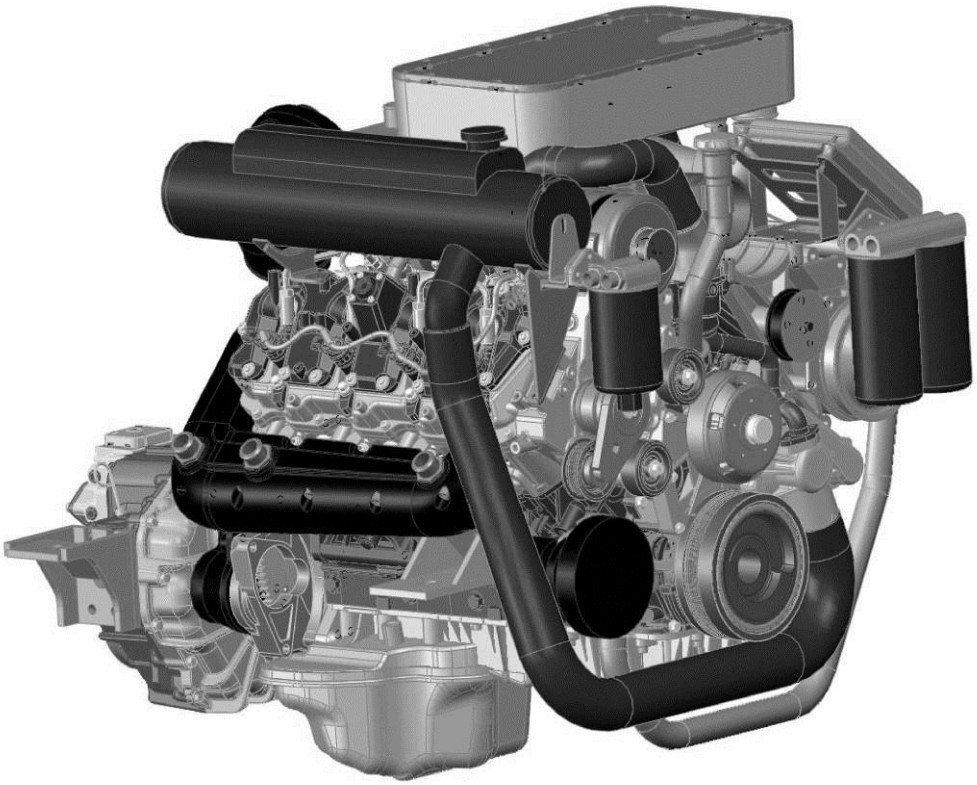
VGT and TSC APPLICATION

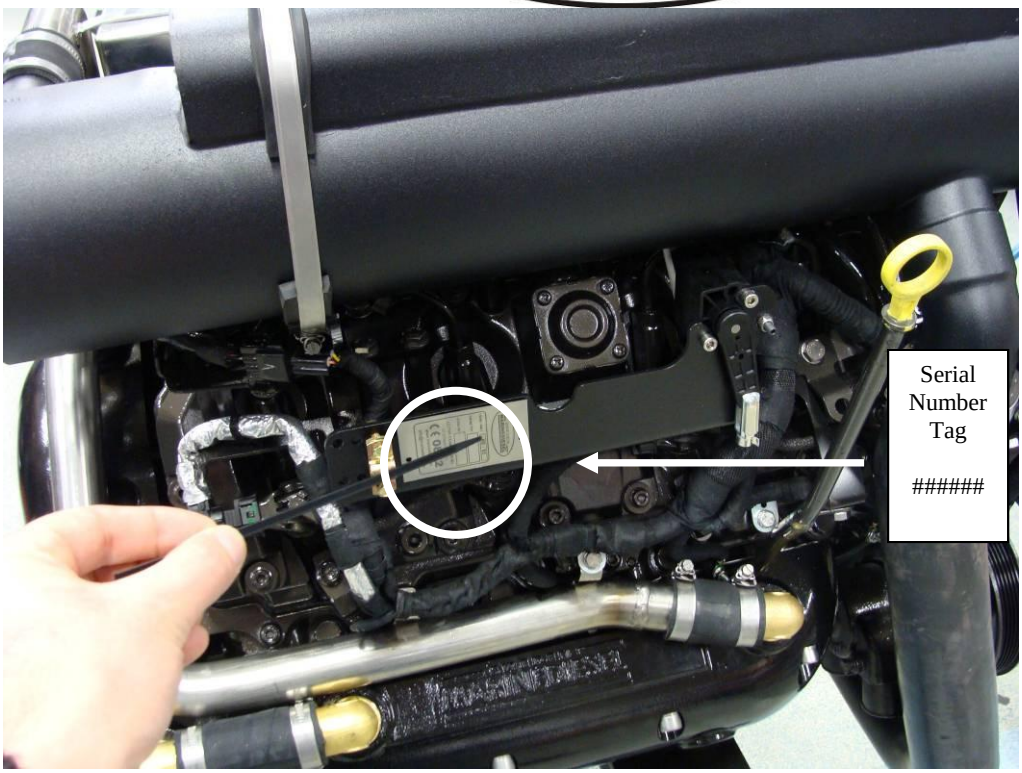
In 2009, Marinediesel introduced it's new 6,6L V8 turbo and supercharged, common rail intercooled marine engines for light duty commercial and pleasure craft applications.

The base engine is manufactured at the General Motors Isuzu 584,000 square foot production facility, located in Moraine, Ohio. The GM 6,6L base engine is Euro V and QS 9000 certified. The engine is marinized and marketed by Marinediesel Sweden AB, headquarters located in Engelholm Sweden.



IDENTIFICATION

The Marinediesel engine has a stainless steel serial number tag located on the starboard side of the engine. This serial number tag will reflect the engines six digit serial number starting with MD-XXX######.



Serial number tag on starboard side of the engine

BREAK IN PROCEDURE

The Marinediesel VGT series engines need break-in time before being operating to its full potential. This is due to the design characteristics of the base engine.

Follow the recommendations below:

0-5hrs: Use varied load and rpm but do not load the engine above 50% throttle and keep maximum rpm below 2500. Do not stay at one load and rpm configuration for more than 30 minutes at a time.

5-10hrs: Use varied load and rpm but do not load the engine above 60% throttle and keep maximum rpm below 2800. Do not stay at one load and rpm configuration for more than 30 minutes at a time.

Do an oil and filter change after the engine has run a total of 10hrs.

10-30hrs: Use varied load and rpm but do not load the engine above 80% throttle and keep maximum rpm below 3000. Do not stay at one load and rpm configuration for more than 30 minutes at a time.

30-50hrs: Use varied load and rpm, the engine can be used up to 100% throttle and full rpm. Do not stay at one load and rpm configuration for more than 30 minutes at a time.

Do an oil and filter change after the engine has run a total of 50hrs.

Use oil and filter as specified in the engine technical manual. This is highly important!

If you have any questions regarding this break-in procedure please consult the technical department at your local Marinediesel dealership or with Marinediesel in Sweden.

Starting procedure

Before starting the engine always check the oil and coolant level. Also inspect that no leaks on oil-, fuel- or cooling systems are evident.

1. Make sure gear is in neutral and that throttle is in idling position.
2. Turn ignition key to the ON position and wait for glow light to stop. This allows the automatic glow system to glow it's first sequence.

Warning: DO NOT USE STARTING AIDS SUCH AS STARTING GAS; ETHER OR OTHER. (this will void any warranty.)

3. Turn the ignition key to the CRANK position to start the engine. If the engine doesn't start in 15 seconds, wait for 30 seconds and go back to step 2.

As soon as the engine starts, let it run at idle while checking oil pressure and volt reading. It's not unusual with smoke from the exhaust system just after start-up but this will stop once the engine reaches operating temperature. Glow system will automatically afterglow.

Recommended cruising rpm for all Marinediesel engines is 2700-3200rpm although the maximum rated effect is at a higher rpm. It is necessary to choose a propeller that will allow the engine to reach maximum engine rpm at WOT to not inflict unnecessary load on the engine, which could effect longevity **and void warranty**. Do not exceed maximum recommended engine rpm as the pump reduces the amount of injected diesel after this rpm and engine power drops quickly.

Winter storage

- Oil system

Change oil on the supercharger (only TSC models), se technical maintenance specifications. Drain the oil from the engine, either by removing the oil plug in the oil pan or by a suction tube down the dipstick tube; remember it's always recommended to do this when the engine is at operating temperature. Tighten the plug, clean the oil dipstick and reinsert it in the tube.

Then remove the oil filter and replace it with a new unit (don't forget to prelubricate the seal ring on the filter and prefill the filter with oil) tighten hard

with manual power. Refill the engine with new oil according to technical maintenance specifications. Check the oil level on the dipstick and if necessary add more oil to reach the correct oil level. Start the engine and run it for a few minutes so that the new oil can lubricate all moving parts. Turn off the engine and recheck the oil level on the dipstick, again add more oil if necessary.

- Fuel system

Check all hoses, clamps and fittings for leakage and wear, replace if necessary. Make sure the fuel tank is full to prevent water contamination. Add "water repellent" isopropanol to the fuel system. Remove and replace the fuel filter (remember to prefill the filter with fuel as you otherwise will have issues with bleeding all the trapped air from the fuel system).

- Cooling – system

Start the engine and run antifreeze mix through the raw water system. Check the freeze protection of antifreeze in the freshwater cooling system. If you need to add antifreeze make sure you allow the engine to run up to operating temperature allowing the thermostat to open and mix the added antifreeze. Never use more than 50% antifreeze. Turn off the engine and drain the raw-water system. At the same time remove the impeller from the impeller pump. Check all hoses, clamps and fittings for wear and leakage, replace if necessary. The heat exchanger, intercooler and oil cooler are exposed to raw water and should be inspected for corrosion that could lead to engine failure. It is recommended that the raw-water cooling system be cleaned and flushed every 500 hours or at least every two years.

- Exhaust system

When the winter service is completed make sure all exhaust outlets and the air filter are sealed to prevent moist/salt air from entering the engine.

- Electrical System

Remove and clean the battery/batteries. Also clean the battery cables and connecting poles. Store battery in a cold/dry environment (never below 0C/32F) and keep it fully charged.

Procedures after winter storage

- Exhaust System

Remove all winter-storage-seals from exhaust and intake system.

- Electrical System

Reconnect the fully charged battery/batteries and tighten/lubricate the connectors. Check the condition of the serpentine drive system belt; replace if worn or dry.

- Cooling system

Recheck that all hoses and fittings in the raw-water system are connected and replace the impeller (be careful not to scuff the impeller, use grease). Prime the raw-water system to prevent overheating of the impeller at start-up.

- Air filter

Replace with new filter unit..

- Start-up

See starting procedures on page 3. Check for leakage of oil, fuel and water. Also check the oil level on the dipstick, if necessary fill up with oil. Let the engine idle up to operating temperature before usage or shutdown. When the operating temperature is achieved, again check for leaking fluids. It is always good to mix approx 1% two-stroke oil into the fuel tank once a year to give the fuel system added lubrication.

Periodic maintenance - see separate Marinediesel Service book.

Periodic maintenance important notes

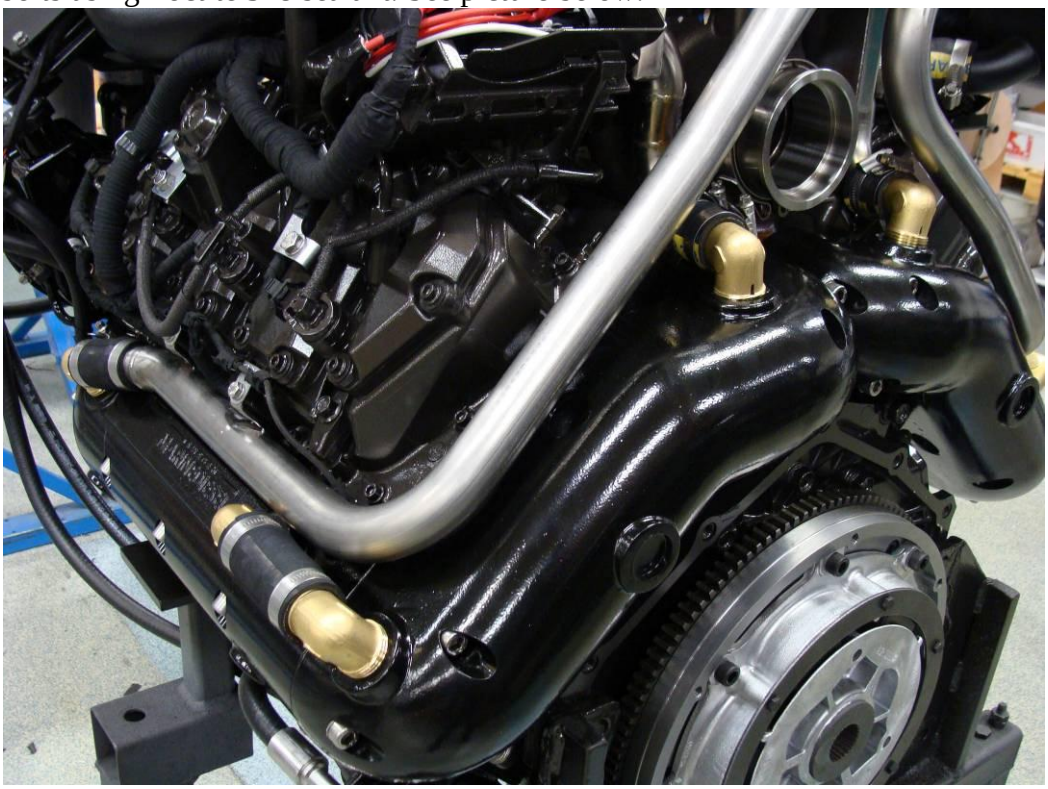
Periodic oil change on the supercharger (Only TSC-models). USE ONLY Marinediesel High Performance Supercharger oil. Do NOT overfill, correct level is critical. (Low level can cause gear failure, high level can cause drive coupling failure)

