

Transmission and Driveline

Section 2A - Transmission and Driveline

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A**

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General Information

Gear Ratio Selection

The transmission gear ratio and propeller must provide the optimum match between the engine and the boat application. Gear ratio and propeller selection are affected by numerous factors including engine horsepower, WOT RPM, hull design, propeller clearance, boat weight, and other factors. Several computer programs are available to assist in analyzing all of these variables and selecting the proper propeller and gear ratio. Typically, a higher reduction transmission coupled with a slower turning, larger diameter propeller provides the best efficiency for larger, heavier boats. Conversely, a lower reduction transmission and a smaller diameter, faster turning propeller will generally provide superior performance on lighter, faster applications (35 mph and above).

Engine and Propeller Shaft Installation Angle

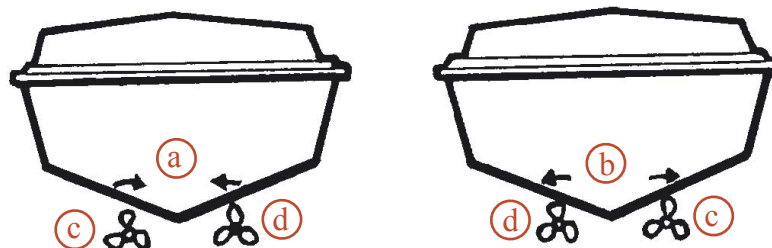
Mount the transmission and engine so that the angle relative to horizontal is within the range shown on the installation drawings. As a general rule, the propeller shaft angle should position a properly-sized propeller at least one propeller diameter below the waterline.

Installing the engine with the front end too high can cause aerate the transmission fluid and engine oil. Take special care on 5.7 MPI and 6.2 MPI V-drive applications with propeller shaft angles of less than 9° to avoid water reversion problems through the exhaust system. See **Exhaust System**. The exhaust elbow outlets will have less than their prescribed amount of downward slope with the exhaust elbows installed in their normal orientation. On these applications, reverse the exhaust elbows to get the proper slope. The engine can be obtained from the factory with this orientation.

***NOTE:** 5.7 MPI, 6.2 MPI, and 8.1 model have an increased slope in the exhaust elbow outlets and can accommodate any propeller shaft angle within the specified range in V-Drive applications, without the need to reverse the elbow.*

Propeller Shaft Rotation and Spacing on Dual Installations

For best performance, set up the boat so the propellers rotate outward when looking from the stern. As a general rule, insufficient spacing reduces efficiency and increases vibration. Shaft spacing must provide the minimum distances between engines as specified in the following table to allow for servicing.



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a - Inward propeller rotation
b - Outward propeller rotation

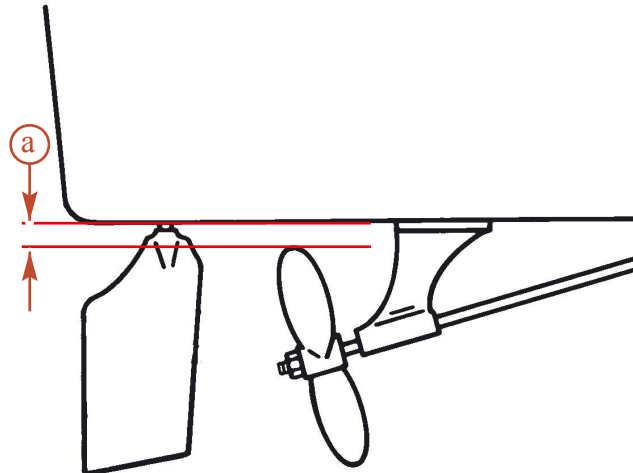
c - RH rotation
d - LH rotation

Minimum Distance Between Engine Centerlines	
Model	Measurement
All Except 8.1 H.O. and Horizon 8.1	838 mm (33 in.)
8.1 H.O. and Horizon 8.1	927 mm (37.5 in.)

Propeller Blade Tip Clearance

IMPORTANT: Sufficient clearance is required between the propeller blade tips and the boat bottom to prevent a water-hammering action against the hull.

Insufficient clearance can generate excessive noise, vibration, and cavitation. A clearance of 10–15% of the propeller diameter is typical for most boats.



14885

a - 10–15% of propeller diameter minimum

Propeller Shaft Coupling

Since the engine has flexible mounts, some provision must be provided in the propeller shaft and coupling to accommodate for slight engine movement. On recreational boats, this is typically provided by a flexible stuffing box and a single strut bearing. In these cases, a rigid propeller shaft coupling can be used. Purchase rigid propeller shaft couplings with the engine or through Mercury Precision Parts and Accessories. Alignment with these couplings is critical. See **Section 3 — Engine**.

To minimize vibration, provide a minimum distance of 20 times the propeller shaft diameter between the transmission output flange and the first fixed bearing. If this distance is not available, use a flexible coupling. Flexible couplings provide vibration isolation and are more tolerant to engine misalignment. They also reduce the need for periodic realignment of the engine.

