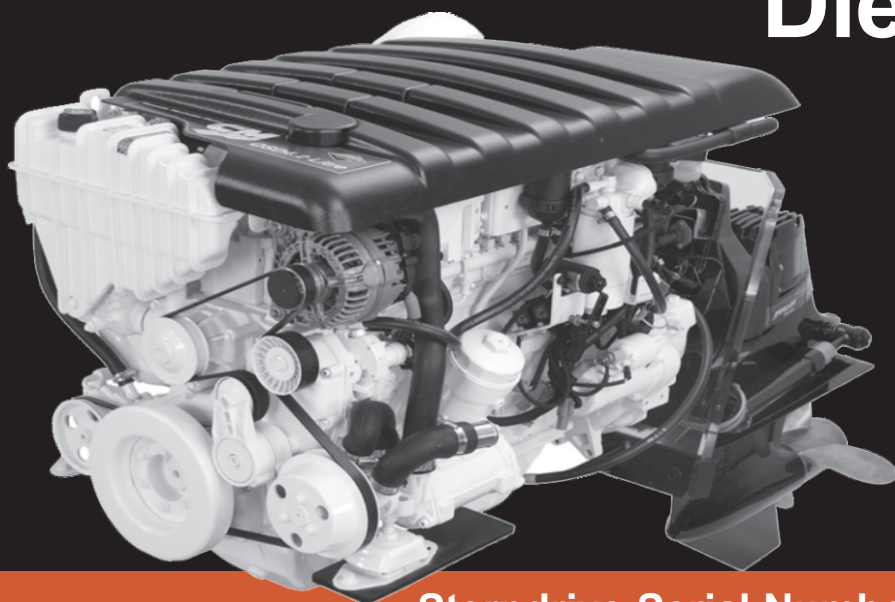




# Service Manual #47

## QSD 2.8 and 4.2 Liter Diesel Engines



**Sterndrive Serial Numbers:** 88300400 and Above (2.8L)  
88401000 and Above (4.2L)

**Inboard Serial Numbers:** 88300000 and Above (2.8L)  
88400000 and Above (4.2L)

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## Models Covered


### Sterndrive

Models Covered	Serial Number
QSD 2.8 Sterndrive 170 HP	88300400 - 88304999
QSD 2.8 Sterndrive 200 HP	88305400 - 88309999
QSD 2.8 Sterndrive 230 HP	88310400 - 88314999
QSD 4.2 Sterndrive 270 HP	88401000 - 88404999
QSD 4.2 Sterndrive 320 HP	88406000 - 88415999
QSD 4.2 Sterndrive 350 HP	88417000 - 88419999

### Inboard

Models Covered	Serial Number
QSD 2.8 Inboard 170 HP	88300000 - 88300399
QSD 2.8 Inboard 200 HP	88305000 - 88305399
QSD 2.8 Inboard 230 HP	88310000 - 88310399
QSD 4.2 Inboard 270 HP	88400000 - 88400999
QSD 4.2 Inboard 320 HP	88405000 - 88405999
QSD 4.2 Inboard 350 HP	88416000 - 88416999

## Notice To Users Of This Manual

Throughout this publication, dangers, warnings, cautions, and notices, (accompanied by the International HAZARD Symbol ) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. These safety alerts follow ANSI standard Z535.6-2006 for product safety information in product manuals, instructions, and other collateral materials. **OBSERVE THEM CAREFULLY!**

These safety alerts alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus common sense operation, are major accident prevention measures.

### DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

### WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

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## NOTICE

Indicates a situation which, if not avoided, could result in engine or major component failure.

**IMPORTANT:** Identifies information essential to the successful completion of the task.

*NOTE:* Indicates information that helps in the understanding of a particular step or action.

This manual has been written and published by the Service Department of Cummins MerCruiser Diesel to aid our dealers' mechanics and company service personnel when servicing the products described herein. We reserve the right to make changes to this manual without prior notification.

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It is assumed that these personnel are familiar with marine product servicing procedures. Furthermore, it is assumed that they have been trained in the recommended service procedures of Cummins MerCruiser Diesel Power Products, including the use of mechanics' common hand tools and the special Cummins MerCruiser Diesel or recommended tools from other suppliers.

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

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

Refer to dealer service bulletins, operation maintenance and warranty manuals and installation manuals for other pertinent information concerning the products described in this manual.

## Work Precautions

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

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

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

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Personnel should not work on or under an engine that is suspended. Engines should be attached to work stands, or lowered to ground as soon as possible.

## Replacement Parts

Use of parts other than the recommended service replacement parts, will void the warranty on those parts that are damaged as a result.