Dealer & Service directory

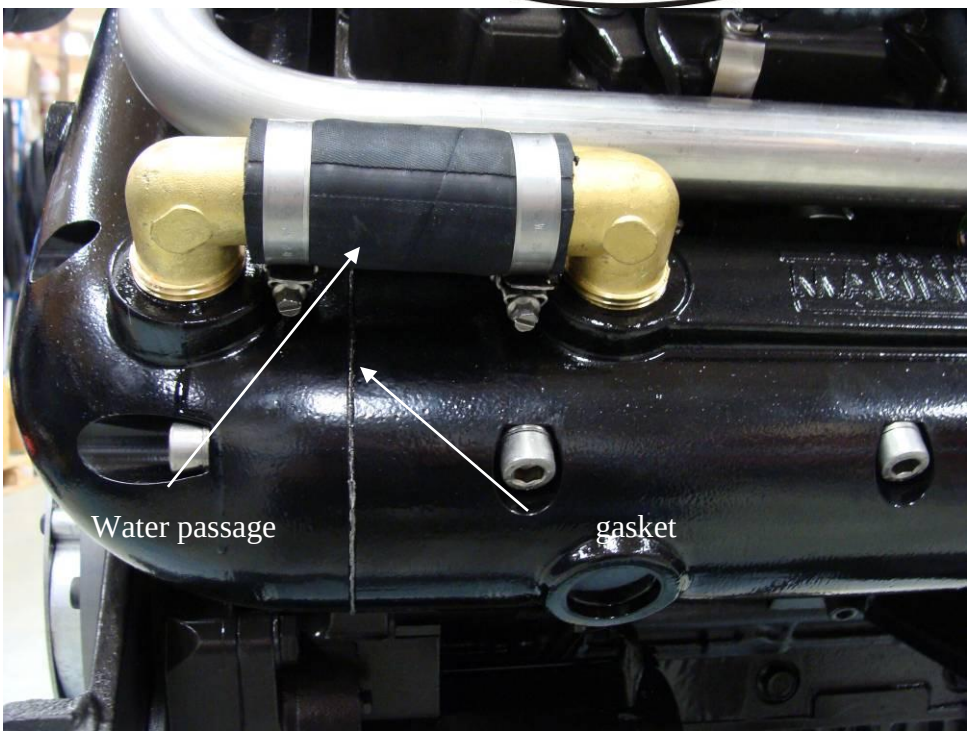
FOR LATEST UPDATE WE REFER TO WWW.MARINEDIESEL.NU

Exhaust Manifolds

The MD exhaust manifolds are made of high quality cast aluminium that is heat treated, anodized, vacuum injected and powder coated for maximum corrosion resistance. Each exhaust manifold mounts to the cylinder head with a metric (M10) stainless steel hexagon socket head bolts using Loctite 518 sealant. See picture below.



Torque the M10 bolts to 30Nm using Loctite 518 sealant and high temp flange sealant on both sides of the gasket. See picture below



Turbo and Intercooler System

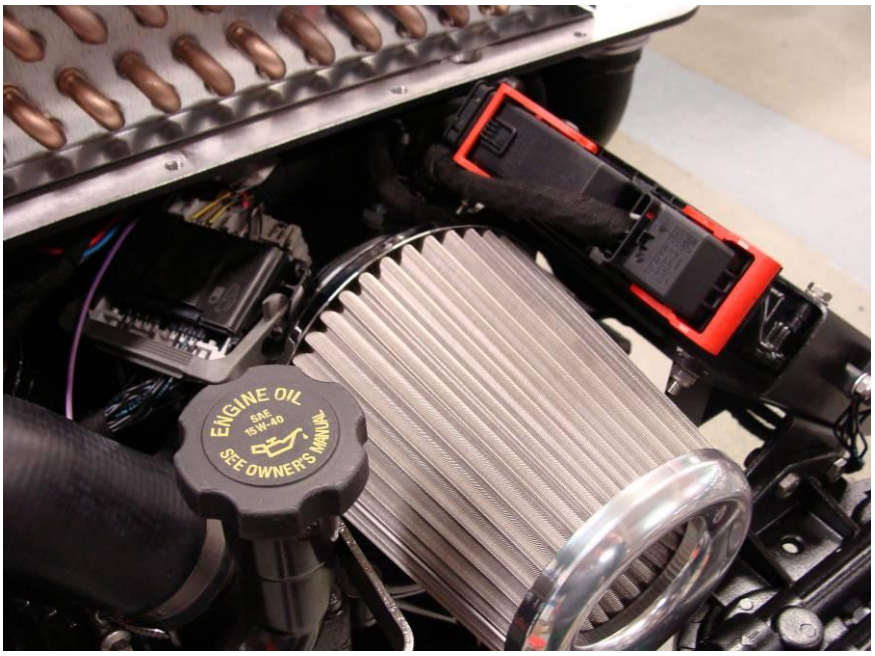
Air induction on Marinediesel VGT-engines includes the following parts:

- Air intake duct and air filter assembly
- Variable Geometry Turbo assembly
- Intake assembly with integrated stainless steel intercooler
- Crankcase ventilation system

Air intake duct and air filter assembly

Outside air enters the induction system through a filter located on the front of the engine (see picture below). This is a bonded stainless steel mesh filter material and should be cleaned and replaced according to service intervals (see service book). The air filter element mounts to the intake runner inlet with a clamp. The intake runner mounts to the turbo with a v-clamp according to pictures below.

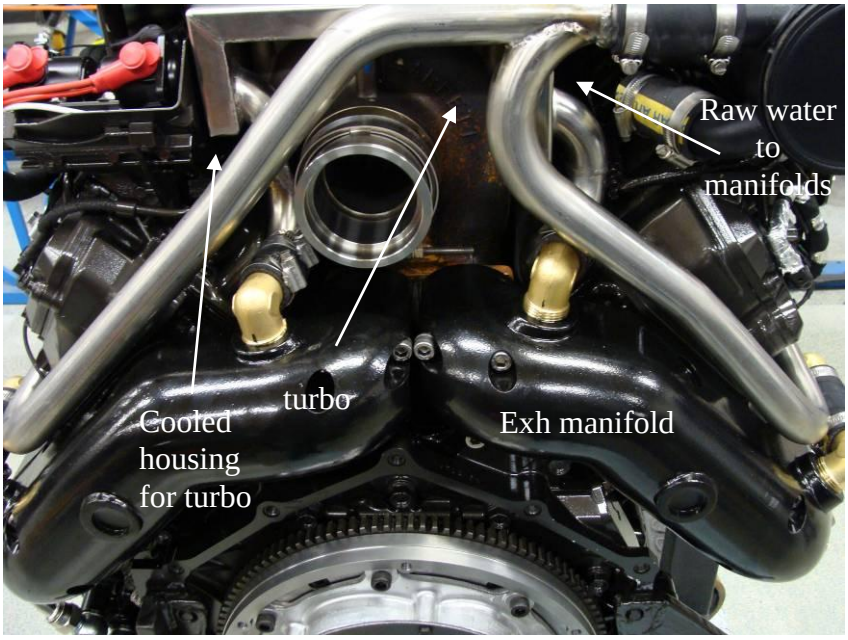
Air intake runner and turbo.

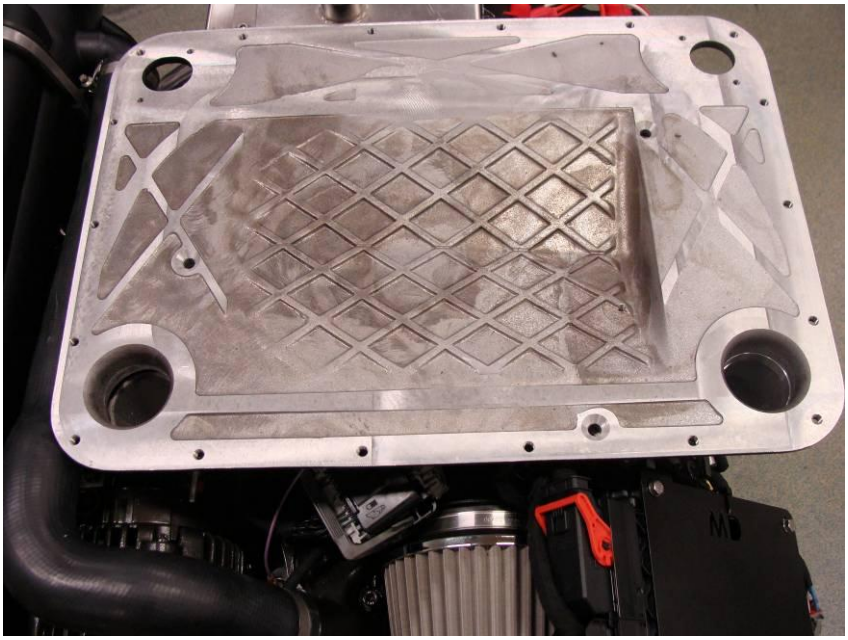


Air filter assembly

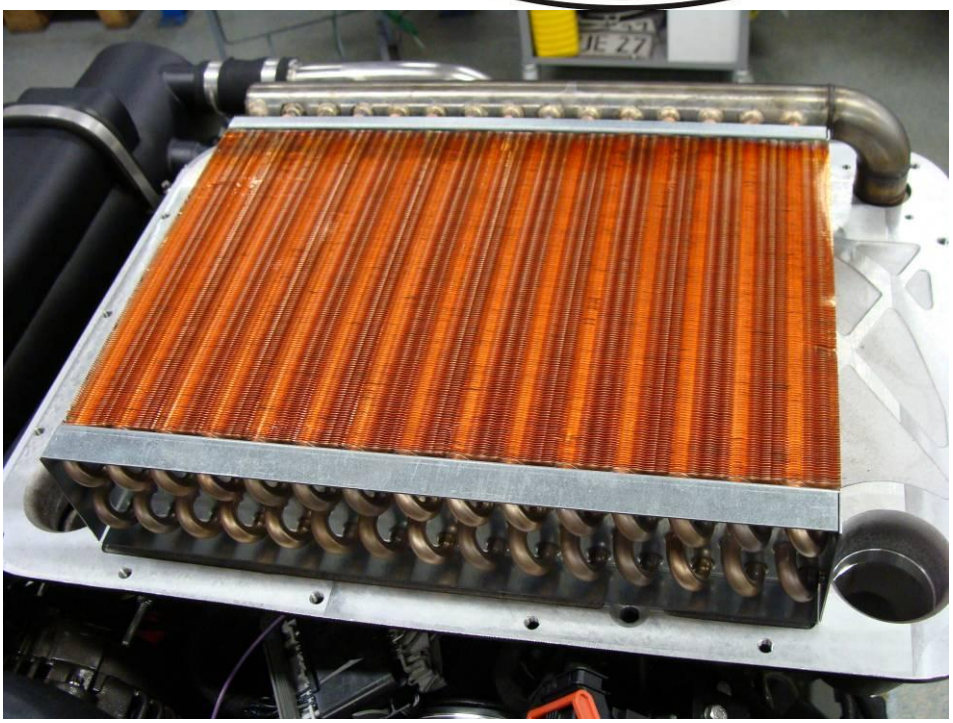
Turbocharger and intercooler assembly

The turbocharger assembly information can be found in the correct page in this manual. Below is an explanation of some interacting parts.