If using an aftermarket coupling, the flange must conform with the specifications on the installation drawing. The transmission output flanges comply with:

- Velvet Drive 71C and ZF 45C—SAE J756 Type 410.
- All other transmissions—SAE J756 Type 5.

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 coupler and transmission output flange. Tighten all coupler bolts to specification.

Description	Nm	lb-in.	lb-ft
Coupler bolts	68	—	50

Propeller Shaft

The required propeller shaft diameter can vary significantly depending on the material used, strut and bearing design, engine horsepower, and shaft RPM. Information is available from the propeller shaft manufacturer and in marine handbooks for selecting the proper diameter. Sufficient shaft diameter is critical for durability and minimizing vibration. As a guideline, the propeller shaft should be a minimum of 1/14 the diameter of the propeller.

Propeller Shaft Log Seal Connections

NOTICE

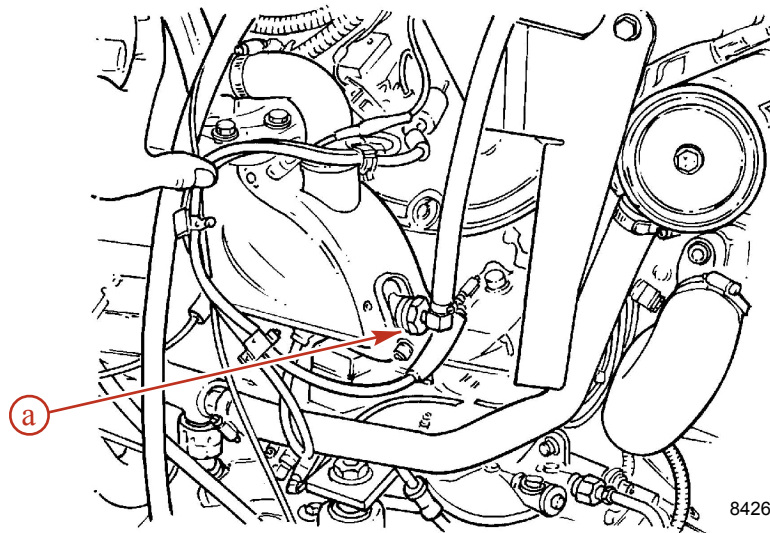
Incorrectly installing the water supply hose to the shaft log seal can cause increased exhaust system corrosion or submersion or freeze damage due to siphoning. Position and securely fasten the water supply hose with a portion of the hose above the engine exhaust elbows.

Route the propeller shaft log seal hose so that a portion of the hose extends above the top of the engine exhaust elbows to prevent a siphoning action when the engine is not running. Securely fasten the hose to maintain its proper position.

8.1 MODELS WITHOUT EMISSIONS CONTROL

1. Attach the shaft log seal cooling hose to the reducer fitting on the end of the starboard exhaust manifold.

IMPORTANT: Do not remove the reducer fitting, even if you are not using the shaft log seal. The reducer fitting has been carefully sized to maintain the proper pressure balance in the cooling system.



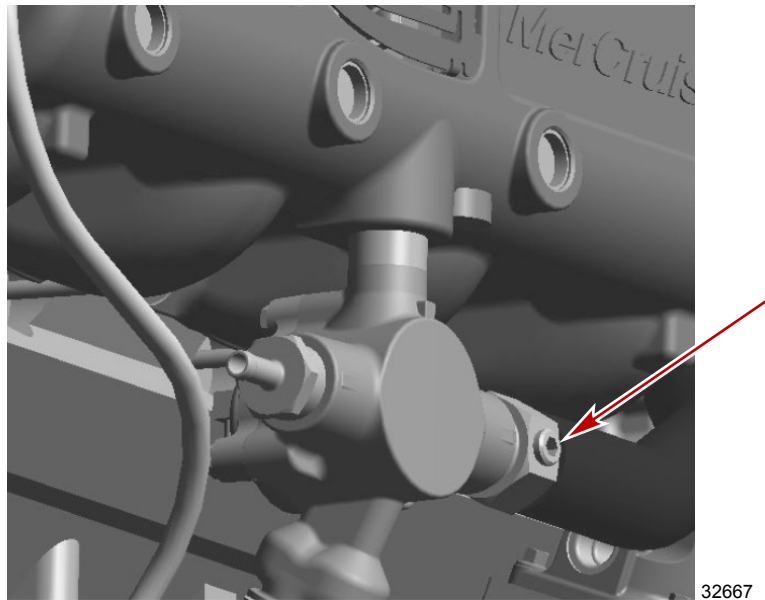
Propeller shaft log seal connection — 8.1 models without emissions control

a - Reducer fitting

8.1 MODELS WITH EMISSIONS CONTROL

1. Attach the shaft log seal cooling water hose to the access port in the reducer fitting, located on the poppet valve underneath the exhaust manifold. There is a reducer fitting on the port and starboard manifolds.

