- c - Cable Barrel Stud
- d - Elastic Stop Nut and Washer
- e - Spacer
- f - Cable End Guide Stud
- g - Elastic Stop Nut and Washer

NOTE: For models equipped with a dual station shift bracket such as the one shown, refer to shift cable manufacturer's instructions for adjusting the cable. Shift lever must be positioned as stated in the preceding steps.



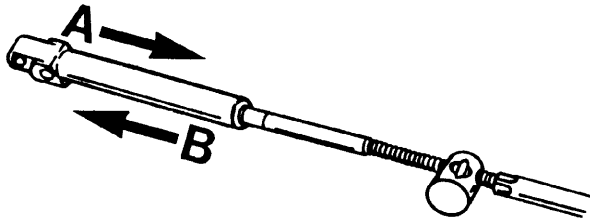
22457

Dual Station Shift Bracket (Not Quicksilver)

5000 SERIES (8° DOWN ANGLE AND V-DRIVE)

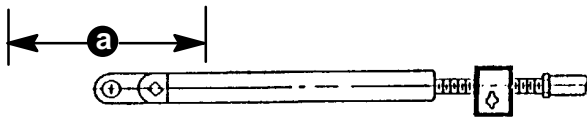
For Left-Hand Propeller Shaft Rotation: Shift cable hookup at remote control must result in shift cable end guide moving in direction "A" when remote control handle is placed in forward position.

For Right-Hand Propeller Shaft Rotation: Shift cable hookup at remote control must result in shift cable end guide moving in direction "B" when remote control handle is placed in forward position.



23242

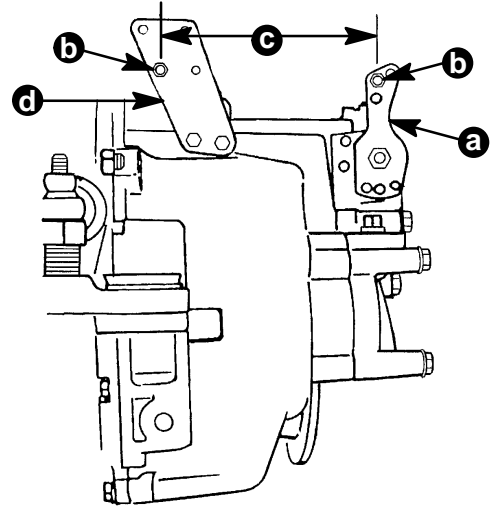
Remote control must provide a total shift cable travel (at transmission end) of at least 2-3/4 in. (70 mm). This is necessary to position transmission shift lever fully in the forward and reverse gear positions. Insufficient shift cable travel will cause transmission to slip and eventually fail.



72602

a - 2-3/4 In. (70 mm) Minimum

IMPORTANT: The distance between studs (Dimension "C") shown in the following illustration is set at 7-1/8 in. (318 mm).



73284

8° Down Angle Shown (V-Drive Similar)

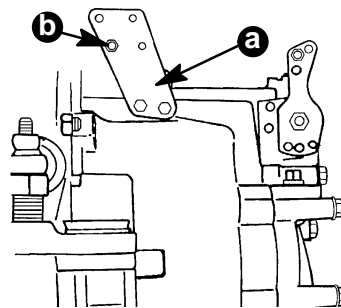
- a - Shift Lever
- b - Anchor Stud
- c - Dimension Between Studs - 7-1/8 In. (318 mm)
- d - Shift Cable Bracket

1. Connect and adjust Quicksilver shift cable(s) as outlined following:

WARNING

Avoid serious injury or property damage caused by improper shifting. Anchor stud for shift cable must be installed in the correct hole.

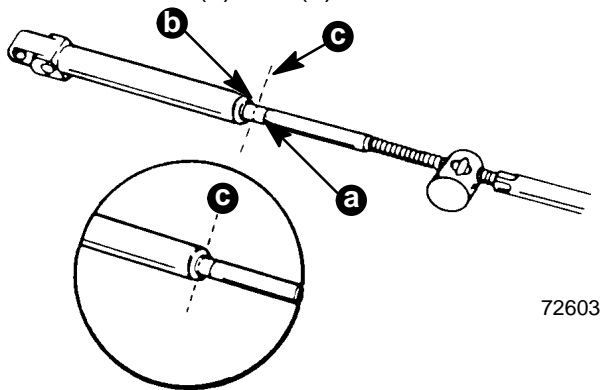
- a. Be certain anchor stud is installed in the front hole as shown in the illustration following.