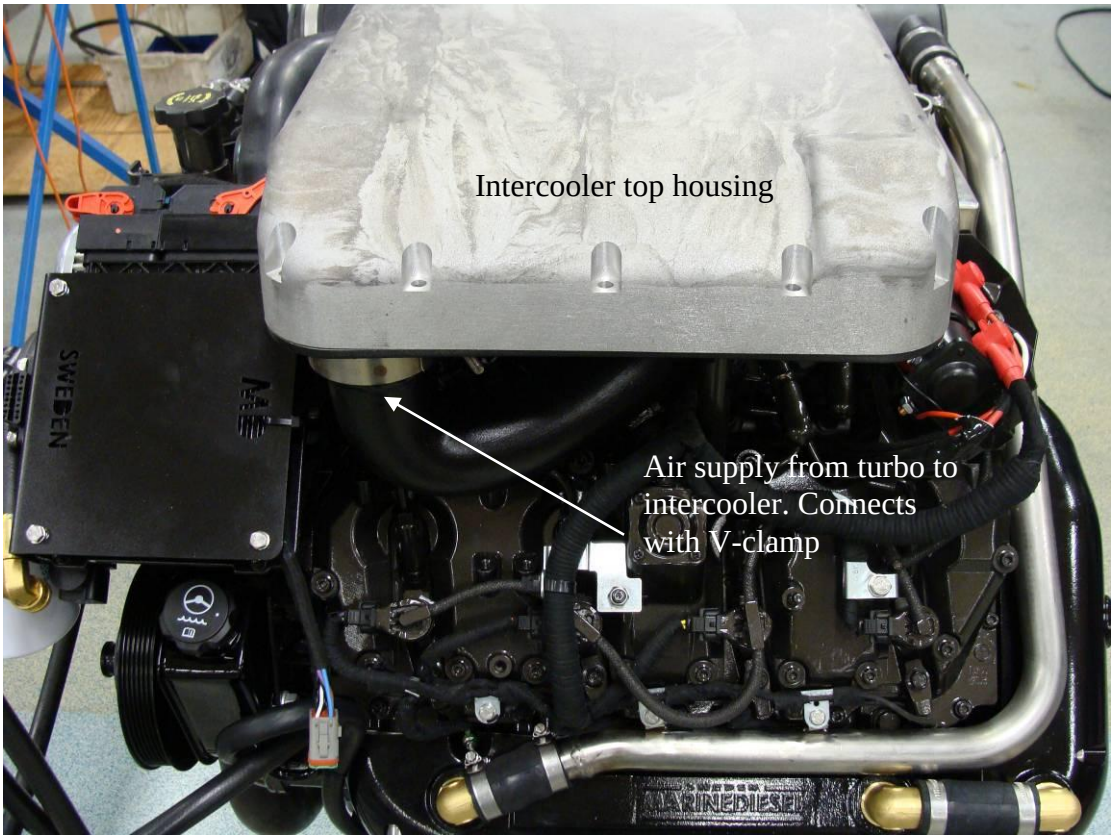




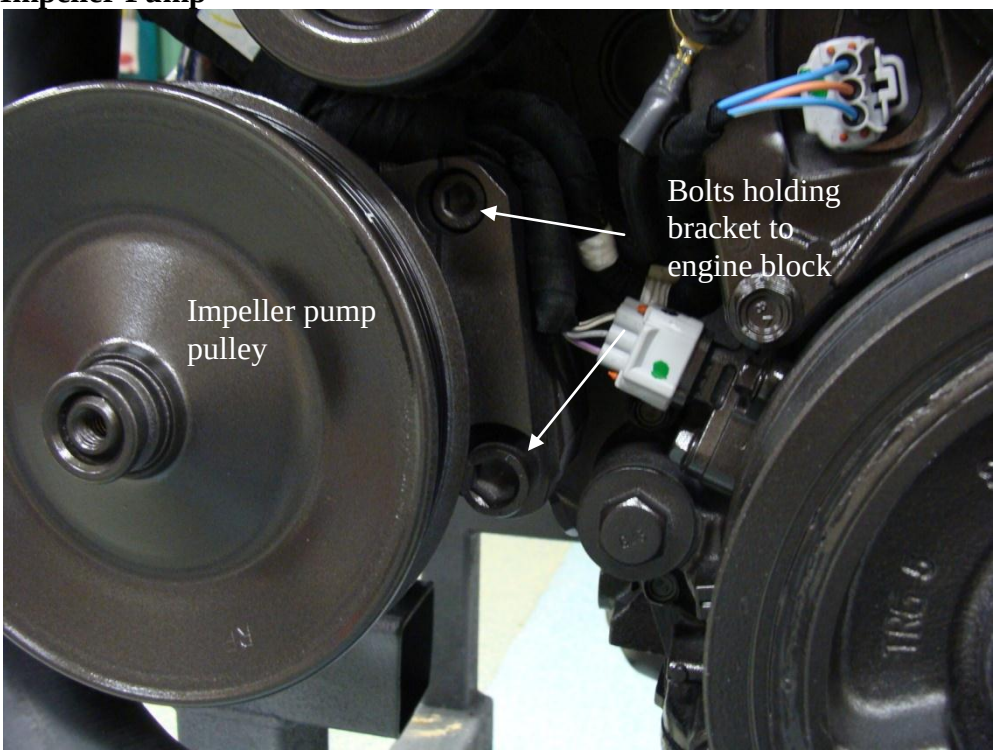
Bottom plate of intercooler assembly



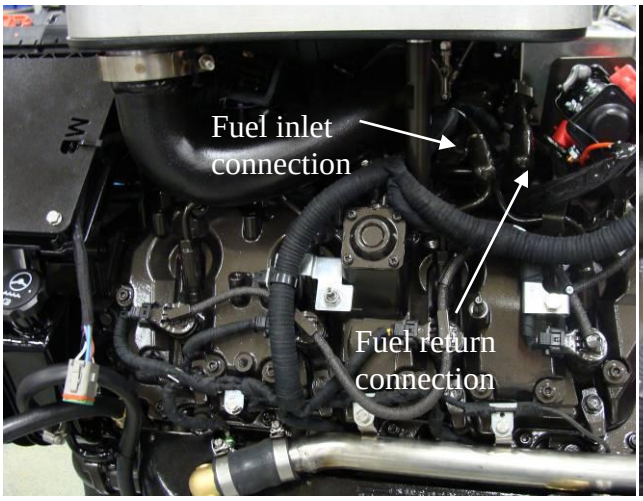
Stainless steel intercooler core

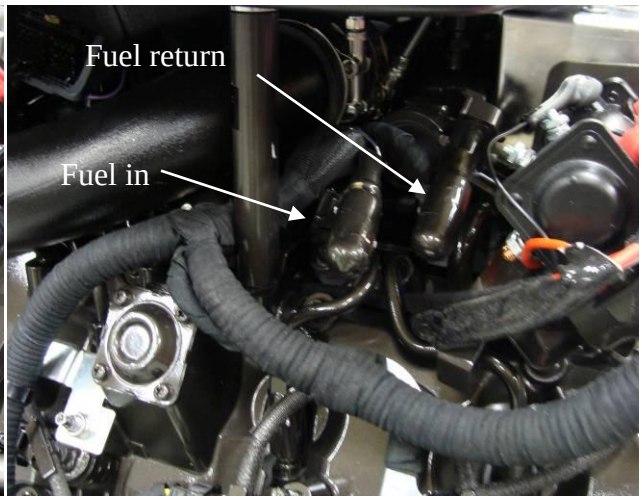


Impeller Pump



Raw water and fuel inlet connections

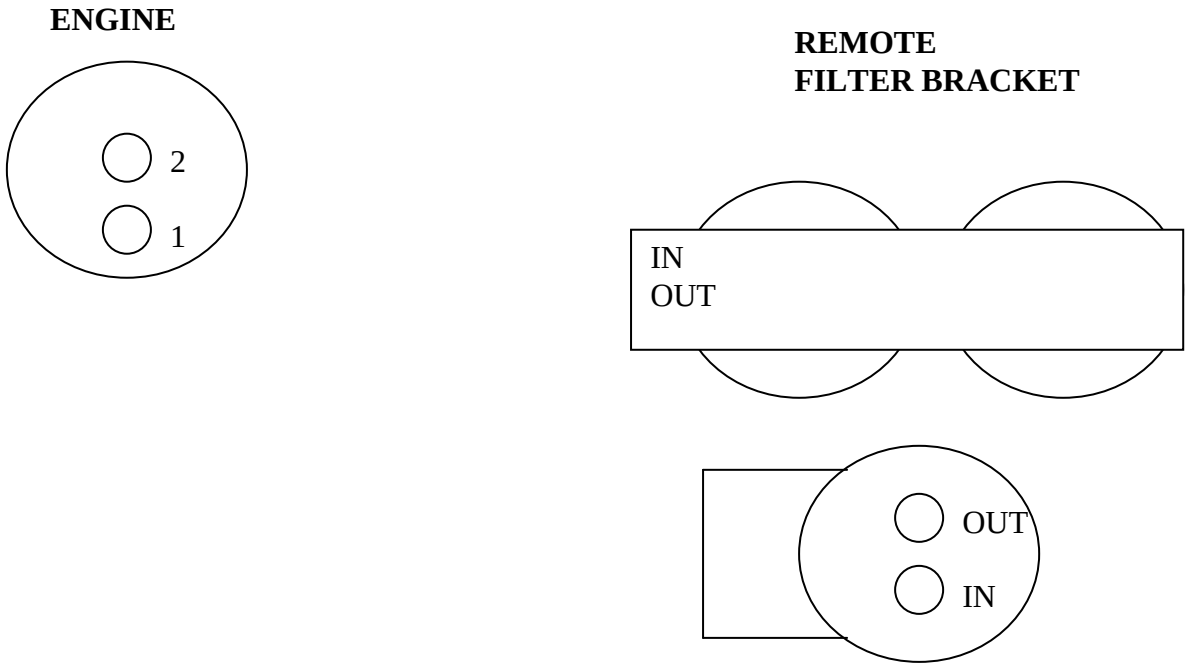




The return fuel must pass via the fuel cooler before returning to the tank. Raw water connection is on the impeller pump on the lower starboard side of the engine. Please see installation section for further information

Oil filter relocator

The oil filter relocator is ordered as an option when ordering the engine. As it is supplied separately it is essential that the oil lines and oil filter are prefilled with oil before starting the engine. The lines should be connected as shown below. To check the function of the remote filter feel the oil lines when engine is running, if they are warm the oil is circulating as it should, if not, stop the engine and recheck the connections.



CONNECT FROM ENGINE ADAPTER ”1” TO REMOTE OIL FILTER BRACKET ”IN” AND FROM ENGINE ADAPTER ”2” TO REMOTE OIL FILTER BRACKET ”OUT”. TO CHECK THE CONNECTION MAKE SURE THAT THE OIL HOSES GET WARM WHEN ENGINE IS RUNNING, IF THEY STAY COLD RECHECK CONNECTION.

WARNING!!!!!!!!

BEFORE MOUNTING THE OIL FILTER, FILL THE OIL FILTER COMPLETELY WITH OIL. THIS TO ENSURE THAT THE ENGINE GETS LUBRICATED DIRECT FROM START-UP. USE LOCTITE 518 ON ALL CONNECTIONS TO PREVENT LEAKAGE.

Section 1 – ENGINE

ENGINE MOUNTING

Engine Bed

The engine bed provides a location for the engine and associated marine gear to be mounted, if it is not mounted directly on boat stringers. The engine bed or stringers should be constructed in such way as to allow even weight distribution and load transfer.

Cross braces on the engine bed or stringers may be desired in certain applications to prevent lateral movement of the engine. This bracing limits hull vibration and reduces stress on engine casting, such as mounts.

IMPORTANT: The finished engine bed or boat stringers must position engine so that a minimum amount of adjustment still exists. This is necessary for future adjustments.

Marindiesel engines are generally equipped with pedestal-type, flexible front engine mounts

Flexible Engine Mounting

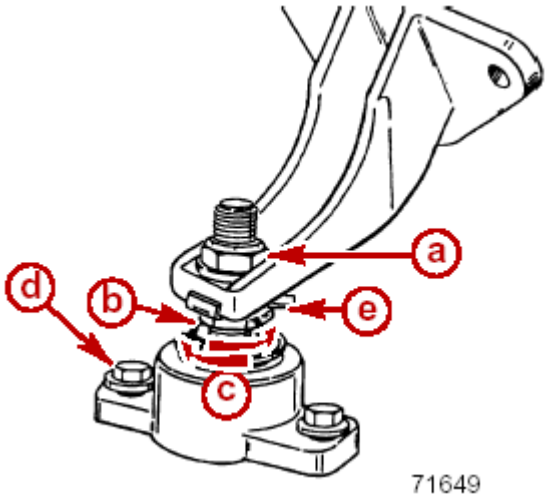
Generally, Marinediesel engines are equipped with pedestal type front engine mounts. All front mounts include provisions for isolating engine vibrations. The rear of the engine mounts to the stern drive transom plate or transmission.

IMPORTANT: do NOT use solid engine mounts, doing so will cause severe engine damage and void warranty.

Engine Mounts

Front engine mounts are adjustable and must rest on boat stringers. 3/8 in. lag screws or bolts, depending upon stringer construction, retain engine mount pedestal to stringer. Grade and length of lag screws or bolts, must be selected based on stringer material and anticipated loading forces.

Adjustment nut is turned counterclockwise to raise front of engine, or clockwise to lower front of engine.



Typical Front Mount
a -Nut And Lock washer
b -Adjustment Nut
c -Adjustment Nut
d -Lag Screws Or Bolts
e -Tab Washer

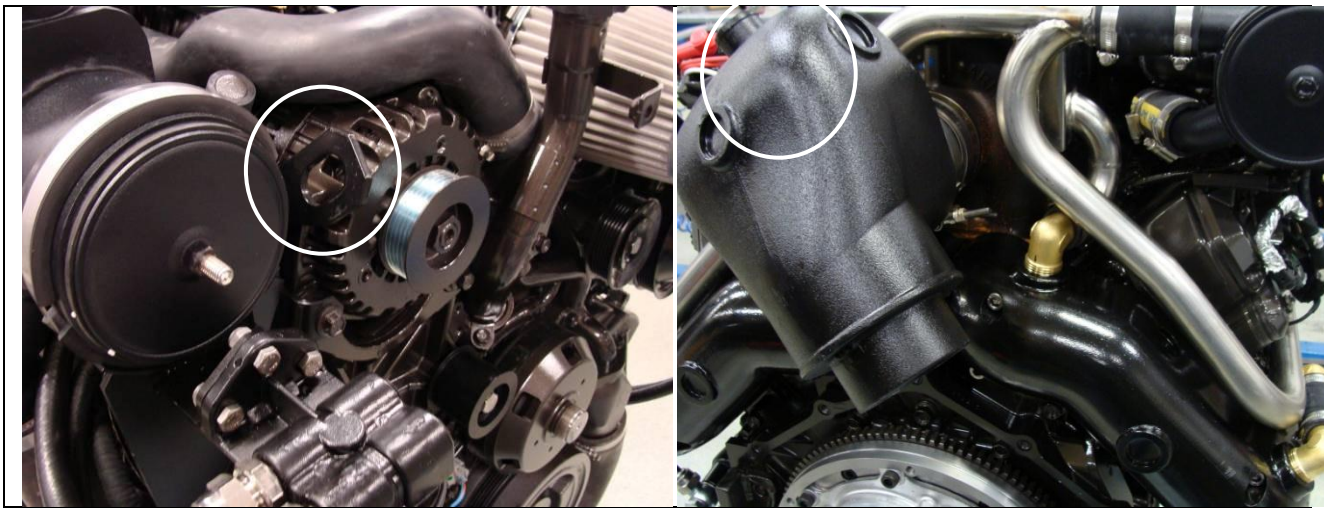
ENGINE ALIGNMENT

Checking Stringer Height

Ensure that the stringers are equal in height before installing the engine. Tying a string from the port front mount location to the starboard rear engine mount on transom assembly or transmission may check this. Another string should be tied from starboard front to port rear. The strings should lightly touch where they cross. If not, corrections should be made to the engine bed.

Suspending The Engine

Front and rear lifting eyes on the engine are provided to allow attachment of a suitable sling.
The engine can then be lifted into position (in boat) using an overhead hoist.