IMPORTANT: Do not remove the reducer fitting, even if you are not using the shaft log seal. The reducer fitting has been carefully sized to maintain the proper pressure balance in the cooling system.

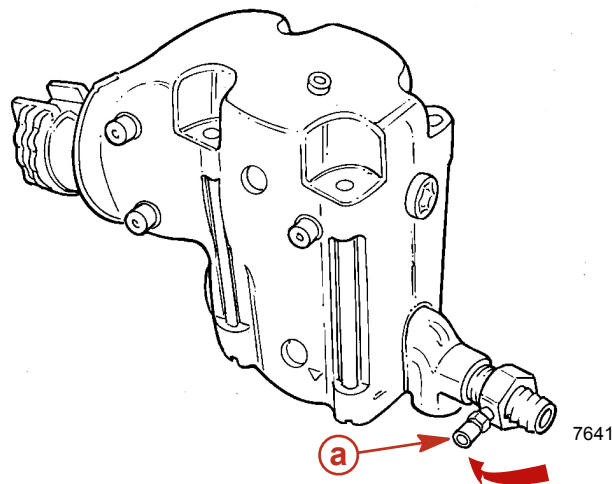


Shaft log seal access port — 8.1 models with emissions control

2. Route the shaft log seal hose so that a portion of the hose extends above the top of the engine exhaust elbows.
3. Fasten the hose securely to keep it properly positioned.

5.7 MPI AND 6.2 MPI MODELS WITHOUT EMISSIONS CONTROL

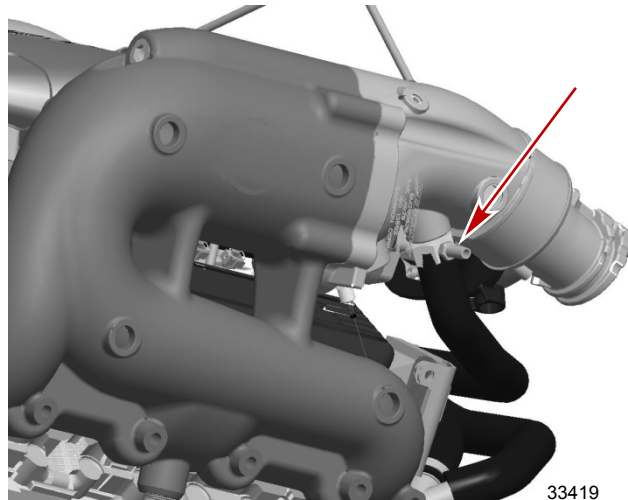
A fitting is installed at the factory into the proper port on the port exhaust elbow.



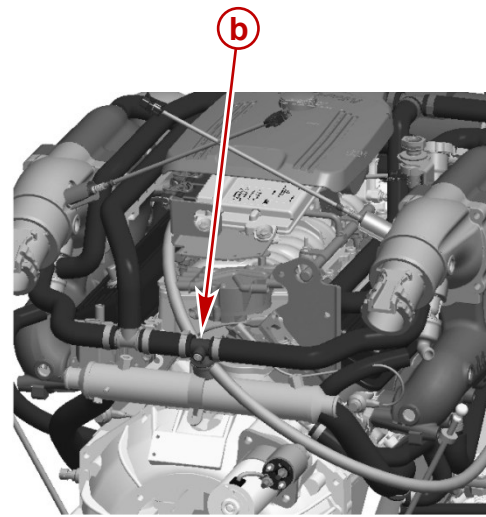
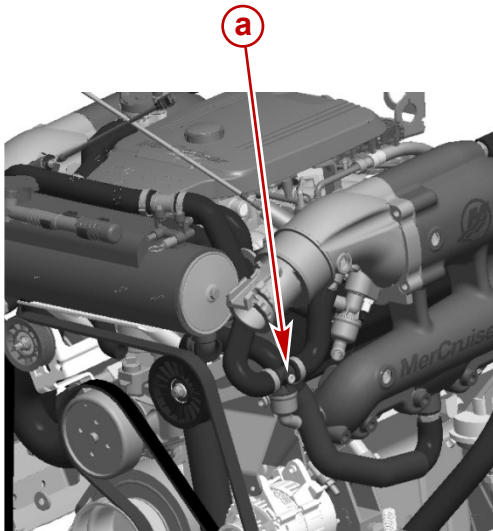
Propeller shaft log seal connection — 5.7L and 6.2L models without emissions control