73284

- a - Shift Cable Bracket
- b - Anchor Stud in Front Hole

- b. Place remote control shift lever and transmission shift lever in neutral position.
- c. Remove nuts and washers from shift cable attaching studs.
- d. Locate center of remote control and control shift cable play (backlash) as follows:
 - (1) Check that remote control is in neutral position.
 - (2) Push in on control cable end with enough pressure to remove play; mark position (a) on tube.
 - (3) Pull out on control cable end with enough effort to remove play; mark position (b) on tube.
 - (4) Measure distance between marks (a) and (b); mark position (c), half-way between marks (a) and (b).



72603

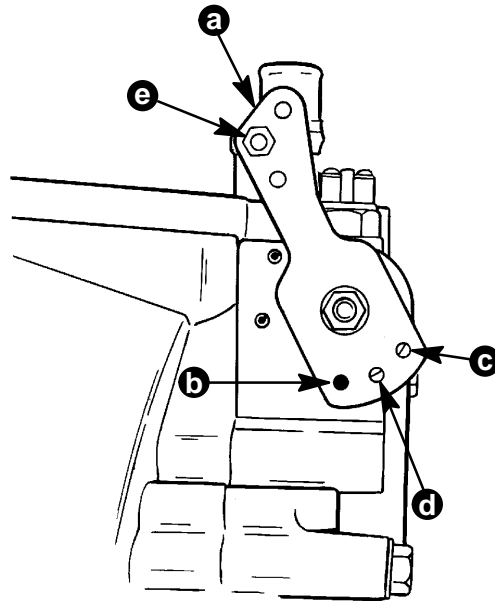
- e. Center cable-end play, then adjust cable barrel to align holes in barrel and in cable end guide, with attaching points on transmission.
- f. Temporarily install shift cable. Do not secure at this time.
- g. Place remote control shift lever in gear and check position of transmission shift lever. Shift lever must be positioned in the desired detent hole.

IMPORTANT: Transmission is “fully” in gear when shift lever comes to a stop, in either direction.

IMPORTANT: Velvet Drive Transmission Warranty is jeopardized if the shift lever poppet ball or spring is permanently removed, if the shift lever is repositioned or changed in any manner or if remote control and shift cable do not position shift lever exactly as shown.

⚠ CAUTION

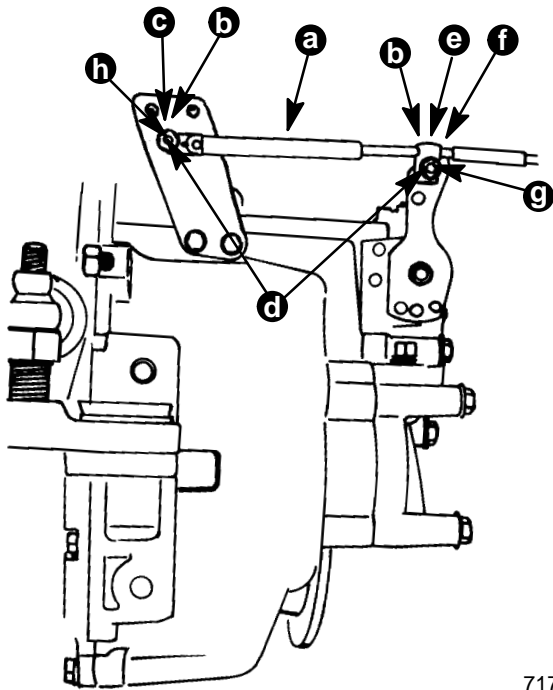
Remote control and shift cable must position transmission shift lever exactly as shown, or transmission failure may occur. Do not remove poppet ball or spring.



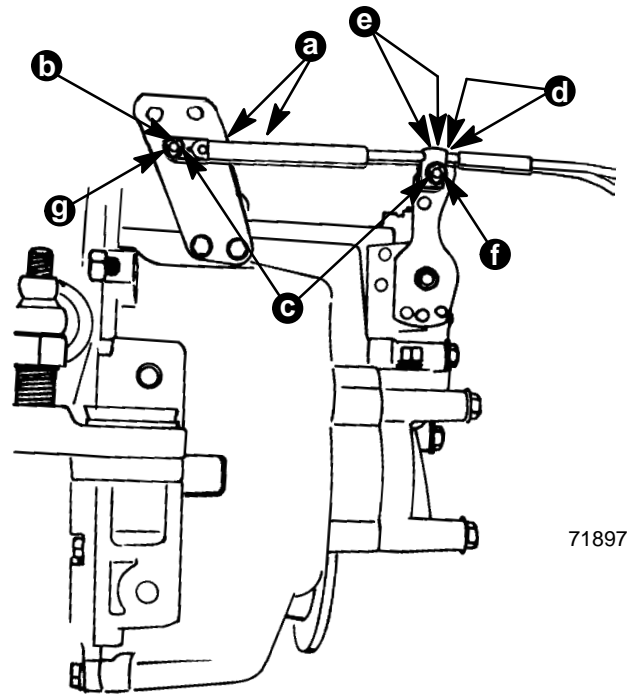
73248

Velvet Drive 5000 Series (8° Down Angle Shown, V-Drive Similar)

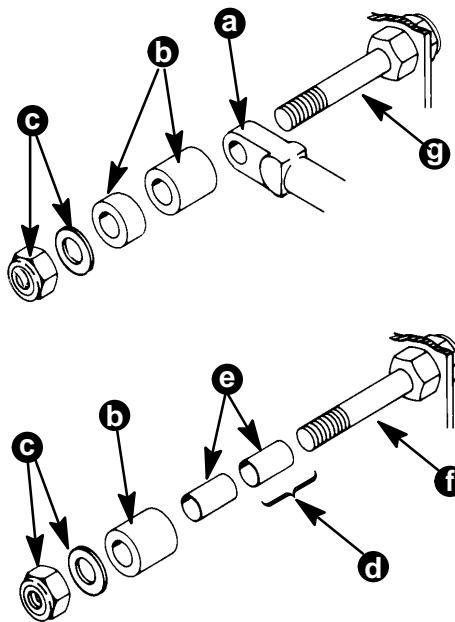
- a - Transmission Shift Lever
 - b - Poppet Ball Must Be Centered in This Detent Hole when Left-Hand Propeller Shaft Rotation Is Desired
 - c - Poppet Ball Must Be Centered in This Detent Hole when Right-Hand Propeller Shaft Rotation Is Desired
 - d - Poppet Ball Must Be Centered in This Detent Hole for Neutral Position
 - e - Install Shift Lever Stud in This Hole when Using Quicksilver Shift Cables
- h. Place remote control shift lever in opposite gear position and again check transmission shift lever position. Lever must be positioned in the desired detent hole.
 - i. If transmission shift lever will not position properly in one gear or both gears, recheck shift cable adjustment and travel as previously instructed in “a”-“h.” If proper positioning is still not obtained, remote control does not provide sufficient shift cable travel and must be repaired or replaced.
 - j. Install nut and washer to cable end guide stud. Tighten until snug, then back off one half turn.
 - k. Install nut and washer to cable barrel stud. Tighten until they bottom out. Tighten securely, but DO NOT OVER-TIGHTEN.



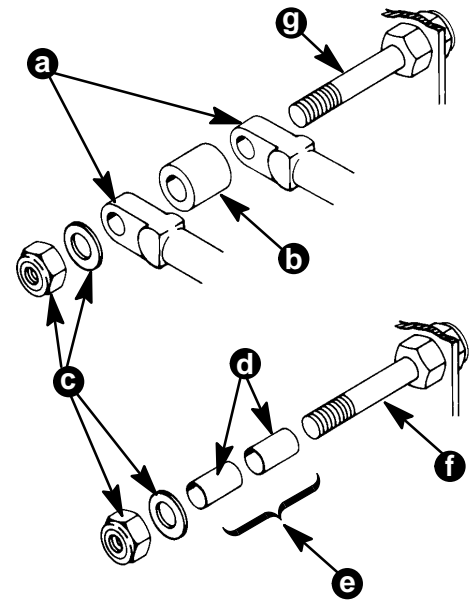
71780



71897



71972



50073

Typical Single Cable Installation - Rear Approach

- a - Cable End Guide
- b - Spacer (As Required)
- c - Elastic Stop Nut and Washer
- d - Bushing(s)
- e - Cable Barrel Stud
- f - Cable End Guide Stud

Typical Dual Cable Installation - Rear Approach

- a - Cable End Guide
- b - Spacer (As Required)
- c - Elastic Stop Nut and Washer
- d - Bushing(s)
- e - Cable Barrel (s) [Position(s) Only Indicated In Lower Drawing]
- f - Cable Barrel Stud
- g - Cable End Guide Stud

**THIS PAGE IS INTENTIONALLY BLANK TO
ALLOW FOR CORRECTIONS OR ADDITIONS
AT A LATER DATE**