A B

Engine Lifting brackets
a -Front
b -Rear

Final Engine Mount Height

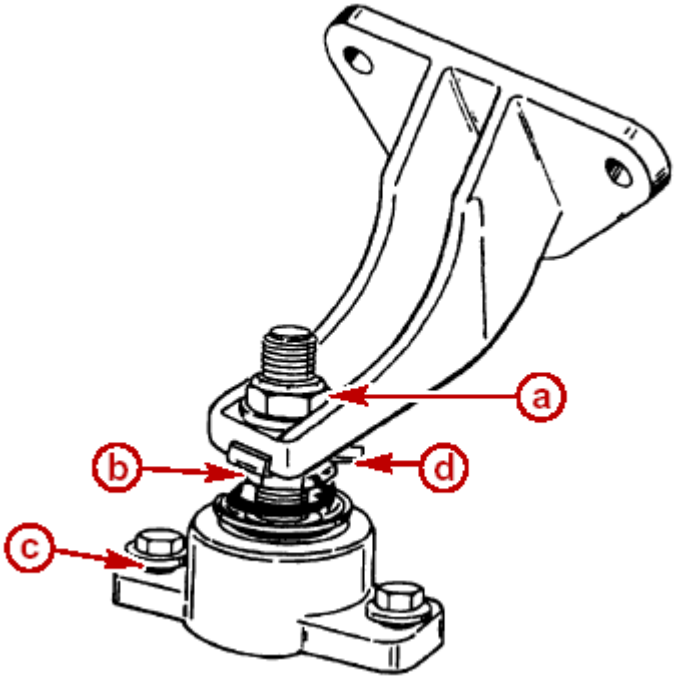
IMPORTANT: Finished boat stringer must position engine so that a minimum mount adjustment exists after front mount is adjusted down to stringer. This allows for future adjustments.

During final engine mount adjustment, the mounts are temporarily adjusted until they rest on the stringers. Hoist tension is relieved so that the engine settles onto the stringers and the mounts are appropriately fastened to stringers. Common attachment is using 3/8 in. or 10 mm lag bolts.

Both adjustment nuts must be turned equally for proper alignment. Alignment must be checked with the alignment tool during the final engine mount height adjustment.

The locknuts on the mounts should be secured by tightening the adjusting nuts firmly.

NOTE: *Ensure that the alignment tool is removed after alignment.*



Typical Front Mount
a -Nut And Lock washer
b -Adjustment Nut
c -Slotted Hole Toward Front Of Engine
d -Tab Washer

POWER STEERING HOSE ROUTING

IMPORTANT: When installing power steering hoses observe the following.

- Make hydraulic connections as quickly as possible to prevent fluid leakage.
- Be careful not to cross-thread or over tighten fittings.

Power steering fluid hoses must be purchased separately. Proper routing and installation of the hoses is required to avoid problems related to power steering system.

Observe the following:

- Hoses must be secured to avoid contact with moving components.
- Torque both power steering hose fittings to 15Nm after connecting to control valve.

Power steering oil cooler is standard on all MD engines.

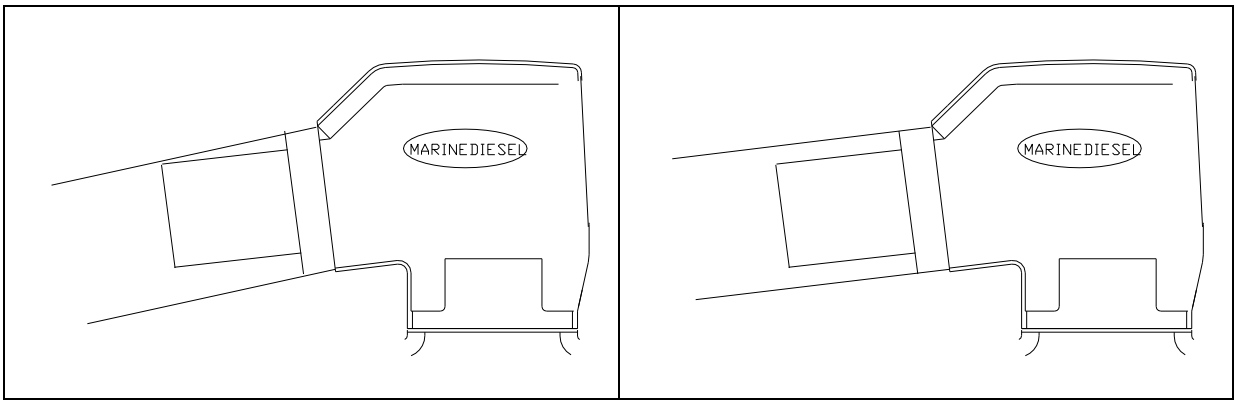
CAUTION

Avoid stress on the hose fittings and avoid kinks in the hoses. Install and route power steering hoses exactly as shown in specific Owners Manual provided with engine.

EXHAUST HOSE ROUTING

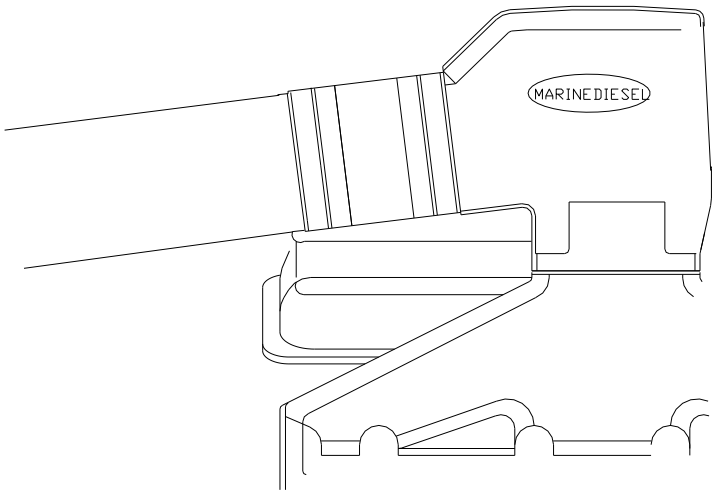
Exhaust hose routing is dependent upon the various engines and boat designs.
However, in all cases, care must be exercised in the proper installation of an exhaust hose, or failure may occur.

CAUTION
Avoid exhaust hose failure. Discharge water from exhaust elbow must flow around entire inside diameter of hose to avoid causing hot spots that could eventually result in burned-through exhau hoses. Exhaust hoses and 'or tubes must be correctly connected to exhaust elbows so that they not restrict the flow of discharge water from elbow.



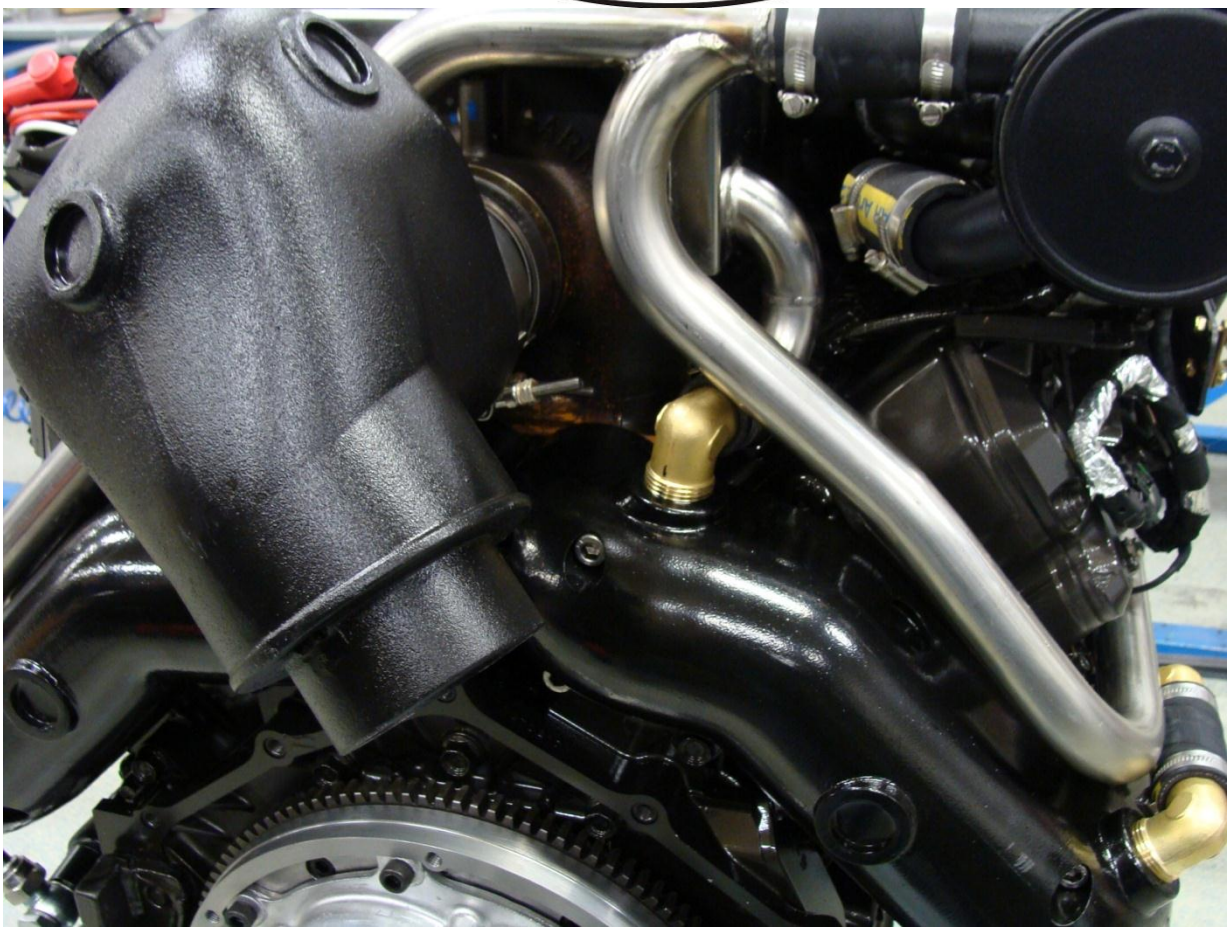
Incorrect **Correct**

When installing, depending on drivesystem and application, the installer may require an installation similar to one of the following examples. All exhaust hoses and / or tubes must be secured with two clamps.



Through Transom Exhaust

- Use double hose clamps



Make sure the exhaust elbow is tilted no more that 45 degrees to make sure there is no water intrusion through the exhaust back into the turbo.

Section 2 – AIR INTAKE SYSTEM

ENGINE COMPARTMENT

WARNING
Boating standards (NMMA, ABYC, etc.) and Coast Guard regulations must be adhered to when constructing the engine compartment.

ENGINE COMPARTMENT VENTILATION

General Information

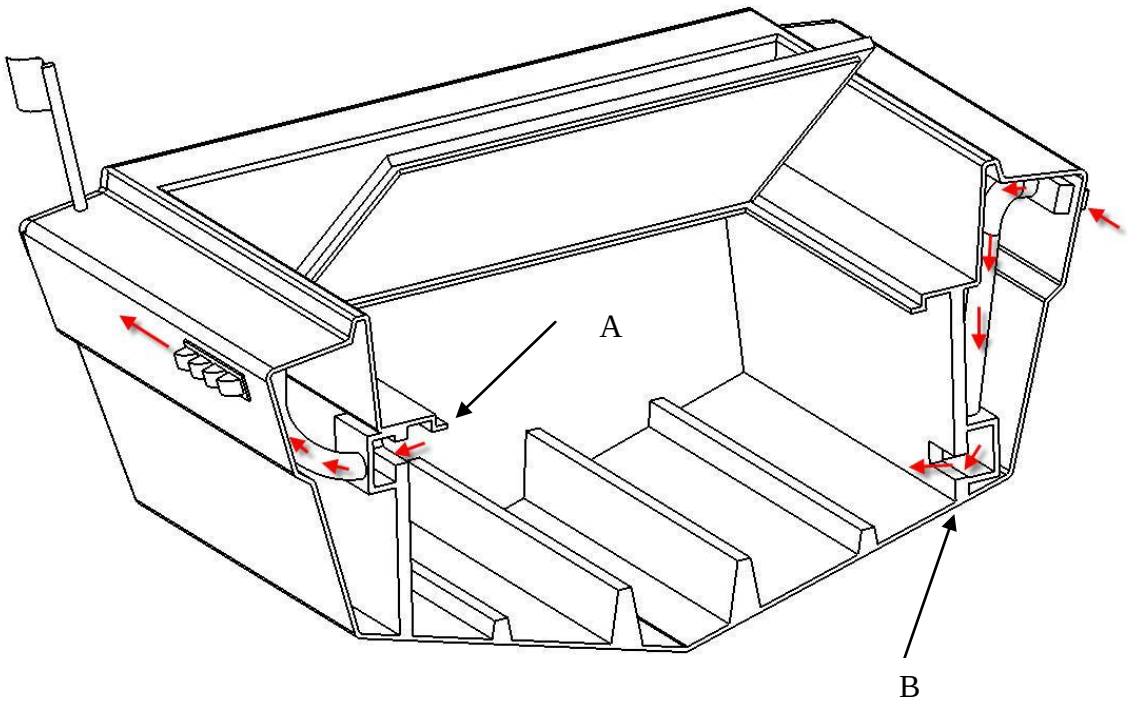
According to Boating standards (NMMA, ABYC, etc.) and Coast Guard regulations the engine compartment ventilation system has multiple tasks. Including:

- Supply the engine with combustion air.
- Maintain a low temperature in the engine compartment.
- Vent the air and fumes in the engine compartment.

Fresh air should enter the engine compartment as low as possible and the heated air should be discharged from the highest point.

When sufficient ventilation is not provided, too much heat can build-up inside the engine compartment and cause vapor locking. The engine will not restart after it has been shut off for a short period of time.