a - Shaft log seal fitting

5.7 MPI WITH EMISSIONS CONTROL



Engines with seawater cooling



35179

Engines with closed cooling

a - V-drive location

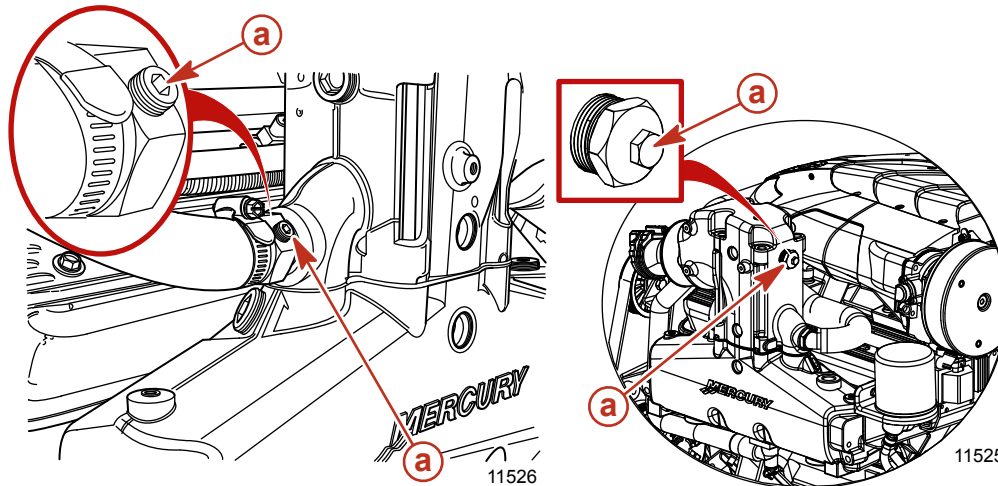
b - Inline location

IMPORTANT: If not using a shaft log seal, this fitting must remain plugged.

1. Remove the plug from the exhaust port elbow.
2. Install the reducer fitting, shipped with the parts bag, to the applicable location.
3. Attach the shaft log seal cooling water hose to the reducer fitting.
4. Route the propeller shaft log seal hose so that a portion of the hose extends above the top of the engine exhaust elbows.
5. Fasten the hose securely to keep it properly positioned.

SCORPION MODELS WITHOUT EMISSIONS CONTROL

A brass plug is installed at the factory into the proper port on the port exhaust elbow.



In-line models

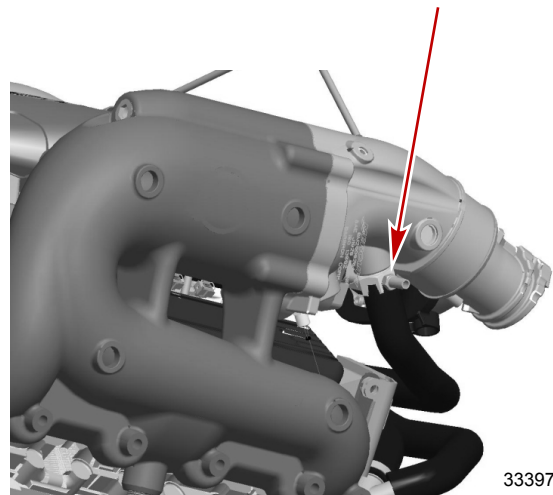
V-Drive models

a - Brass plug

IMPORTANT: If not using a shaft log seal, this fitting must remain plugged.

SCORPION 350 WITH EMISSIONS CONTROL

A fitting is installed at the factory into the proper port on the port exhaust elbow.



Shaft log seal fitting

IMPORTANT: If not using a shaft log seal, this fitting must remain plugged.

1. Attach the shaft log seal cooling water hose to the reducer fitting.
2. Route the propeller shaft log seal hose so that a portion of the hose extends above the top of the engine exhaust elbows.
3. Fasten the hose securely to keep it properly positioned.