### WARNING

**Avoid fire or explosion hazard. Electrical, ignition, and fuel system components on Mercury Marine products comply with federal and international standards to minimize risk of fire or explosion. Do not use replacement electrical or fuel system components that do not comply with these standards. When servicing the electrical and fuel systems, properly install and tighten all components.**

## Cleanliness And Care Of Product

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

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



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- 1 - Important Information**
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- 9 - Power-Assisted Steering System**
  - A - Power-Assisted Steering Pump and Related Components

Important Information

1

Removal And Installation

2

Engine Mechanical

3

Electrical System

4

Fuel System

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Cooling System

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Intake and Exhaust System

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Drive System

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# Important Information

## Section 1A - General Information

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A**

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## Introduction

This comprehensive overhaul and repair manual is designed as a service guide for the MerCruiser and Cummins MerCruiser Diesel models listed earlier. It provides specific information, including procedures for disassembly, inspection, assembly and adjustment, to enable dealers and service mechanics to repair these products. Before attempting repairs, read through the procedures to understand the methods and tools used and the cautions and warnings required for safety.

## How To Use This Manual

This manual is divided into sections, which represent major components and systems.

Some sections are further divided into parts that more fully describe the component.

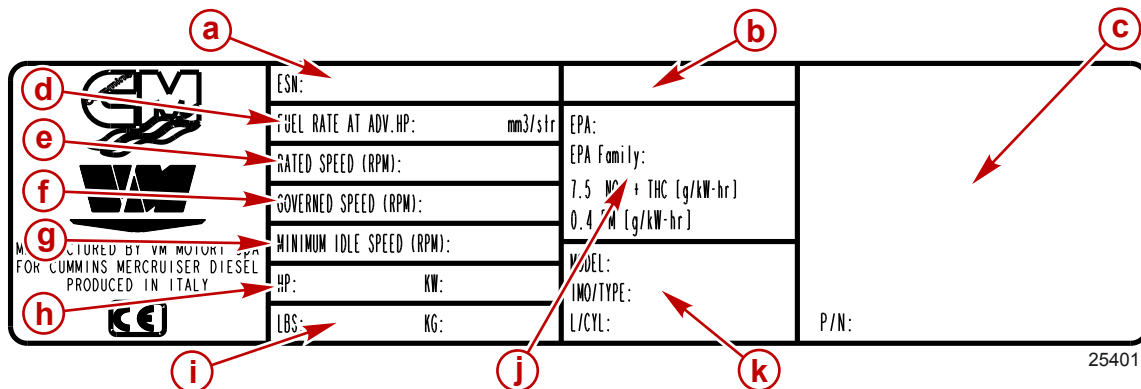
Refer to the **Service Manual Outline** following **Models Covered** in this manual for section titles.

## Engine Serial Number and Decal Locations

### Engine Dataplate

A tamper-resistant engine data plate is affixed to the engine at the time of manufacture by Cummins MerCruiser Diesel. It contains important exhaust gas emissions information. Please note that the engine data plate will not affect the fit, function, or performance of the engine and neither boatbuilders nor dealers may remove the engine data plate or the engine component it is affixed to before sale. If modifications are necessary or the engine data plate is damaged contact Cummins MerCruiser Diesel about the availability of a replacement.

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

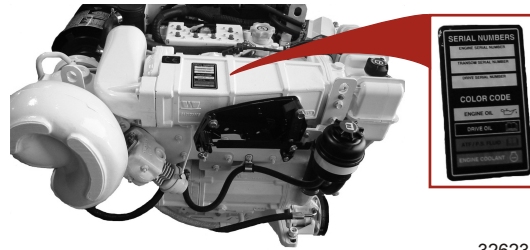


Typical engine dataplate

- a** - Engine serial number
- b** - Cummins MerCruiser Diesel model information
- c** - Emissions certification information
- d** - Fuel rate
- e** - Rated operation engine speed
- f** - Governed engine speed
- g** - Minimum idle speed
- h** - Engine power rating
- i** - Engine weight
- j** - Emissions data
- k** - Manufacturer model number, IMO type, liters per cylinder

## Serial Number Decal

The serial number decal is located on top of the engine on the aft end of the intercooler.



32623

Serial number and maintenance color code decal

## Operation—Duty Cycle

### Duty Cycle Rating

**IMPORTANT:** Damage caused by improper application or failure to operate the power package within the specified operating parameters will not be covered by the Cummins MerCruiser Diesel Limited Warranty.

The boat manufacturer or the installing dealer is responsible for ensuring that the power package is applied in accordance with recommendations indicated in the appropriate Cummins MerCruiser Diesel applications manual. In all cases, the power package must be equipped with a gear ratio and propeller that allows the engine to operate at wide open throttle (WOT) at the rated engine RPM. The power package must also be applied. Use of Cummins MerCruiser Diesel engines in applications other than those indicated by the following information or the appropriate application manual is not approved.

### High Output Rating

**High Output Rating** applies to variable load applications where full power is limited to one (1) hour out of every eight (8) hours of operation. Reduced load operation occurs when engine RPM is at least 200 RPM below the engine's maximum rated RPM for applications rated at or below 3000 RPM and at least 400 RPM below the engine's maximum rated RPM for applications rated above 3000 RPM. This rating is for pleasure (non-revenue generating) applications that operate 500 hours or less per year.