For diesel engines utilizing environmentally friendly, low viscosity fuels, proper ventilation is more critical to prevent vapor locking. Contact your dealer for further specifications.



A - Air should exit the engine bay and the upper section
B – Air should enter the engine bay at the lower section

The reason for this is that hot air is lighter than cold air and will exit at the top of the compartment. Once the engine is shut down such a system will autoventilate until the engine bay temperature is at ambient level.

Combustion Air Requirements

Engine compartments with natural draft ventilation must have vent openings of sufficient size and location to accomplish the tasks previously outlined.

IMPORTANT: The size of ventilation openings must be increased if any auxiliary equipment is located in the engine compartment.

The combustion air requirement (per engine) for the specified engines at Wide Open Throttle is given in the following table.

Model	Engine Air Requirments at WOT	MINIMUM Combustion Air Vent Area Per engine
300-400hp	25m^3/min	500cm^2
400-500 hp	30$m^{3/}$min	600cm^2
500-600 hp	35$m^{3/}$min	700cm^2

For engine combustion air only - ***NOT*** total engine compartment ventilation requirement.

IMPORTANT: The amount of vent area required, according to boating standards (NMMA, ABYC, etc.) and Coast Guard regulations, for *complete* (total) engine compartment ventilation must include the engine combustion air vent area plus the engine compartment ventilation requirements.

The pressure differential between outside and inside the engine compartment must not exceed the following value.

Maximum Pressure Differential at W.O.T.
2 in. H_2O (51 mm H_2O) (measured with a manometer)

Section 3 – FUEL SYSTEM

FUEL DELIVER SYSTEM – General Information

WARNING
Boating standards (NMMA, ABYC, etc.) and Coast Guard regulations must be adhered to when constructing the fuel delivery system.

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

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

Fuel Tank

The Fuel Tank is an integrated component of the boat. Marinediesel makes no attempt in this manual to cover all aspects of design and integration of the fuel tank in the boat due to the broad range of possible configurations. Refer to information from the tank manufacturer as well as boating standards (NMMA, ABYC, etc.) and Coast Guard regulations for complete guidelines.

Only a few points related to function and safety are listed here.

- All connections should be on the upper side of the tank.
- The tank vent pipe must have an inner diameter of at least 1/2 in. (13 mm) and must be fitted with a swan neck to prevent water from entering the tank.
- Fuel pickup should be at least 1 in. (25 mm) from the bottom of fuel tank to prevent picking up impurities.
- Return fuel line connection must flow freely into the top of the fuel tank, must NOT have a pipe that exits at the bottom of the fuel tank.

Some additional consideration regarding the fuel tank and fuel delivery system performance should be given to the following:

- Keep vertical distance between top of the fuel tank and fuel inlet fitting on engine as small as possible. Fuel flow restriction occurs with greater distances.
- Keep vertical distance between bottom of fuel tank and fuel inlet fitting on engine as small as possible. Fuel flow restriction occurs with greater distances.
- Keep vertical distance between bottom of the fuel tank and fuel return fitting on engine as small as possible. Fuel flow restrictions occur with greater distances.
- **When repowering from gasoline application to diesel in is VERY important to clean out all remaining gasoline from the tank. Failure to do so may cause serious engine damage and can result in fire or explosion!**

Fuel Tank Bottom Versus Fuel Inlet Height (Measured from bottom of fuel tank to height of fuel inlet fitting.)	
Less than 20 in. (< 508 mm)	Not generally a problem
20-40 in. (508-1016 mm)	May be suspect of causing fuel delivery system problems.
Greater than 40 in.(> 1016 mm)	Could cause fuel delivery system problems. Avoid if possible.

Fuel Lines

The following, but not limited to the following, additional fuel connection related points, *applying to all engines unless otherwise stated*, must be considered. Refer to boating standards (NMMA, ABYC, etc.), Coast Guard regulations and/or your countries regulatory agency for complete guidelines.

- Fuel lines used must be Coast Guard approved (USCG Type A1) and meet the following size specifications according to engine model: All Models must not be smaller than 3/8 in. (10 mm) I.D.
- Return lines used must be Coast Guard approved (USCG Type A1) and meet the following size specifications according to engine model: All models must not be smaller than 5/16in (8mm) I.D. preferably 3/8in (10mm) I.D.

- **On Multi-Engine Installations:** It is best to use a fuel pickup and supply line for **each** engine. If a single pickup and line is used, line must not be smaller than 3/8 in. (14 mm) I.D.
- Larger diameter (than previously specified) lines and fittings must be used on installations requiring long lines or numerous fittings.
- It is recommended that the exact route and length of the fuel lines be established at the first installation of the engine to prevent problems later in connecting them to the engine.
- Holes where the lines run through the bulkheads should be carefully rounded off or protected with rubber grommets. This prevents damage to the lines from abrasion.
- Fuel line(s) should be installed free of stress and firmly secured to prevent vibration and/or chafing.
- Sharp bends in fuel lines should be avoided.
- A flexible fuel line must be used to connect fuel supply line to fuel inlet fitting on engine to absorb deflection when engine is running.
- An anti-siphon device (valve) is required. It is critical to choose one with the least restriction. An electric solenoid anti-siphon device is one of the least restrictive and is allowed by the Coast Guard.
- The maximum measured vacuum at the engine's fuel inlet must not exceed 2 in. Hg(6.9 kPa) at idle rpm and full throttle rpm.

SPECIAL INFORMATION ABOUT ADDITIONAL FUEL FILTER USAGE

CAUTION
The engine fuel pump and factory installed water separating fuel filter have been carefully designed to function properly together. Do not install additional fuel filters and/or water separating fuel filters between fuel tank and engine.

The installation of additional filters may cause:

- Fuel Vapor Locking
- Difficult Warm-Starting
- Poor Drivability

SPECIAL INFORMATION FOR FUEL LINE FITTING INSTALLATION

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

- **Apply #592 Loctite Pipe Sealant on threads of brass fittings or plugs. DO NOT USE TEFLON TAPE.**
- **Brass fittings or plugs should first be threaded into fuel pump or fuel filter base until finger tight.**
- **Fittings or plugs should then be tightened an additional 1-3/4 to 2-1/4 turns using a wrench. DO NOT OVER TIGHTEN.**
- **To prevent over tightening when installing a fuel line, the brass fittings should be held with a suitable wrench as fuel line connectors are tightened securely.**

FUEL RETURN FITTING REQUIREMENTS

- Return fuel line is recommended to be 3/8in (10mm) and must end freely in the top of the fuel tank. There must be no restriction on the return fuel system.

WATER SEPARATING FUEL FILTER

The engine must be installed with the water separating fuel filter supplied with the engine.
The boat's fuel supply line connects to the fuel inlet fitting (line connector), on the filter base, using a flexible fuel line. A flexible fuel line must be used to absorb deflection when the engine is operated.

FUEL SYSTEM TEMPERATURE AND PRESSURE DROP

General Information

The power output of an engine can be limited by the amount of restriction in the boat's fuel supply system. The Marinediesel specifications for the boat's fuel system performance regarding fuel inlet are:

Specifications For Fuel System Performance	
Maximum Fuel Inlet Temperature	**Maximum Fuel Pressure Drop**
110° F (44° C)	1 psi / 6.9 kPa

Power output of an engine is directly related to the amount of fuel demanded. An engine with more power output can cause a greater demand on a fuel system and therefore cause a greater fuel pressure drop. The design of the fuel system should always take into account the highest output engine offered in the boat. Doing this will help prevent performance problems related to fuel supply.

Air temperature and the RVP (Reid Vapor Pressure) of the fuel also play an important role in fuel system performance. Higher air temperature can cause higher fuel line temperature. Overall design of the fuel system and fuel line routing should take into account the highest air temperature to which the craft could be subjected. In some cases it may be necessary to measure the RVP of the fuel. Special test equipment can be used to determine the fuel's RVP or check with a local regulatory agency.

Section 4 – EXHAUST SYSTEM

Important Information

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

CAUTION
Avoid severe engine damage. Improper installation of the engine, exhaust system, or both, may allow water to enter the exhaust manifolds and combustion chambers and severely damage the engine. Install the engine and exhaust system according to Marinediesel instructions and procedures, and according to recommended practices.

The exhaust system must be installed in accordance with the information contained in this section to prevent water intrusion problems. Special care must be taken on through the hull exhaust applications, as the design of these systems can produce a tuning effect that can cause water to be pulled back into the engine.

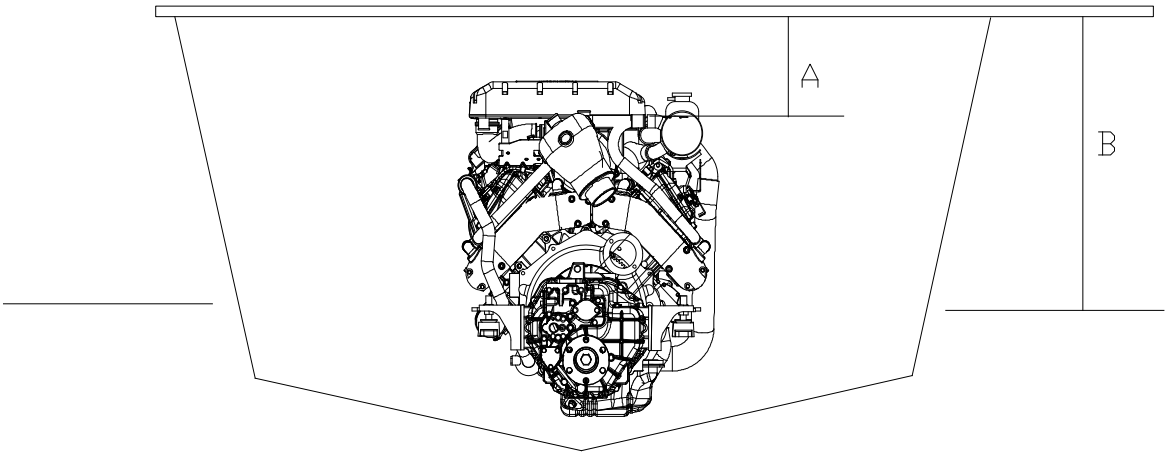
Measuring Exhaust Elbow Height
Straight Edge Method

TOOLS

Description	Part Number
Tape Measure	Obtain Locally
Straight Edge (long enough to cross port to starboard gunwales)	

INSTRUCTIONS

1. Place a long straight edge across boat.
2. With the straight edge above the engine and parallel to the water, measure the distances between the straight edge and the top of the exhaust elbow.
3. With the straight edge above the engine and parallel to the water measure the distance between the straight edge and the outside waterline.
4. The difference between these two measurements is the exhaust elbow height above the water line. Refer to *Measuring Procedure* and compare measurement to Marinediesel specifications.



Straight Edge Method For Measuring Exhaust Elbow Height
A -Measurement Between Straight Edge And Top Of Exhaust Elbow
B -Measurement Between Straight Edge And Water Line
Measurement Raiser to waterline =B-A (minimum 330mm!)

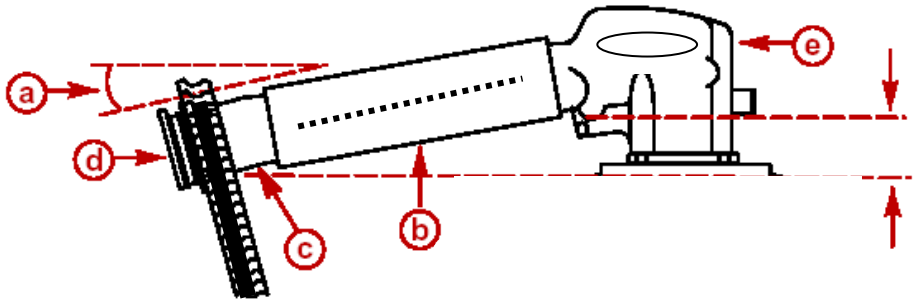
On All Applications:	
Minimum Exhaust Elbow Height from Top of Elbow to Waterline	
Model	**Measurement**
All Models	13 in. (330 mm)

Additional Requirements for Through The Hull and Through The Transom Exhaust System Applications:	
Minimum Continuous Downward Slope (Exhaust Hoses, Collector, Etc.)	
Model / Application Measurement	
All	6°

Through The Hull Exhaust

When designing and installing an exhaust system, in addition to other model specific requirements, Marinediesel requires the following to be observed:

- Exhaust fittings (flanges and outlets) must be of proper size to accommodate 4 in. (102 mm) inner diameter exhaust hoses.
- Exhaust fittings must be equipped with internal water shutters.
- An exhaust flapper must be used over each outlet.
- Exhaust outlet must be slightly above the water line with boat at rest in the water and a full load aboard.
- Exhaust hoses, collectors and pipes must not be higher than exhaust elbows at any point.
- The drop in the exhaust system must be continuously sloping so that a low spot does not exist at any point in the exhaust hose or pipe.
- The exhaust system on Marinediesel engines must have a minimum of 6° downward slope between the exhaust elbow outlet and the exhaust outlet of the boat.
- The exhaust system on Marinediesel VGT/TSC engines must have a minimum of 5 in. (127 mm) of vertical drop between the exhaust elbow outlet and the exhaust outlet of the boat.