Transmissions

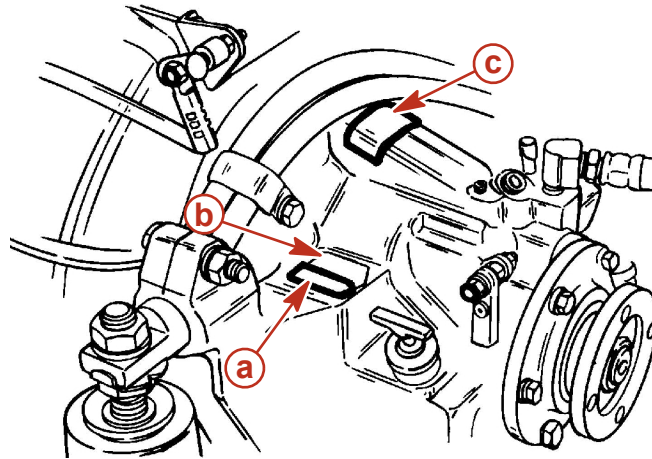
Gear Ratios

	Velvet Drive Gear Ratios				Walter V-Drive Gear Ratios		ZF Marine Gear Ratios			
	71C	72C	5000A	5000V	45C	71C	45C	63A	63IV	80A
Tow Sports										
Tow Sports 5.7 TKS	1.0:1						1.0:1			
Tow Sports 5.7 MPI	1.0:1						1.0:1			
Scorpion 350 Scorpion 377	1.0:1				1.46:1	1.46:1	1.0:1			
Inboard										
5.7 TKS Inboard 5.7 MPI Horizon 5.7	1.0:1	1.0:1	1.25:1 1.5:1 2.0:1 2.5:1 2.8:1	1.5:1 2.0:1 2.5:1				1.5:1 2.0:1 2.5:1 2.7:1	1.5:1 2.0:1 2.5:1	
6.2 MPI Horizon 6.2		1.0:1	1.25:1 1.5:1 2.0:1 2.5:1 2.8:1	1.5:1 2.0:1 2.5:1				1.5:1 2.0:1 2.5:1 2.7:1	1.5:1 2.0:1 2.5:1	
8.1 H.O. Horizon 8.1		1.0:1	1.25:1 1.5:1 2.0:1 2.5:1 2.8:1	1.5:1 2.0:1 2.5:1				1.5:1 2.0:1 2.5:1 2.7:1	1.5:1 2.0:1 2.5:1	2.8:1
IMPORTANT: 8.1 H.O., and Horizon 8.1 Models using Velvet Drive 72C 1.0:1R—V-Drive installation only, used with level mounted engine coupled to a drive shaft with forward-facing exhaust elbows.										

Model Offerings and Identification

VELVET DRIVE 71C AND 72C TRANSMISSIONS

On all Velvet Drive In-Line 71C and 72C series transmissions, the gear ratio in FORWARD gear is marked on the identification plate. Transmission output flange rotation in FORWARD gear is indicated on a decal on the transmission case. Transmission rotation is described when viewed from the rear of transmission.



Velvet Drive 71C and 72C transmissions

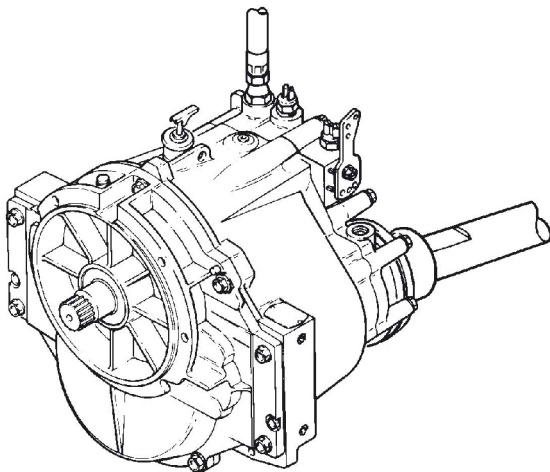
a - Identification plate

b - Gear ratio (in FORWARD gear)

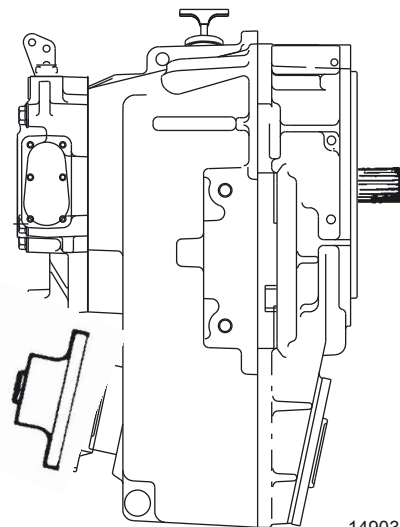
c - Output flange rotation decal (in FORWARD gear)

VELVET DRIVE 5000 SERIES TRANSMISSIONS

On the Velvet Drive 5000A and 5000V transmissions, the identification plate indicates gear ratio, serial number, and model.

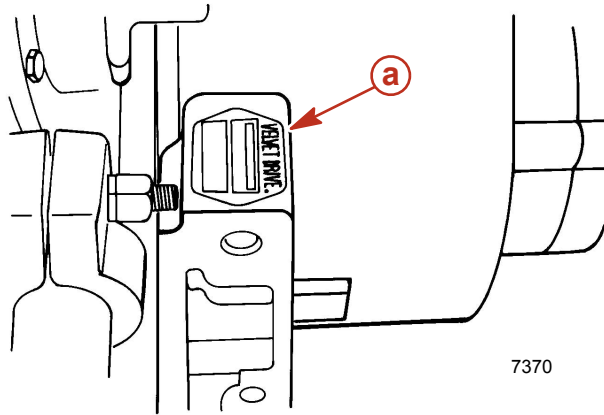


5000A 8° down angle



5000V 12° V-drive

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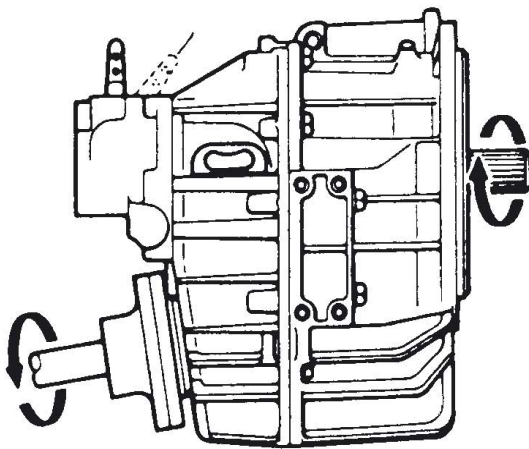