## Engine Break-In

### 20-Hour Break-In Period

**IMPORTANT:** The first 20 hours of operation are a break-in period for the engine. Correct break-in is essential to obtain minimum oil consumption and maximum engine performance. During this break-in period, observe the following rules:

- Do not operate below 1500 RPM for extended periods of time during the first 10 hours. Advance the throttle above 1500 RPM as soon as conditions permit safe operation.
- Do not consistently operate at one speed for extended periods.
- Do not exceed 3/4 throttle during the first 10 hours, during the next 10 hours do not operate at full throttle for more than five minutes at a time.
- Do not accelerate at full-throttle from idle speed.
- Do not operate at full throttle until the engine reaches normal operating temperature.
- High oil consumption is normal during the break-in period. Frequently check the engine oil level.

## After the 20-Hour Break-In Period

To help extend the life of your power package, Cummins MerCruiser Diesel recommends:

- Changing the engine oil and filter, and the transmission fluid on inboard models, at the interval indicated in the **Maintenance Schedule**.
- Using a propeller that allows the engine to operate at the rated engine RPM when at full throttle with a maximum boat load.
- Operating at 3/4 throttle or lower. See the duty cycle information listed in **Section 1A: Operation—Duty Cycle**.

# Important Information

## Section 1B - Maintenance

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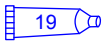

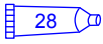


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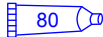

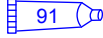

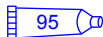



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## Engine Specifications

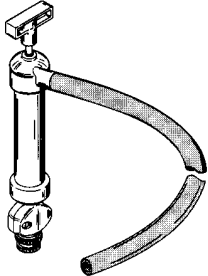


Description	Specifications	
	QSD 2.8	QSD 4.2
Rated engine RPM ( <b>Conditions Affecting Operation —Propeller Selection</b> for additional information)	For complete, specific engine performance data refer to the Cummins MerCruiser Diesel Performance Curves & Datasheets at <a href="http://www.cmdmarine.com">www.cmdmarine.com</a>	
Engine type	In-line 4-cylinder diesel	In-line 6-cylinder diesel
Displacement	2.8 liter (169 cid)	4.2 liter (256 cid)
Firing order	1-3-4-2	1-5-3-6-2-4
Bore	94 mm (3.700 in.)	
Stroke	100 mm (3.937 in.)	
Compression ratio	17:1	
Valve clearance	Hydraulic	
Maximum pressure difference between cylinders	500 kPa (72 PSI)	
Idle RPM in neutral (engine at normal operating temperature)	700	600
Oil pressure at idle	2.4 bar [240 kPa] (35 PSI)	2.1 bar [210 kPa] (30 PSI)
Oil pressure at 3800 RPM	6.2 bar [620 kPa] (87 PSI)	6.6 bar [660 kPa] (93 PSI)
Oil temperature	100-110° C (212-230° F)	
Thermostat (water)	83° C (181° F)	89° C (192° F)
Thermostat (oil)	95° C (203° F)	87° C (187° F)
Coolant temperature	80–85° C (176–185° F)	
Electrical system	12-volt negative (-) ground	
Alternator rating	1540 W, 14 V, 110 A	
Recommended battery rating	750 CCA, 950 MCA, or 180 Ahm	
Starter	12 V, 2.4 kW	



## Lubricant, Sealant, Adhesives

Tube Ref No.	Description	Where Used	Part No.
	Fleetguard Compleat with DCA4, Fleetguard Part Number CC2825	Closed cooling system	Obtain Locally
	Perfect Seal	Drain plug or fitting threads	92-34227 1
	Liquid Neoprene	All electrical connections	92- 25711 3
	Dexron III Automatic Transmission Fluid	Power-assisted steering system	Obtain Locally
	Special Lubricant 101	Steering cable grease fitting	92-802865Q02
		Steering cable	
		Propeller shaft	
		Propeller shaft splines	
	U-joint and Gimbal Bearing Grease	Gimbal bearing grease insert	92-802870A1
		Transom end grease fitting, engine end grease fitting, driveshaft grease fittings	

Tube Ref No.	Description	Where Used	Part No.
 80	SAE Engine Oil 30W	Transmission filter element O-ring	Obtain Locally
		Water-separating fuel filter sealing ring	
		Throttle cable pivot points and guide contact surfaces	
		Shift cable pivot points and guide contact surfaces	
 87	High Performance Gear Lube	Gear lube monitor	92-858064K01
 91	Engine Coupler Spline Grease	U-joint shaft splines and O-rings	92-802869A1
		Engine coupler and shaft splines	
 94	Anti-Corrosion Grease	Propeller shaft	92-802867Q 1
		Propeller shaft splines	
 95	2-4-C Marine Lubricant with Teflon	Propeller shaft	92-802859A1
		Propeller shaft splines	
 114	Power Trim and Steering Fluid	Power trim pump	92-858074K01
		Power-assisted steering pump	
 121	15W40 4-cycle Diesel Engine Oil	Oil filter O-rings	92-858042K01
 123	Marine Engine Coolant (Only available in Europe)	Closed cooling system	92-813054A2

### Special Tools

Crankcase oil pump  11591	91-90265A 5  Aids in the removal of engine oil without draining the crankcase.
Dual Water Pick-up Flush Gearcase Seal Kit  9194	91-881150K 1  Blocks off the front water inlet holes on the dual water inlet gearcases.
Side Water Pickup Flushing Device  9192	91-44357Q 2  Attaches to the water intakes; provides a fresh water connection when flushing the cooling system or operating the engine.