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Example Of Through Transom Exhaust Models

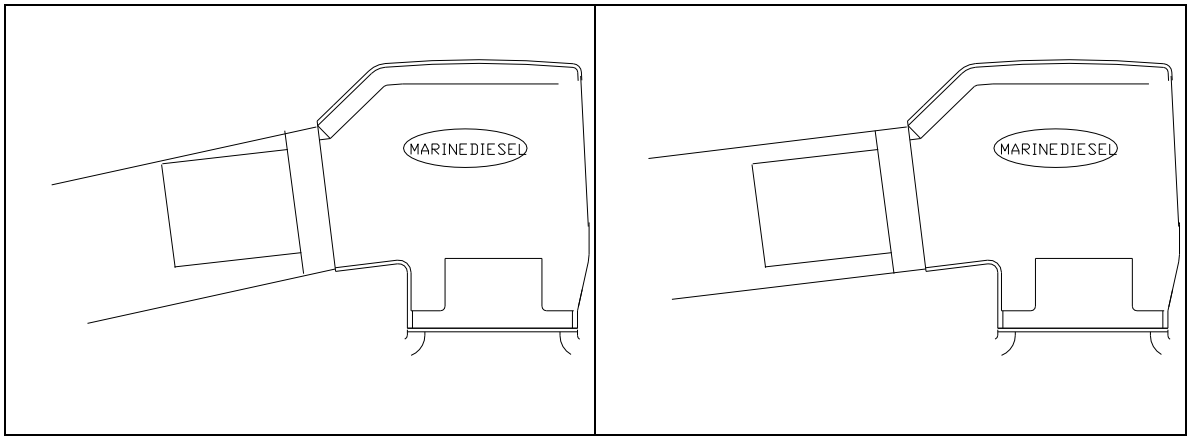
a -Minimum Continuous Exhaust System Slope
b -Exhaust Hose
c -Exhaust Fitting
d -Flapper
e -Exhaust Elbow
f -Minimum Exhaust System Vertical Drop

- Back pressure must not exceed 2 psi (14 kPa) when measured at exhaust elbow outlets.
  Refer to *Exhaust Back Pressure* outlined in this SECTION.

Exhaust Connections

Important Information

CAUTION
Avoid exhaust hose failure. Discharge water from exhaust elbow must flow around entire inside diameter of hose to avoid causing hot spots, which could eventually result in burned-through exhaust hoses. Exhaust hoses and/or tubes must be correctly connected to exhaust elbows so that they do not restrict the flow of discharge water from exhaust elbow.



Incorrect **Correct**

Exhaust Back Pressure

General Information

All exhaust systems have some restriction to flow, or what is called “exhaust back pressure”, but this must remain at a minimum. The power output of an engine is directly related to the amount of exhaust that can flow out of the exhaust system. For example, engines will generally suffer approximately a 10 horsepower loss for the first 1 psi (7 kPa) of exhaust back pressure.

A higher output engine will cause a greater backpressure using the same size exhaust system as an engine with less output. On boats with through the hull or through the transom exhaust, it is recommended that the boat’s exhaust system be designed and tested for the highest horsepower engine to be offered in that boat.

Marinediesel specifies the following maximum backpressure, which can be measured using the test outlined following.

Exhaust Back Pressure Specification	
Model / Application	**Measurement**
All Engines	Maximum 1 psi (7 kPa)

Ensure that both cylinder banks of any engine are tested. Record the highest back pressure readings. If pressure is excessive, changes must be made to the system to reduce the pressure; including but are not limited to the following:

- Reduce exhaust system length.
- Increase exhaust system diameter.
- Reduce muffler restriction if equipped.
- Ensure that through the transom or through the hull fittings are above water.

Section 5 – COOLING SYSTEM

General Information

Marinediesel engines are closed (fresh water) cooled. Closed cooled engines have the engine block and select other components cooled by a mixture of water and antifreeze.

Cooling system components must be constructed and sized appropriately to supply the engine with sufficient water under all operating conditions. Observe the following information.

Seawater Supply and Hose Connections

Specifications

Seawater Supply Specifications	
Seawater Pickup (through the hull or transom) - Minimum Flow Rate	60 gallons per minute (228 liters per minute)
Seawater Pickup Hose (Wire Reinforced) Inner Diameter	1-1/2 in. (38 mm)
Seacock Size (Internal Cross-Sectional Area Equal to or Greater Than Size Shown)	1-1/2 in. (38 mm)
Seawater Strainer Minimum Flow Rate 60 gallons per minute	(228 liters per minute)

Important – Engine Installed Flush System

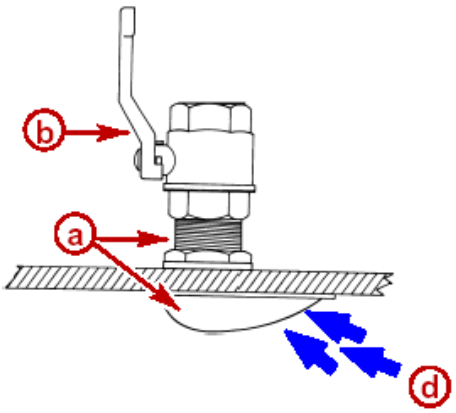
Sterndrive engines must have the flush system installed with the Y-fitting located on the outlet side of the sea water pump. The system should be used only when the engine is NOT running.

Inboard engines MUST have the Y-fitting located on the inlet side of the sea water pump, and used in conjunction with a manual water shut off valve. In the inboard configuration the flush is used only with the engine running, to ensure water lift mufflers do not overfill and enter the engine exhaust system. Resulting damage will NOT be covered under warranty

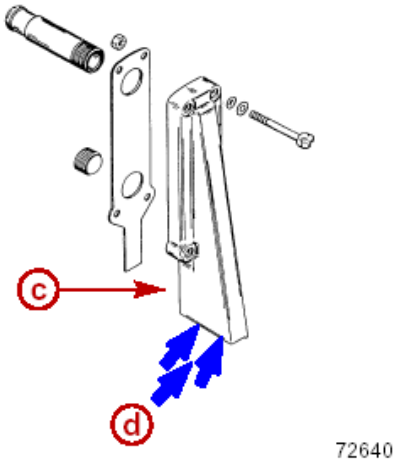
THROUGH THE HULL OR TRANSOM

On the engine the seawater cooling hose connects to a water pickup that is mounted through the hull or transom of the boat. Refer to instructions provided by the seawater pickup manufacturer, or Installation Manual supplied with product. A seacock (water inlet valve) is recommended.

A through the hull or through the transom seawater pickup, must have an internal cross-sectional area equal to or greater than seawater inlet hose to prevent restricting water flow. Pickup must be located on the boat in an area that permits an uninterrupted flow of water to the pickup. Be sure to make hose connections with double hose clamps.



Typical Through The Hull Pickup



Typical Through The Transom Pickup

a -Through The Hull Pickup
b -Seacock
c -Through The Transom Pickup
d -Water Flow

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

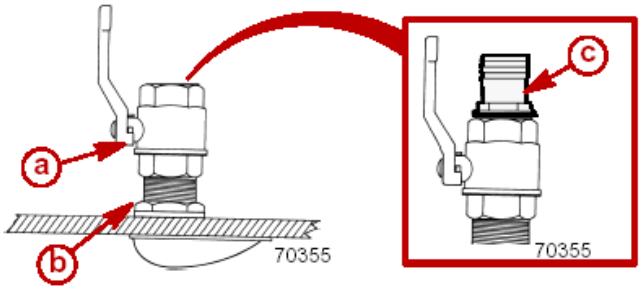
Seawater Pickup Hose

THROUGH THE STERNDRIVE UNIT
Seawater inlet hose through sterndrive is NOT recommended. Any resulting engine overheat problems will NOT be covered by Marinediesel's warranty.

THROUGH THE HULL OR TRANSOM
Seawater pickup hose must be obtained separately if using a through the hull or through the transom seawater pickup. Hose must be correct inner diameter (refer to *Specifications*) and wire reinforced hose of adequate wall thickness to prevent it from collapsing from pump suction. Be sure to make hose connections with double hose clamps. Secure hose to prevent contact with any moving parts.

Seacock

Seacock (seawater inlet valve), if used, must be installed between water pickup and seawater pickup pump (or sea strainer) to allow operator to shut off the seawater to flush or drain the engine, or clean the sea strainer while boat is in the water. Valve used must have an internal cross-sectional area equal to or greater than hose to prevent restricting water flow. Install valve in an area where it will be easily accessible. Support valve adequately to prevent hose fatigue. A brass ball or gate valve is required.



Typical Seacock Installation
a -Seacock
b -Seawater Pickup (Through The Hull Fitting)
c -Hose Connector

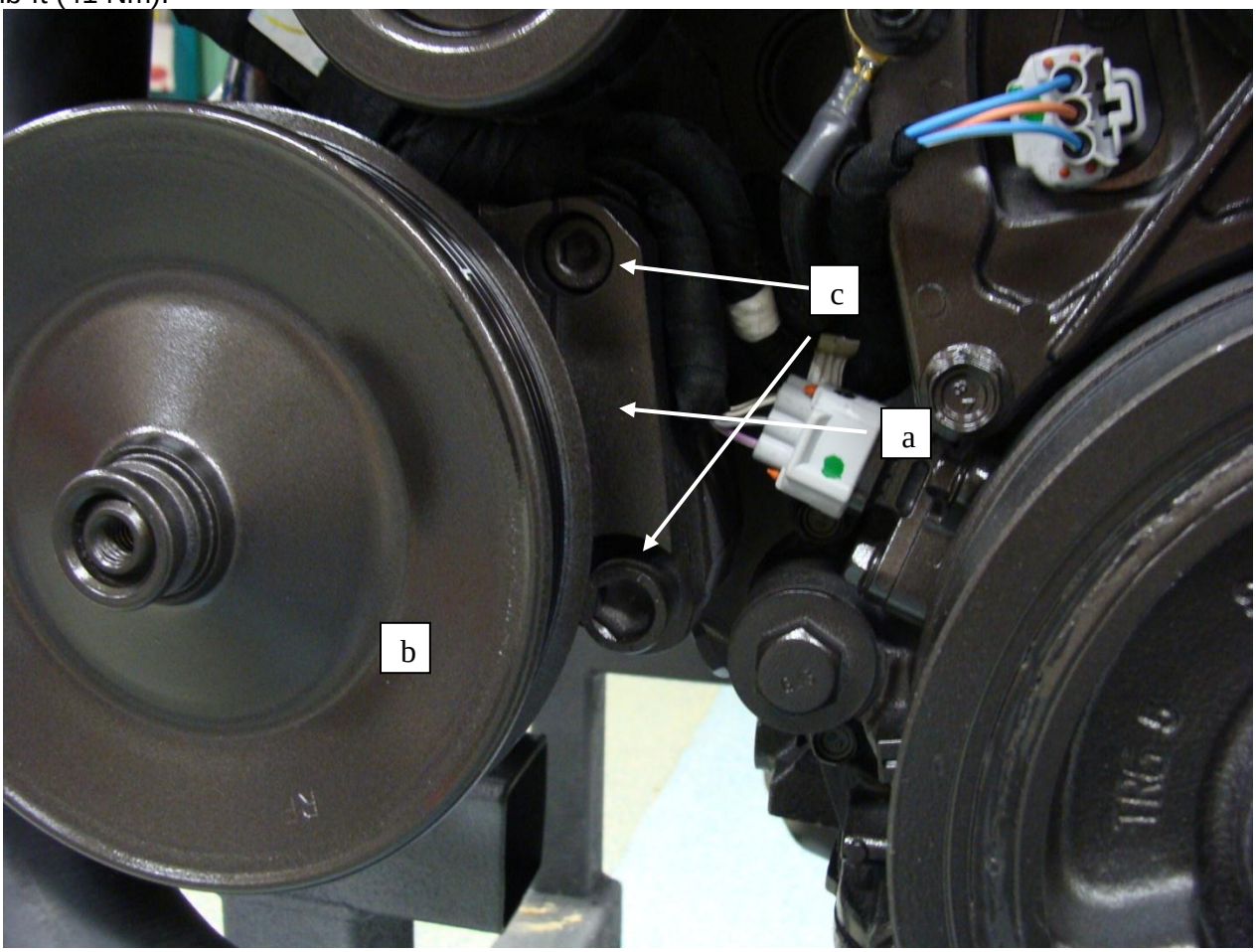
Seawater Filter

Strainer used, if equipped, must be of sufficient size to ensure that an adequate supply of water will be maintained for cooling the engine. Refer to *Specifications.*

Seawater strainer should be installed in an area where it will be easily accessible for inspection and cleaning. Strainer must be installed in water inlet hose after the seacock (water inlet valve) to allow operator to shut off water when cleaning strainer. Hose connections must be made with double hose clamps. Secure hose to prevent contact with any moving parts.

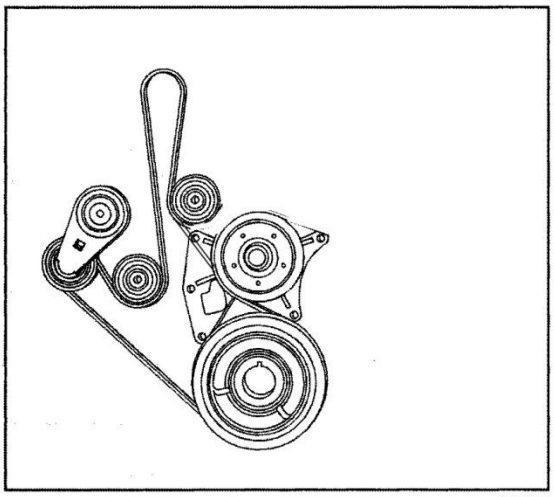
SEAWATER PUMP AND BRACKET

The seawater pump is installed and secured with hardware shown. Screws torque to 30 lb-ft (41 Nm).



a -Seawater Pump Bracket
b -Seawater Pump Serpentine Belt Pulley
c –10mm hex head bolt holding the bracket

DRIVE BELT ROUTING



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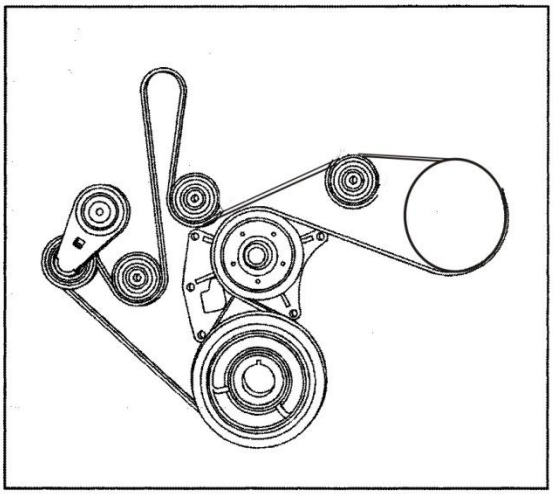
VGT without power steering



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VGT with Power steering

Water Heaters

Important Information

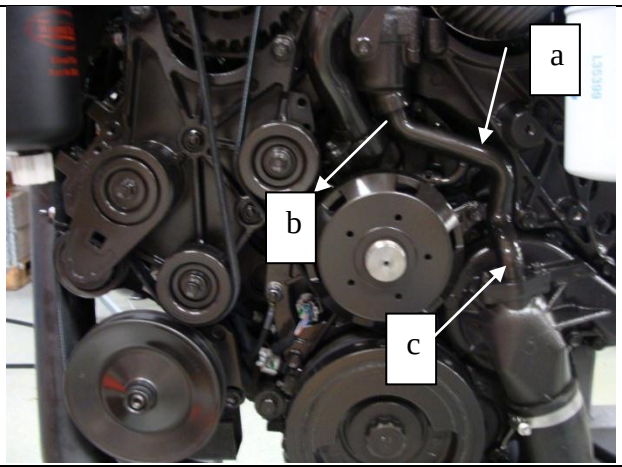
IMPORTANT: When connecting a cabin heater or hot water heater, certain requirements must be met:

- **Supply hose (from engine to heater) and return hose (from heater to engine) MUST NOT EXCEED 5/8 in. (16 mm) ID (inside diameter).**
- **Make heater connections ONLY at locations indicated in the following information.**
- **Do not reposition engine temperature switch; it must remain where installed by factory.**

CAUTION
Avoid performance loss and/or possible engine damage. Engine coolant must flow continuously from the engine intake manifold to the engine water-circulating pump. NEVER close off or block the coolant flow to or from a heater. All heater installations must be plumbed in series with the supply and return connections.

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

Hose Connection



To install a water heater or cabin heater you must purchase the optional water heater tube available from Marinediesel. This will replace the original bypasstube (a) installed on the engine**. If the optional tube is installed you must circulate water to the external heater and back to the engine or the engine can overheat thus voiding warranty. The heater must also be installed lower than the fill cap of the engines heat exchanger or the engine will overheat!**

a – water out to heater
b – water return from heater to engine

Section 6 – ELECTRICAL SYSTEM

Electrical Connections

Battery

GENERAL INFORMATION

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

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

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

Battery should be located as close to engine as possible.

Each engine requires it's own battery for normal operation. Failure to do this will cause an unstable voltage source. The alternator may not charge the battery properly if two engines are connected to a single battery. Battery leads should not be reversed (for example, positive to negative).

RATING
The various engine models have a variety of battery minimum rating requirements. Failure to meet these requirements may result in hard starting.

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

Select a battery that meets all of the following specifications:
- 12-volt marine type.
- Tapered post connectors or side terminal connectors are required.
- Battery required capacity rating of at least:

Engine (Cyl./Type)	CID (L)	Cranking Battery Minimum Required Rating Per Engine
All	6.6L	1050cca/1200 mca/200 Ah

Battery Cables

GAUGE

Battery cable gauge will change based on the length of the cable needed. Be sure to measure the length of the battery cables from battery to engine so the gauge can be determined by the chart shown.

Select proper gauge (size) positive (+) and negative (–) battery cables, using chart:

Cable Length Cable Gauge	
Up to 7-1/2 ft. (1.1m)	00 (70mm^2)
7-1/2 - 9-1/2 ft. (2.3-2.9m)	00 (70mm^2)
9-1/2 - 12 ft. (2.9-3.7m)	000 (95mm^2)
12 - 15 ft. (3.7-4.6m)	000 (95mm2)
15 - 19 ft. (4.6-5.8m)	0000 (120mm2)

CONNECTIONS

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

The positive battery cable is connected to the battery positive terminal (B+) stud on the starter motor.

The negative battery cable is connected to the ground on the engine block. All of these connection points must be unpainted to help ensure a good connection.

Accessories

CONNECTION POINT
Up to 3 accessory leads can be connected to the positive battery terminal (B+) stud on the starter motor. These leads must be equipped with the appropriate current overload protection. Refer to the ABYC standards or applicable industry standards for more information.

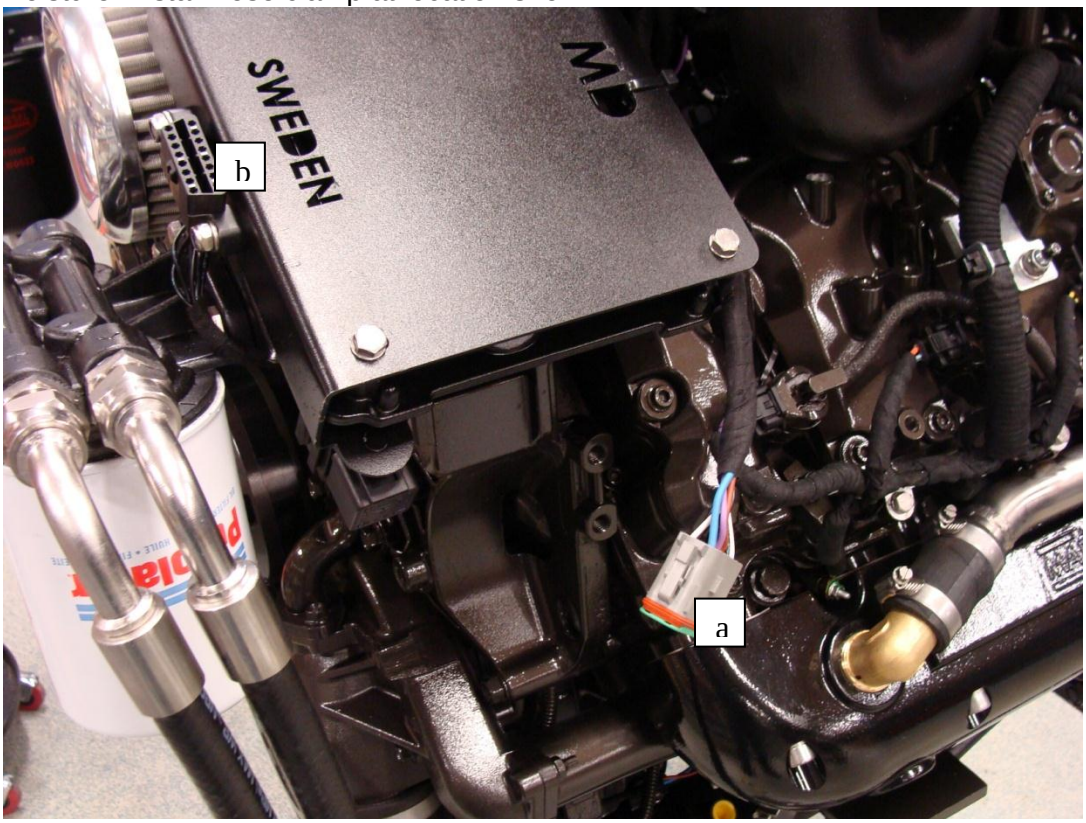
IMPORTANT: Do not attach any accessory ground (-) wires to engine block Accessory ground wires should only be attached to ground terminal (–) on battery.

WIRE GAUGE

Except for intermittent higher currents, each low tension (less than 50 Volts) wiring circuit must not carry a current greater than the allowable amount specified for the wire gauge and temperature rating. Refer to industry source material such as SAE J378 - *Allowable Amperage Of Conductors For Systems Under 50 Volts* and select the appropriate conductor size as required for the accessory.

Electrical Harness Plug

A plug receptacle is located on the engine that will allow the instrumentation wiring harness to be connected to the engine wiring harness. The receptacle is designed for Marinediesel wiring. A hose clamp is required to prevent separation and seal out moisture. Install hose clamp at location shown.



All Models w (B1 ECU)

a – Engine monitoring and starting panel harness connector

b - OBD diagnostics connector

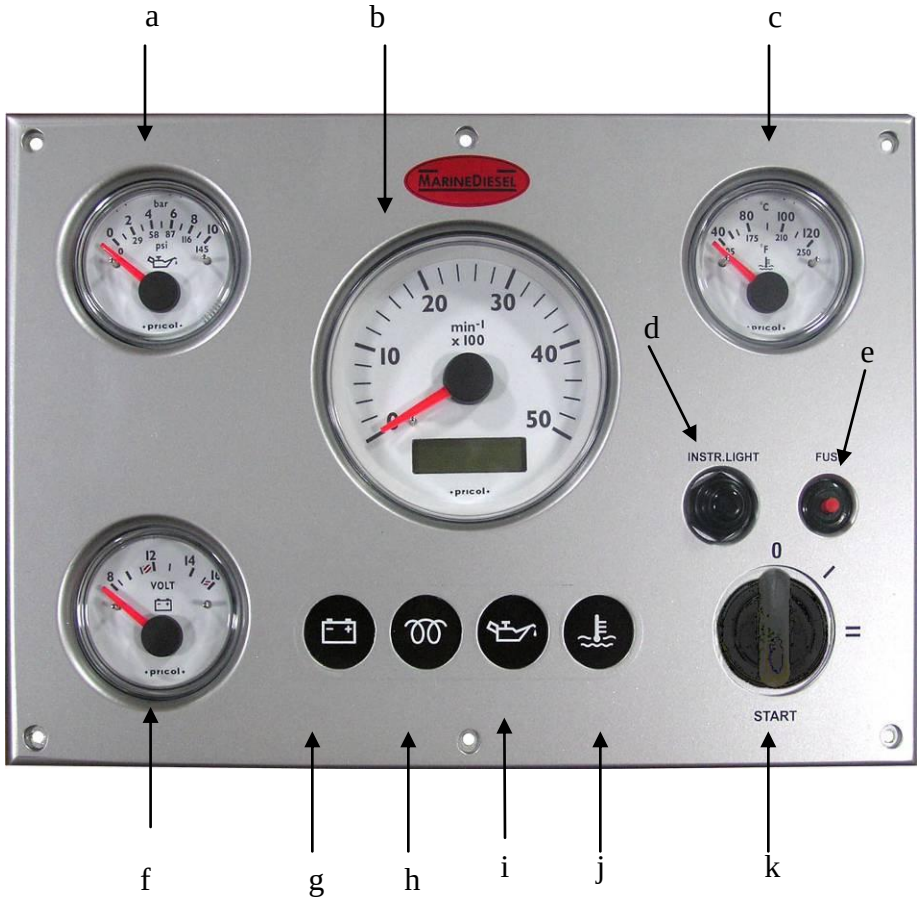
Warning System

From 2006 all Marinediesel engines are equipped with a panel integrated Warning System. The light and a audible buzzer comes on when engine oil pressure is too low or engine coolant temperature is too high.

If warning system is activated, immediately shut down the engine by turning the key to off position.

The installer will test warning system during Predelivery Preparation. Refer to SECTION 7 – *Predelivery*.

Engine monitoring panel (CAN based LCD display available as option)



Instrument Panel A-type (IP65)

Function	Standard
a – L.O. pressure meter	Yes
b – Tachometer with hour meter	Yes
c – C.W. temperature meter	Yes
d – Instrument light switch	Yes
e – Fuse	Yes
f – Volt charge meter	Yes
g – Alarm lamp/buzzer charging	Yes
h – Glow indicator lamp	Yes
i – Alarm lamp/buzzer L.O. low pressure	Yes
j – Alarm lamp/buzzer C.W. high temp	Yes
k – Key switch GLOW/ON/OFF/START	Yes

Typical Wire Color and Usage

NOTE: *Color codes listed below may not apply to current production harnesses in all cases.*

Color Code And Abbreviations	Where Used
BLACK	All Grounds
GRAY	Tachometer Signal (4 pulses per engine revolution, same as gasoline V8)
YELLOW/RED	Starter Switch to Starter Solenoid
RED	Battery to Ignition Switch (+12V)
PURPLE	Ignition ON
BROWN/BLUE	Warning light low oil press + water temp (grounds (-) when warning)
TAN	Water Temperature Sender to Gauge
BROWN/WHITE	Glow light (gives + when glowing)
BLUE	Oil Pressure Sender to Gauge

Section 7 - Predelivery

Predelivery Preparation

NOTICE
Before starting Predelivery, completely read and thoroughly understand this Owners/Applications Manual supplied with the engine package.

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

Battery Connection

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

1. Connect engine positive (+) battery cable from the starter motor (usually RED) to positive (+) battery terminal.
2. Connect engine negative (-) battery cable from engine block (usually BLACK) to negative (-) battery terminal.
3. Ensure that all battery terminal connections are tight, then spray terminals with a battery connection sealant to help retard corrosion.

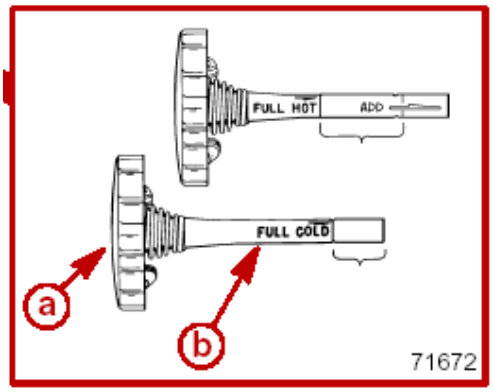
Power Steering

IMPORTANT: Use only Dexron III automatic transmission fluid (ATF) in power steering system.

CAUTION
DO NOT RUN POWER STEERING DRY, or pump will be damaged.

1. Position drive unit so that it is straight back.
2. Remove fill cap from power steering pump reservoir and check fluid level.
3. Add fluid (provided with power package) as required.

NOTE: *When first starting engine, be prepared to add fluid to pump.*



a -Fill Cap
b -Dipstick

WARNING
Do not leave helm unattended when making test with boat in the water.

1. Ensure that cooling system drain plugs, petcocks and hoses are installed and tight.
2. Check drive belt tension.
3. Test warning system.
4. Start engine and run at idle rpm until water temperature is normal.
5. Watch all gauges for normal readings.
6. Turn steering wheel starboard, then port and ensure steering unit or sterndrive unit turns the correct way.
7. Inspect engine compartment for water, oil, fuel and exhaust leaks.
8. Check power steering oil level.

   a. Turn steering wheel **left/port** until it stops and continue to apply pressure. If pump lugs (engine rpm drops and/or power steering pump tone changes), check the following.

      (1.)Check for an obstruction between gimbal ring and gimbal housing and all moving steering components.

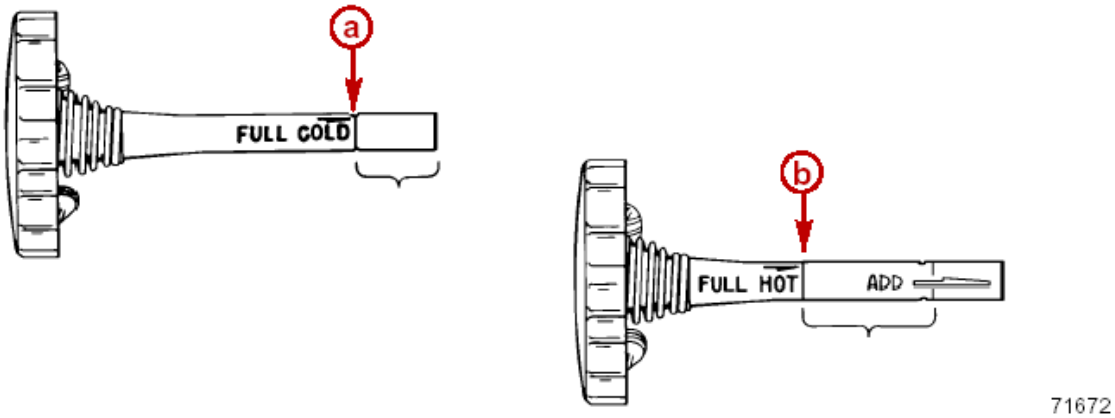
      (2.) Ensure steering lever is not contacting cutout in transom. If contact is being made, modify cutout.

   b. Turn steering wheel **right/starboard** until it stops and continue to apply pressure. If pump lugs (engine RPM drops and/or power steering pump tone changes), check the following.

      (1.) Check same items as (1.) and (2.) above.

      (2.) Check steering cable end dimension with cable FULLY EXTENDED.

11. Check power steering fluid level.
a. Turn engine OFF.
b. Remove cap/dipstick from power steering pump. Check fluid level and add as necessary.



Cap/Dipstick
a -Full When COLD Line
b -Full When HOT Line

Boat-In-The-Water Tests

CAUTION
Avoid engine damage. Ensure that cooling water is supplied to the engine if it will be operated with the boat out of the water. Connect 32mm supply direct to impeller pump.

ENGINE IDLE SPEED
Engine should idle at 600-700 rpm with engine at normal operating temperature. If idle speed is incorrect, proceed as follows:
1. Disconnect the throttle cable from injection pump.
2. Connect a shop tachometer to engine.
3. Start engine and place the remote control lever in NEUTRAL gear, idle position.
4. Adjust idle speed to current recommended rpm.
5. Stop engine. Readjust cable barrel and reinstall the throttle.

IMPORTANT: Throttle cable barrel must be adjusted properly.

WIDE OPEN THROTTLE TEST

IMPORTANT: To operate engine at full throttle before the break-in period is complete, follow this procedure.

- Start engine and operate at idle rpm until normal operating temperature is reached.
- Run boat up on plane.
- Advance engine rpm in 200 rpm increments, until engine reaches its maximum rated rpm.

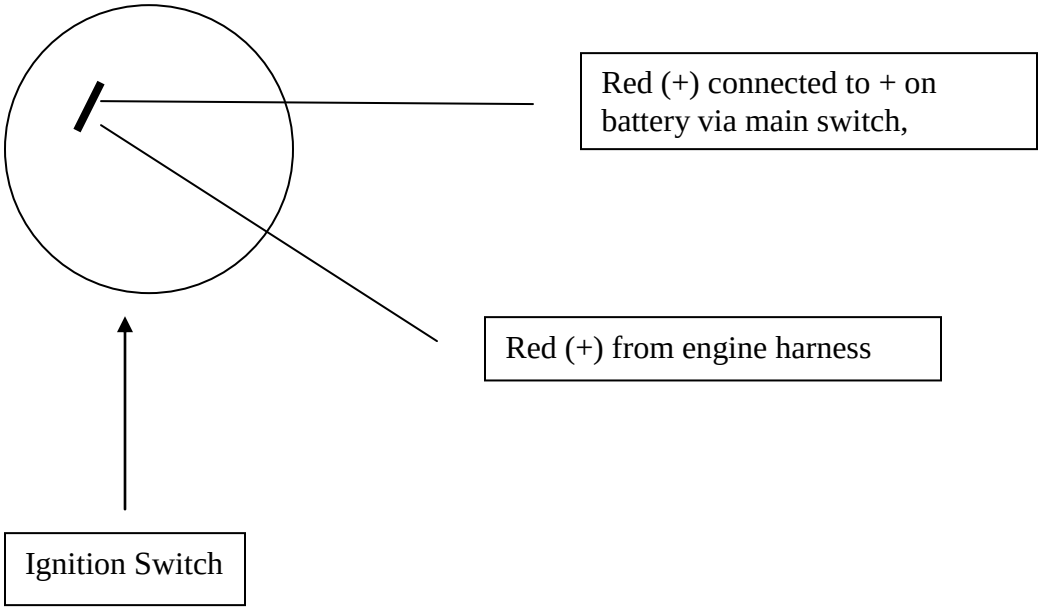
To test if the correct propeller has been installed, operate boat (with normal load on board) at WOT and check rpm with an accurate tachometer. Engine rpm should be near top of the specified range so that under a heavy load engine speed will not fall below specifications. If engine speed is too high, replace propeller with a higher pitch propeller. Normally, a
200-400 rpm change exists between propeller pitches.

---------- IMPORTANT INSTALLATION NOTES----------

These Notes are very important and the most common cause of problems historically on Marinediesel engines, for further information review Section 2, Installation of the Owners Manual.

- **Please make careful notes on mounting battery cables of the correct dimensions, failure to comply with this <u>will</u> make the engine difficult to start.**
- **<u>Engines are shipped without oil</u>, make sure you fill the engine with oil and check the level before starting. At the same time also ALWAYS check the supercharger oil and coolant levels.**
- **Engines delivered with remote oil filter relocators: Make sure you prefill the oil lines and oil filter before you start to prevent engine damage.**
- **Make sure you use minimum 5/16in (8mm) ID return hose, preferably 3/8in (10mm) I.D. , make sure that there is no restrictions and that the return fuel can flow freely into the top of the fuel tank. Improper installation of fuel return will cause hard starting, rough idle, high fuel consumption and poor engine performance.**
- **Make sure you use minimum 3/8" (10 mm) ID fuel feed hose/line and that this is of adequate quality so that it doesn't get flat from the fuel feed pump suction. If the fuel feed hose/line get flat from suction the engine will loose rpm and performance instantly even if it may not run rough.**
- **You MUST use double hose clamps on all fuel line fittings to prevent air penetrating into the fuel system.**
- **Do NOT use Teflon tape or other to seal fuel or oil fitting, use only Loctite 518 and use it on ALL fuel and oil fittings to prevent leakage or air-penetration into the fuel system.**
- **Make sure you have adequate ventilation for the fuel tank as the engine fuel system otherwise can cause vacuum in the tank. Improper ventilation will lead to hard starting and poor engine performance.**

- **Make sure the engine room is well ventilated or power loss may occur, se specifications in section 2, air intake system.**
- **When installing the engine extension harness it is important to connect the + main lead in this harness to the other electrical system under the instrument panel, this giving + a direct feed from the boats battery, this to ensure that not all power goes through the engine extension harness. This to prevent losses in the extension harness from the engine, failure to comply may result in glow system problems and severe engine damage.**



- **It is <u>HIGHLY</u> recommended that you use a separate 1 ¼" water intake for the engine and NOT the water pickup on sterndrives. Historical experience has indicated issues resulting in high engine temperature running conditions resulting from congested sterndrive inlets. We have found that adding the through hull inlet ensures adequate water flow to the engine and prevents issues arising in the future. The MARINEDIESEL warranty does NOT cover engine overheat related problems.**
- **It is HIGHLY recommended that the engine exhaust be run through the transom and NOT run exhaust through the sterndrive as this will lead to excessive backpressure.**
- **It is MANDATORY that all MARINEDIESEL engines are propped according to MARINEDIESEL recommendations. Over-propping of the boat induces excessive loading of the engine which will generate excessive exhaust temperatures and resulting reduction of engine longevity. Propping must be completed such that the engine is capable of achieving the specified maximum rpm rating, while loaded at the heaviest condition for the vessel. MARINEDIESEL's warranty does NOT cover any resulting issues related to over-propping.**

Predelivery Inspection Checklist **(required for warranty registration)**

Not Applic.	Check/ Adjust		Not Applic.	Check/ Adjust	
		Check before Running			**On the water Test**
☐	☐	Double hose clamps on all fuel lines, tightened	☐	☐	Starter neutral safety switch operation
☐	☐	Min 10mm ID fuel hose	☐	☐	Instruments operation
☐	☐	Min 8mm ID return hose	☐	☐	Oil leaks + oil pressure
☐	☐	Return hose exits at top of fuel tank, no restriction	☐	☐	Fuel leaks
☐	☐	Seawater inlet valve open	☐	☐	Water leaks
☐	☐	Engine mounts tight	☐	☐	Exhaust leaks
☐	☐	Engine alignment	☐	☐	Idle _____ RPM
☐	☐	Battery fully charged	☐	☐	Steering operation
☐	☐	Electrical connections tight	☐	☐	Forward – Neutral – Reverse gear operation
☐	☐	Throttle, shift and steering system fasteners tight	☐	☐	Hot start after 20min with engine off (heat soak)
☐	☐	Throttle opens fully and returns to idle position	☐	☐	Regular Hot start
☐	☐	Engine oil level	☐	☐	Cold start
☐	☐	Supercharger oil level	☐	☐	Acceleration from Idle
☐	☐	Power steering oil level	☐	☐	WOT _____ RPM
☐	☐	Freshwater cooling level	☐	☐	Boat handling

Not Applic.	Check/ Adjust		Not Applic.	Check/ Adjust	
		Check before Running			**After on water test**
☐	☐	Remote oil filter filled with oil, if applicable.	☐	☐	Fuel, oil, coolant, water and fluid leaks
☐	☐	Transmission/drive oil level + Belt tension	☐	☐	Oil and fluid levels
☐	☐	Diesel primed to mech fuel pump and fuel filter	☐	☐	Re-torque all clamps incl exhaust
☐	☐	Oil/temp alarm system operation	☐	☐	Re-check engine alignment
☐	☐	Fuel tank cleaned out and filled with diesel	☐	☐	Re-torque raiser bolts
☐	☐	Battery cables area _____mm2	☐	☐	First service after 2hrs, see owners manual
☐	☐	Height from top of exhaust raiser to water level _____mm	☐	☐	Remote oil filter gets warm showing that oil is circulating.
☐	☐	Engine room ventilation area _____m2	☐	☐	Power trim operation
☐	☐	Exhaust flaps to prevent water from entering engine	☐	☐	Remote oil level for drive
☐	☐	Fuel tank ventilation, check flow.	☐	☐	Any abnormal smoke from exhaust
☐	☐	Glow-system operation	☐	☐	Cooling hoses clamps tight
☐	☐	Water intake min 1 ¼” from separate intake not sterndrive (Y/N)_____	☐	☐	Power steering oil level

Not Applic.	Check/ Adjust		Not Applic.	Check/ Adjust	
		Check before Running			**After on water test**
☐	☐	Double hose clamps on all exhaust hoses, tightened	☐	☐	Go through warranty and service information with customer
☐	☐	Down angle on exhaust hose from raiser min 7deg	☐	☐	
☐	☐	Exhaust through drive? Y/N:_____	☐	☐	

Installation finish date DD/MM/YY:	_____
Boat Type/make/build year:	_____
Boat overall length:	_____
Boat weight:	_____
Installed MD engine serial no:	_____
Drive/gear including ratio	_____
Propeller diam/pitch/make:	_____
Cruise speed mph/knots@rpm:	_____
WOT mph/knots@rpm	_____
Installed by:	_____
Inspected by:	_____
Inspection date DD/MM/YY:	_____

_____ _____

Dealer/Installer's signature Customers's signature

THIS SIGNED DOCUMENT IS TO BE FAXED TO MD SWEDEN FOR WARRANTY TO GO INTO EFFECT. MD headquarters in Sweden fax nr. +46-431-12638

Cold Weather or Extended Storage Draining Instructions

The following precautions and important information are provided as a quick reference regarding the procedures and information found in the product's Installation Manual with respect to cold weather or extended storage.

CAUTION
If Engine Package will not be used for an extended period of time or will be exposed to freezing temperatures, drain water from seawater section of cooling system. Water MUST BE drained to prevent corrosion and freeze damage to engine.

CAUTION
If boat is to remain in the water, seacock, if so equipped, must remain closed until engine is to be restarted to prevent water from flowing back into seawater cooling system. If boat is not fitted with a seacock, water inlet hose must be disconnected and plugged to prevent water from flowing into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel with the warning that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.

IMPORTANT: Boat must be as level as possible to ensure complete draining of cooling system.

IMPORTANT: Marinediesel recommends that propylene glycol (a nontoxic and environmentally safe) antifreeze be used in the seawater section of the cooling system for cold weather or extended storage. Make sure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Be certain to follow the propylene glycol manufacturer's recommendations.