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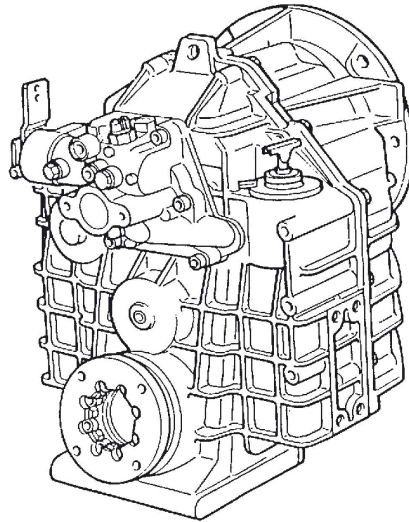
a - Identification plate

ZF MARINE 630 AND 800 SERIES TRANSMISSIONS

On the ZF Marine Down-Angle and V-Drive transmissions, the identification plate indicates gear ratio, serial number, and model.

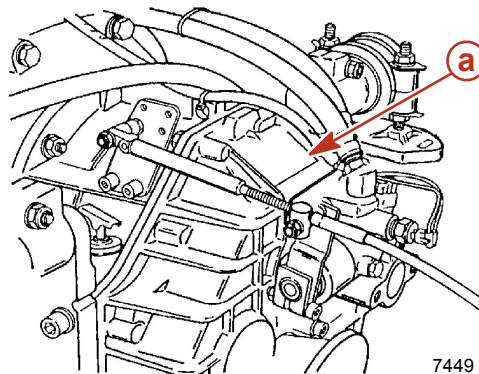


8° down angle



14911

12° V-drive

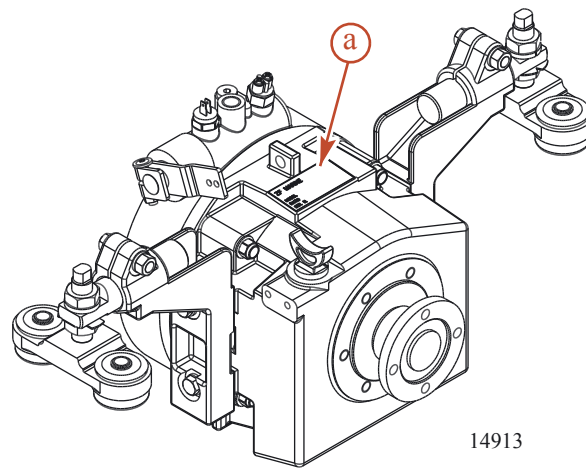


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a - Identification plate

ZF MARINE/HURTH 45C

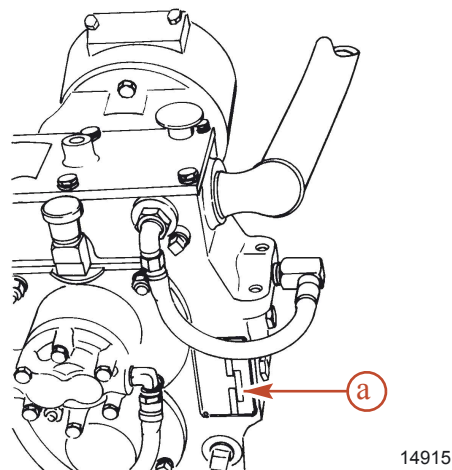
The transmission identification plate is located on the top rear of the transmission.

**ZF Marine/Hurth 45C**

a - Identification plate

WALTER V-DRIVE TRANSMISSIONS

On the Walter V-Drive transmissions, the identification plate indicates gear ratio, serial number, and model.

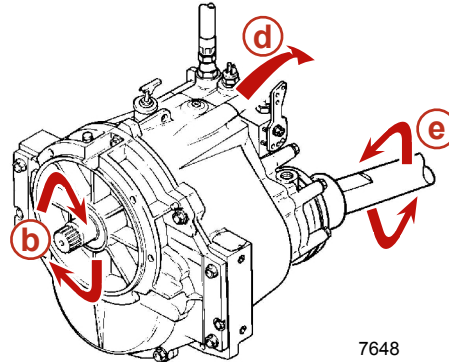
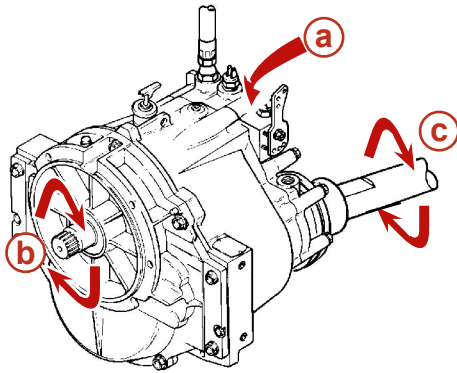
**Walter RV-36 V-Drive**