Reference Electrode	91-76675T 1
 <p>9188</p>	Senses and electrical current in the water when testing the MerCathode system. Use to check hull potential.
Propeller Nut Tool	91-805457T 1
 <p>10677</p>	Aids in the removal and installation of the front propeller nut.

## Tools

Description	Part Number
Water Supply Hose Adapter (to Water Inlet Fitting)	Obtain locally
Typical hand-operated grease gun	

## Approved Paints

The following approved paints are acceptable for refinishing and touch-up.

Description	Part Number
Marine Cloud White (CMD part number: 40918660)	Obtain locally
Mercury Light Gray Primer	92-80287852
Mercury Phantom Black	92-802878Q1

## Capacities

*NOTE: All capacities are approximate fluid measures.*

### Engine

**IMPORTANT: You may need to adjust oil levels depending on the installation angle and cooling systems (heat exchanger and fluid lines).**

Always use the dipstick to determine the exact quantity of oil or fluid required.

### QSD 2.8

All models	Capacity Liters (U.S. qts)	Fluid Type	Part Number
Engine oil (with filter)	8.9 (9.4)	15W40 4-cycle Diesel Engine Oil	92-858042K01
Closed cooling system	11 (11.6)	Marine Engine Coolant (Only available in Europe)	92-813054A2
		Fleetguard Compleat with DCA4 Fleetguard Part Number: CC2825 Container size:3-3/4 liters, 1 U.S. gallon	Obtain locally



## QSD 4.2

All models	Capacity Liters (U.S. qts)	Fluid Type	Part Number
Engine oil (with filter)	13.8 (14.6)	15W40 4-cycle Diesel Engine Oil	92-858042K01
Closed cooling system	17.25 (18.2)	Marine Engine Coolant (Only available in Europe)	92-813054A2
		Fleetguard Compleat with DCA4 Fleetguard part number: CC2825 Container size:3-3/4 liters, 1 U.S. gallon	Obtain locally

## Sterndrive

**NOTE:** Oil capacity includes gear lube monitor.

## BRAVO SERIAL NUMBERS BELOW 0W240000

Models	Capacity	Fluid Type
Bravo One	2602 ml (88 fl. oz.)	High Performance Gear Lubricant
Bravo Two	3076 ml (104 fl. oz.)	
Bravo Three	2839 ml (96 fl. oz.)	

## BRAVO SERIAL NUMBERS ABOVE 0W240000

Models	Capacity	Fluid Type
Bravo One	2736 ml (92½ fl. oz.)	High Performance Gear Lubricant
Bravo Two	3209 ml (108½ fl. oz.)	
Bravo Three	2972 ml (100½ fl. oz.)	

## Transmission

**IMPORTANT:** It may be necessary to adjust oil levels depending on installation angle and cooling systems (heat exchanger and fluid lines).

**NOTE:** Always use the dipstick to determine the exact quantity of oil or fluid required.

Manufacturer	Model	Capacity	Fluid Type
ZF Marine (Hurth)	63A	4.5 liters (4 ¾ U.S. qts.)	Dexron III Automatic Transmission Fluid
	63IV	4.9 liters (5 ¼ U.S. qts.)	
Technodrive TwinDisc	485-A	2.6 liters (2 ½ U.S. qts.)	SAE 20W-40 or SAE 15W-40 engine oil

## Maintenance Intervals

**NOTE:** Refer to appropriate Mercury MerCruiser Sterndrive Service Manual for information and procedures on Sterndrive Maintenance.

**⚠ 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.

Maintenance intervals and the corresponding tasks, as shown in this schedule or found in a previous schedule, are based on an average boating application and environment. However, factors such as individual operating habits and personal maintenance preferences can impact the suggested intervals. In consideration of these factors, Cummins MerCruiser Diesel has adjusted some maintenance intervals and corresponding tasks. In some cases, more tasks are scheduled to be performed in a single visit to the servicing facility. Therefore, the boat owner and servicing dealer should discuss the current Maintenance Schedule and develop appropriate maintenance intervals to coincide with individual operating habits, operating environments, and maintenance requirements.

Always disconnect battery cables from the battery before working around electrical system components to prevent injury to yourself and damage to the electrical system should a wire be accidentally shorted.

## Maintenance Schedule—Sterndrive Models

### Routine Maintenance

**NOTE:** Perform only the maintenance tasks that apply to your particular power package.

Task Interval	Maintenance to Be Performed
Each day start	<ul style="list-style-type: none"> <li>Check the engine oil level. (You may extend this interval based on operator experience with the product.)</li> <li>Check the engine coolant level.</li> <li>Check the power-assisted steering fluid level.</li> <li>Check the sterndrive gear lube level in the gear lube monitor.</li> </ul>
Each day end	<ul style="list-style-type: none"> <li>If operating in saltwater, brackish water, or polluted water, flush the seawater section of the cooling system after each use.</li> <li>Drain any water from the primary fuel filter after each use. (Drain all water from both fuel filters if operating in freezing temperatures.)</li> </ul>
Weekly	<ul style="list-style-type: none"> <li>Drain any water from the fuel filters.</li> <li>Check the trim pump fluid level.</li> <li>Check the seawater inlets for debris or marine growth.</li> <li>Check and clean the seawater strainer.</li> <li>Inspect the sterndrive anodes and replace if eroded 50% or more.</li> </ul>
Every two months	<ul style="list-style-type: none"> <li>Check the battery connections and fluid level.</li> <li>Lubricate the propeller shaft and torque the propeller nut (If operating only in freshwater, you may extend this maintenance to every four months).</li> <li>Treat the engine surfaces with Corrosion Guard if operating in saltwater, brackish water, or polluted waters.</li> <li>Inspect the air filter. (Every two months or every 50 hours, whichever occurs first.)</li> <li>Inspect the engine anodes and replace if eroded 50% or more.</li> <li>Ensure that the gauges and the wiring connections are secure and clean the gauges. (Every two months or every 50 hours, whichever occurs first. If operating in saltwater, reduce the interval to every 25 hours or 30 days, whichever occurs first.)</li> </ul>

### Scheduled Maintenance

**NOTE:** Perform only the maintenance tasks that apply to your particular power package.

Task Interval	Maintenance to Be Performed
After first 25 hours and not to exceed 30 hours	<ul style="list-style-type: none"> <li>Change the engine oil and filter.</li> </ul>
Annually	<ul style="list-style-type: none"> <li>Touch up the power package with paint and spray with Corrosion Guard.</li> </ul>

Task Interval	Maintenance to Be Performed
Every 100 hours or annually (whichever occurs first)	<ul style="list-style-type: none"> <li>• Change the engine oil and filter.</li> <li>• Change the sterndrive gear lube.</li> <li>• Torque the gimbal ring U-bolt locknuts.</li> <li>• Replace the fuel filters.</li> <li>• Check the steering system and the remote control for loose, missing, or damaged parts. Lubricate the cables and linkages.</li> <li>• Inspect and lubricate the sterndrive U-joint splines. Inspect the bellows, the exhaust tube, and check the clamps.</li> <li>• Lubricate the gimbal bearing and engine coupler (Lubricate the engine coupler every 50 hours if operated at idle for prolonged periods of time).</li> <li>• Check the continuity circuit for loose or damaged connections. If equipped with MerCathode, test the unit output.</li> <li>• Check the engine alignment.</li> <li>• Torque the engine mounts.</li> <li>• Check the electrical system for loose, damaged, or corroded fasteners.</li> <li>• On driveshaft extension models, lubricate the drive shaft U-joints, transom end (tailstock) bearings, and engine end (output) bearings.</li> <li>• Inspect the condition and tension of the belts.</li> <li>• Inspect the cooling system and the exhaust system for damage or leaks. Check the hose clamps for tightness.</li> <li>• Disassemble and inspect the seawater pump and replace worn components.</li> <li>• Clean the seawater section of the closed cooling system. Clean, inspect, and test the pressure cap. Check the anodes and replace if eroded 50% or more.</li> <li>• Replace the air filter.</li> </ul>
Every 2 years	<ul style="list-style-type: none"> <li>• Replace the engine coolant.</li> </ul>
Every 500 hours or 5 years (whichever occurs first)	<ul style="list-style-type: none"> <li>• Clean the aftercooler core.</li> </ul>
Every 1000 hours or 5 years (whichever occurs first)	<ul style="list-style-type: none"> <li>• Clean the fuel tank.</li> </ul>

## Maintenance Schedule—Inboard Models

### Routine Maintenance

**NOTE:** Perform only the maintenance tasks that apply to your particular power package.

Task Interval	Maintenance to Be Performed
Each day start	<ul style="list-style-type: none"> <li>• Check the engine oil level. (You may extend this interval based on operator experience with the product.)</li> <li>• Check the engine coolant level.</li> <li>• Check the transmission fluid level.</li> </ul>
Each day end	<ul style="list-style-type: none"> <li>• If operating in saltwater, brackish water, or polluted water, flush the seawater section of the cooling system after each use.</li> <li>• Drain any water from the primary fuel filter after each use. (Drain all water from both fuel filters if operating in freezing temperatures.)</li> </ul>
Weekly	<ul style="list-style-type: none"> <li>• Drain any water from the fuel filters.</li> <li>• Check the seawater inlets for debris or marine growth.</li> <li>• Check and clean the seawater strainer.</li> </ul>

Task Interval	Maintenance to Be Performed
Every two months	<ul style="list-style-type: none"> <li>• Check the battery connections and fluid level.</li> <li>• Treat the engine surfaces with Corrosion Guard if operating in saltwater, brackish water, or polluted waters.</li> <li>• Inspect the air filter. (Every two months or every 50 hours, whichever occurs first.)</li> <li>• Inspect the engine anodes and replace if eroded 50% or more.</li> <li>• Ensure that the gauges and the wiring connections are secure and clean the gauges. (Every two months or every 50 hours, whichever occurs first. If operating in saltwater, reduce the interval to every 25 hours or 30 days, whichever occurs first.)</li> </ul>

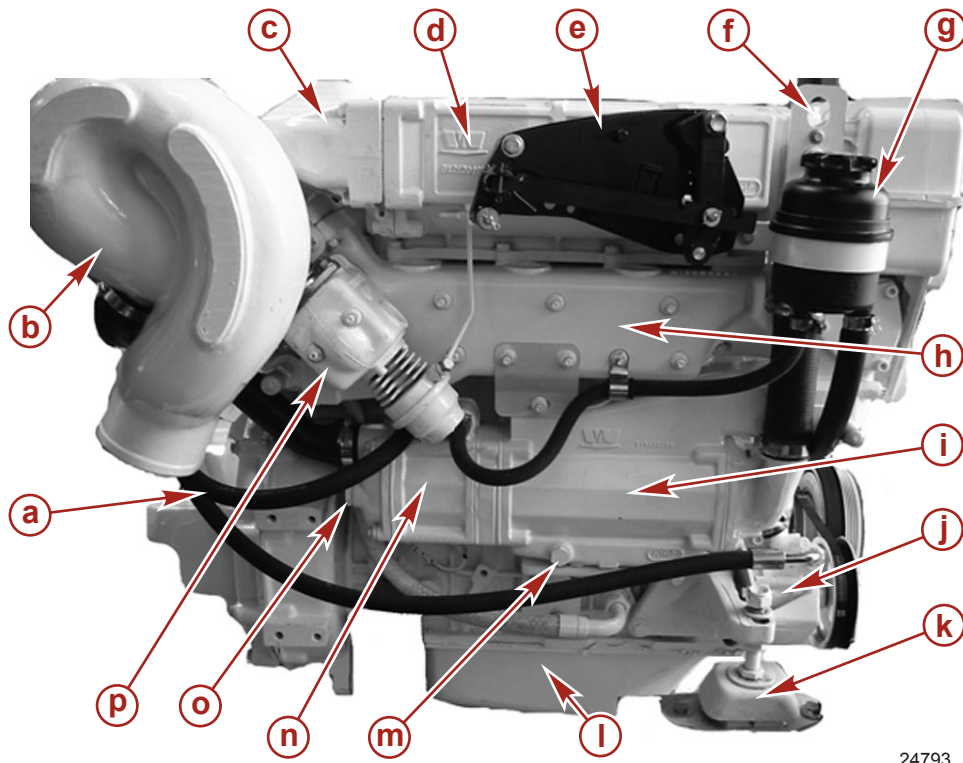
## Scheduled Maintenance

*NOTE: Perform only the maintenance tasks that apply to your particular power package.*

Task Interval	Maintenance to Be Performed
After first 25 hours and not to exceed 30 hours	<ul style="list-style-type: none"> <li>• Change the engine oil and filter.</li> <li>• Change the transmission fluid.</li> </ul>
Annually	<ul style="list-style-type: none"> <li>• Touch up the power package with paint and spray with Corrosion Guard.</li> </ul>
Every 100 hours or annually (whichever occurs first)	<ul style="list-style-type: none"> <li>• Change the engine oil and filter.</li> <li>• Change the transmission fluid.</li> <li>• Replace the fuel filters.</li> <li>• Check the steering system and the remote control for loose, missing, or damaged parts. Lubricate the cables and linkages.</li> <li>• Torque the engine mounts.</li> <li>• Check the electrical system for loose, damaged, or corroded fasteners.</li> <li>• Inspect the condition and tension of the belts.</li> <li>• Inspect the cooling system and the exhaust system for damage or leaks. Check the hose clamps for tightness.</li> <li>• Disassemble and inspect the seawater pump and replace worn components.</li> <li>• Clean the seawater section of the closed cooling system. Clean, inspect, and test the pressure cap. Check the anodes and replace if eroded 50% or more.</li> <li>• Replace the air filter.</li> </ul>
Every 2 years	<ul style="list-style-type: none"> <li>• Replace the engine coolant.</li> </ul>
Every 500 hours or 5 years (whichever occurs first)	<ul style="list-style-type: none"> <li>• Clean the aftercooler core.</li> </ul>
Every 1000 hours or 5 years (whichever occurs first)	<ul style="list-style-type: none"> <li>• Clean the fuel tank.</li> </ul>
According to the OEM	<ul style="list-style-type: none"> <li>• Check the engine-to-propeller shaft alignment.</li> </ul>

## 2.8 Engine External Views

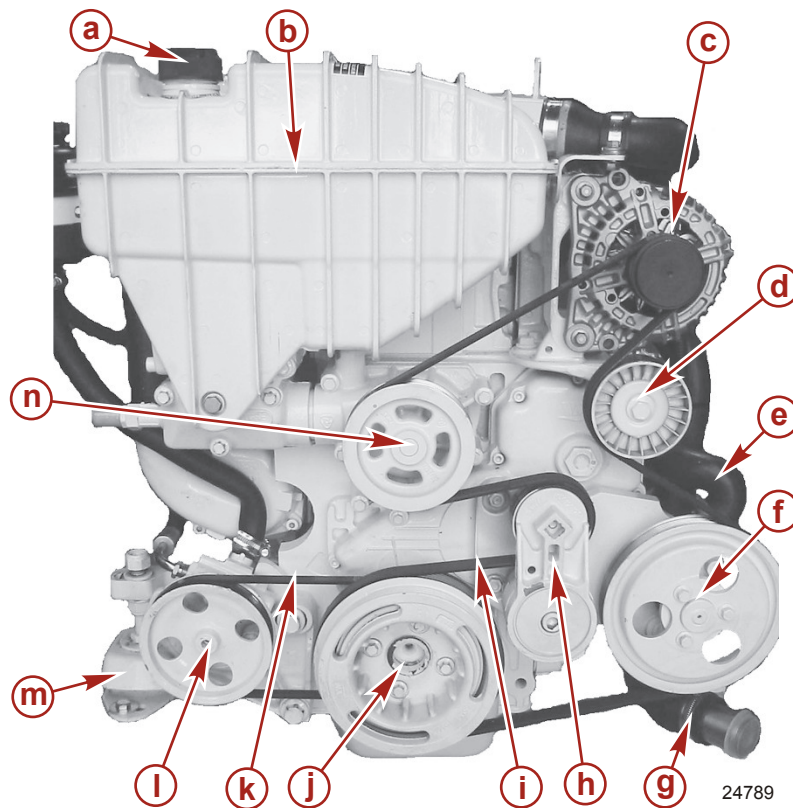
### Starboard Side View



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- |   |   |
|---|---|
| <b>a</b> - Power-assisted steering hoses (connected for shipment)   | <b>i</b> - Heat exchanger                       |
| <b>b</b> - Sterndrive exhaust riser (or inboard exhaust, not shown) | <b>j</b> - Power-assisted steering pump         |
| <b>c</b> - Aftercooler air duct                                     | <b>k</b> - Front engine mount                   |
| <b>d</b> - Aftercooler  | <b>l</b> - Oil pan                              |
| <b>e</b> - Shift plate  | <b>m</b> - Coolant drain                        |
| <b>f</b> - Front engine lifting eye                                 | <b>n</b> - Fluid cooler                         |
| <b>g</b> - Power-assisted steering fluid reservoir                  | <b>o</b> - Seawater drain and sacrificial anode |
| <b>h</b> - Intake and exhaust manifold                              | <b>p</b> - Wastegate                            |

## Front View



- a** - Pressure cap
- b** - Coolant expansion tank and reservoir
- c** - Alternator
- d** - Idler pulley
- e** - Seawater pump outlet hose
- f** - Seawater pump
- g** - Seawater pump inlet hose

- h** - Tensioner
- i** - Serpentine belt
- j** - Crankshaft balancer and pulley
- k** - Power-assisted steering pump belt
- l** - Power-assisted steering pump
- m** - Front engine mount
- n** - Engine water (coolant) circulating pump

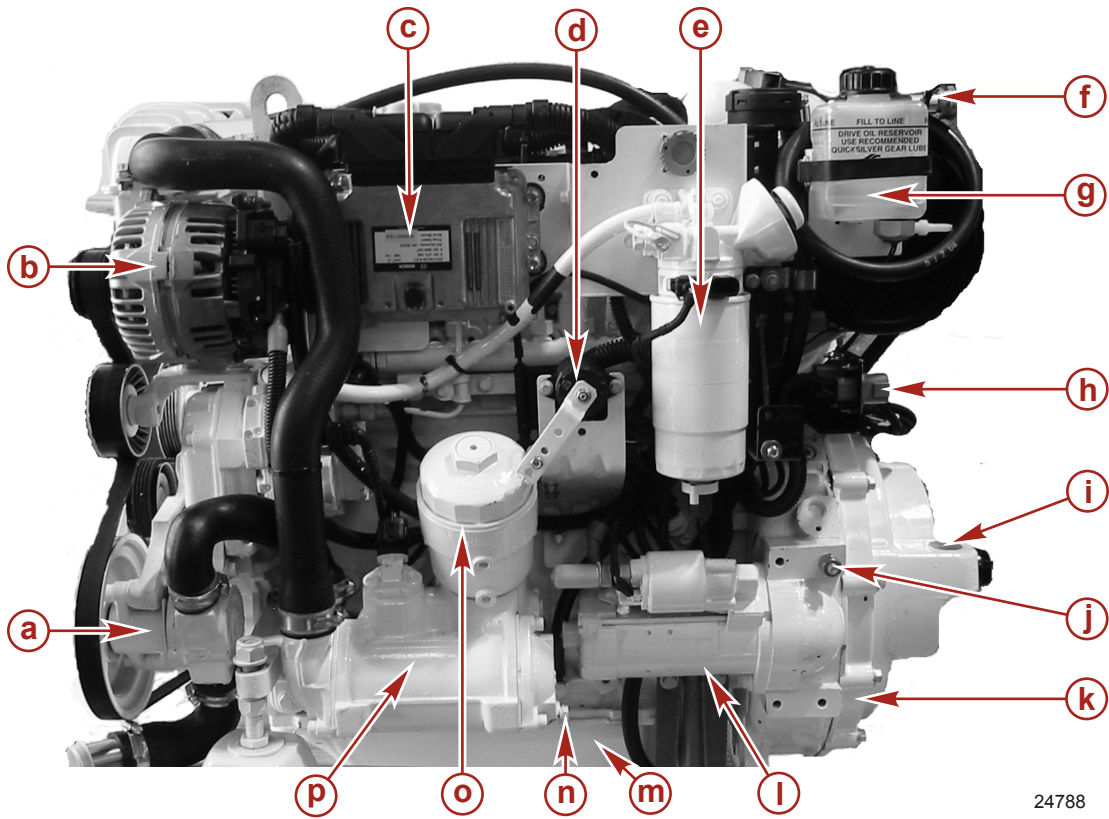
**Thank you very much  
for your reading.**

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download the complete  
manual instantly.**

**No waiting.**

Port Side View

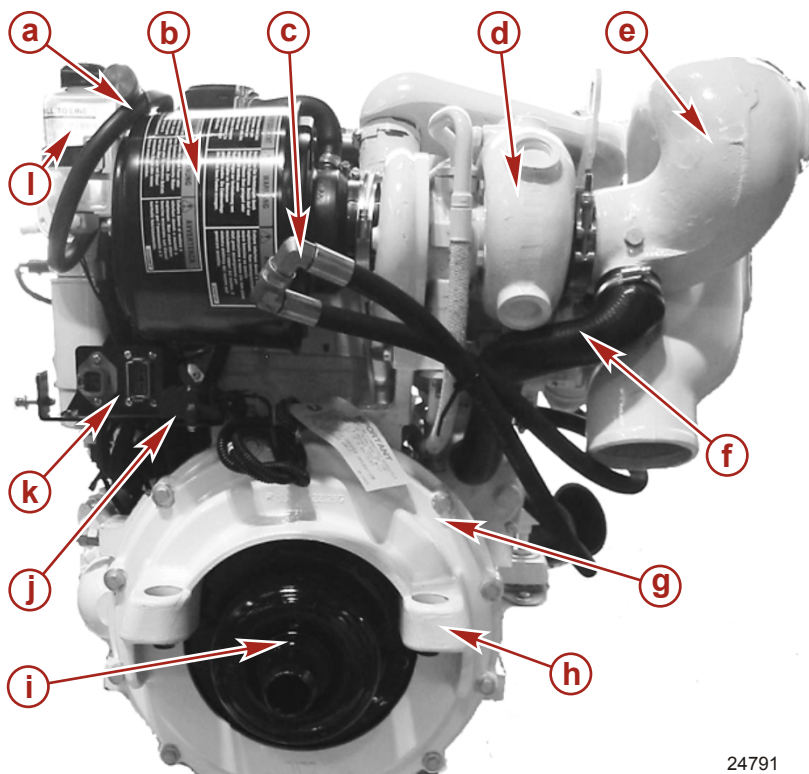


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- |   |  |
|---|--|
| <b>a</b> - Seawater pump                      | <b>i</b> - Rear engine mount               |
| <b>b</b> - Alternator                         | <b>j</b> - Ground stud                     |
| <b>c</b> - Engine control module (ECM)        | <b>k</b> - Flywheel housing (rear portion) |
| <b>d</b> - Throttle position sensor           | <b>l</b> - Starter                         |
| <b>e</b> - Fuel filter                        | <b>m</b> - Oil pan                         |
| <b>f</b> - Oil drain hose                     | <b>n</b> - Seawater drain                  |
| <b>g</b> - Gear lube monitor                  | <b>o</b> - Oil filter                      |
| <b>h</b> - Engine extension harness connector | <b>p</b> - Oil cooler                      |



## Rear View



24791

- a** - Oil drain hose
- b** - Air filter
- c** - Power-assisted steering hoses, secured for shipping
- d** - Turbocharger
- e** - Sterndrive exhaust riser, (inboard exhaust elbow not shown)
- f** - Seawater overboard hose
- g** - Flywheel housing (rear portion)
- h** - Rear engine mount (sterndrive only)
- i** - Engine coupler with grease fitting
- j** - MerCathode
- k** - Engine extension harness connectors
- l** - Gear lube monitor