a - Identification plate

Propeller Rotation

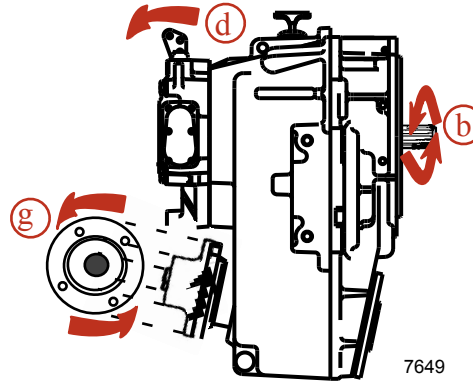
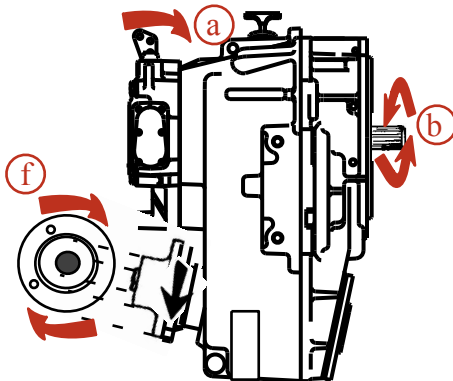
ZF MARINE 630 AND 800 AND VELVET DRIVE 5000 SERIES TRANSMISSION

The ZF Marine 630, ZF Marine, and Velvet Drive 5000 Series transmissions are full power reversing transmissions, allowing a standard LH rotation engine (viewed from flywheel end) to be used for both propeller rotations. Propeller rotation (output flange rotation) is determined by shift cable attachment at the remote control.



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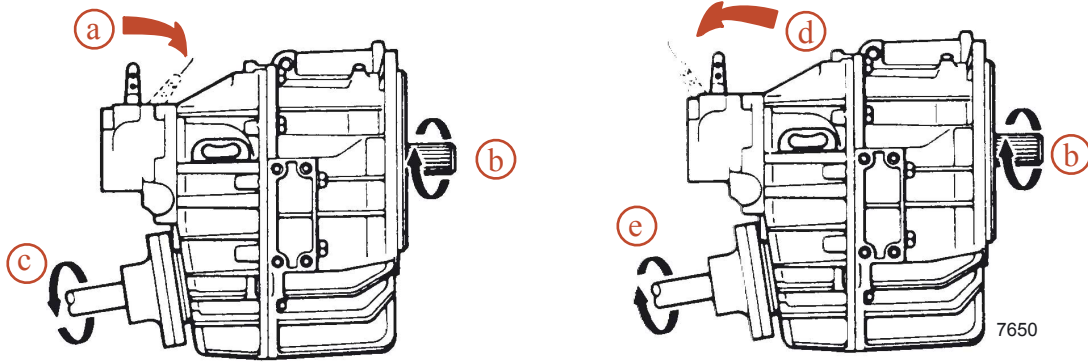
Velvet Drive 5000A — 8° down-angle



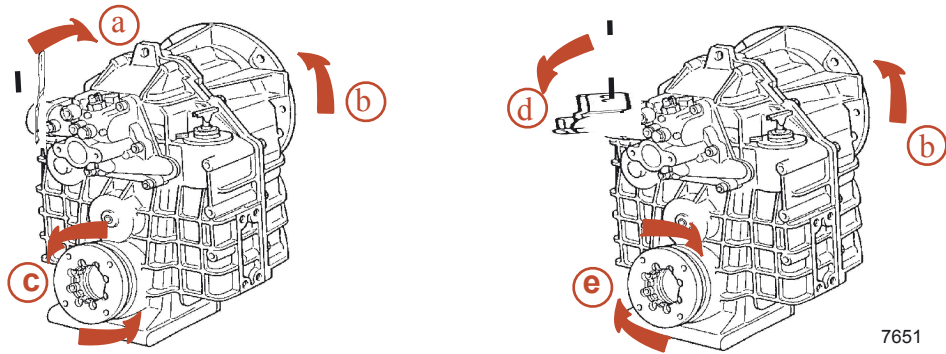
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Velvet Drive 5000V — V-Drive

- a** - Direction of shift lever engagement (toward flywheel)
- b** - Transmission input shaft rotation direction (LH)
- c** - Transmission output shaft rotation direction (LH as viewed at propeller)
- d** - Direction of shift lever engagement (away from flywheel)
- e** - Transmission output shaft rotation direction (RH as viewed at propeller)
- f** - Transmission output shaft rotation direction (LH as viewed at propeller)
- g** - Transmission output shaft rotation direction (RH as viewed at the propeller)



ZF Marine 630A and 800 — down-angle transmissions



ZF Marine 630V — V-drive transmissions

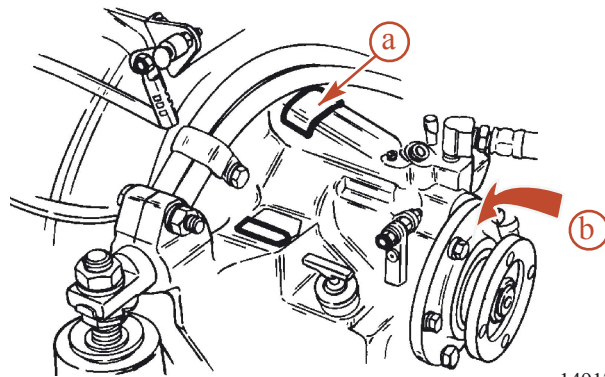
- | | |
|---|---|
| a - Direction of shift lever engagement (toward flywheel) | d - Direction of shift lever engagement (away from flywheel) |
| b - Transmission input shaft rotation direction (LH) | e - Transmission output shaft rotation direction (LH as viewed at propeller) |
| c - Transmission output shaft rotation direction (RH as viewed at propeller) | |

VELVET DRIVE 71C AND 72C TRANSMISSIONS

NOTICE

An incorrect propeller can damage the transmission. Ensure that the rotation of the propeller matches that listed on the output flange rotation decal. Always install the correct rotation propeller and drive the boat forward using forward gear.

The 1:1 gear ratio version of this transmission has a LH output flange rotation when in forward gear. This is the same as the engine rotation and is referenced from the rear of the engine. A LH rotation propeller must be used on these applications (except a Walter V-drive application where the rotation is established by the gear box). The transmission can only be operated under full power when in the forward gear position.



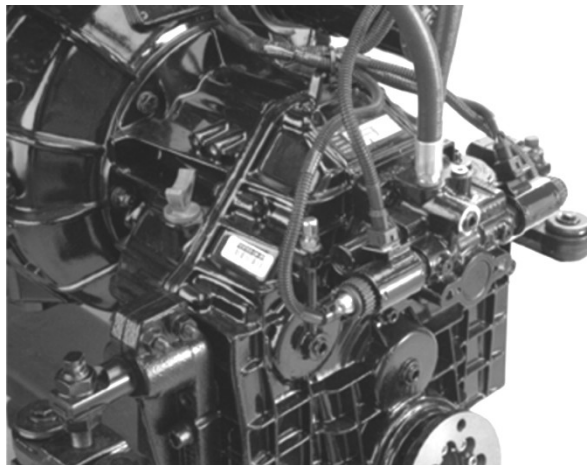
Velvet Drive 71C and 72C transmission

- a** - Output flange rotation decal
- b** - Direction of rotation in forward gear

ZF Marine Transmissions—DTS

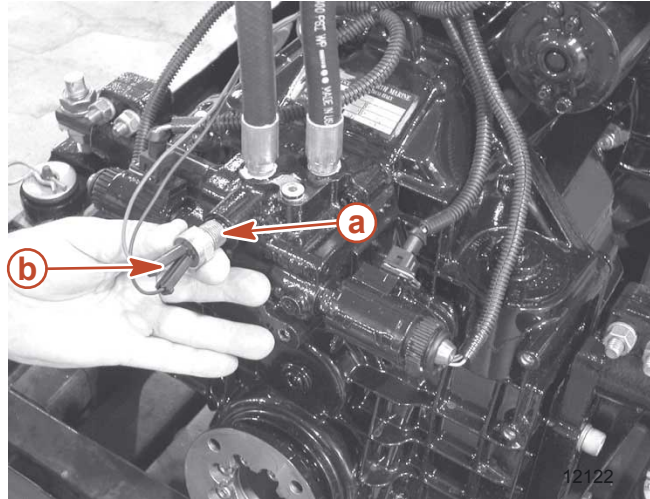
Products without Emissions Control

The oil temperature sensor for the ZF Marine transmissions with electronic shift is not installed at the factory. An allen plug is installed in the port for shipping. The oil temperature sensor is provided in a parts bag.



ZF Marine transmission—DTS (oil temperature sensor not installed)

Remove the allen plug and install the oil temperature sensor. Connect the wire connections, of the harness, to the oil temperature sensor.

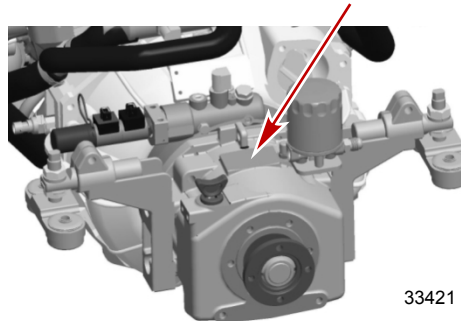


ZF Marine transmission—DTS (oil temperature sensor installed)

- a** - Oil temperature sensor
- b** - Oil temperature sensor wire connections

Products with Emissions Control

On the ZF Marine Transmissions, the transmission identification plate indicates gear ratio, serial number, and model. Transmission output shaft rotation and propeller rotation required (in forward gear) are indicated on a decal on the transmission case. Transmission rotation is described when viewed from the rear of transmission.



Transmission identification plate

Remote Control and Shift Cable

See **Section 9 — Instrumentation and Controls**

Notes: