



Ford 6.2L Marine Engine

INSTALLATION MANUAL
PRELIMINARY COPY



Section 1

Introduction

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This installation manual has been written to provide boat manufacturers the necessary information, recommendations and requirements to properly install an Indmar engine.

It is the responsibility of the installer to select the proper engine for the given boat design. Indmar recommends that any new or different hull/engine combination be thoroughly tested before going on sale to confirm that the boat performs as desired and that the engine operates in the recommended rpm range. All information and specifications contained in this manual is the most recent information made available at the time the manual was published. Indmar reserves the right to make changes to the engine and/or components as a result of continually improving the product without obligation at any time.

Because of Indmar's commitment to continual product improvement, alterations may occur to the current model after the publication of the manual. The information provided covers the topics that are most important to ensure the correct installation of the Indmar engine.

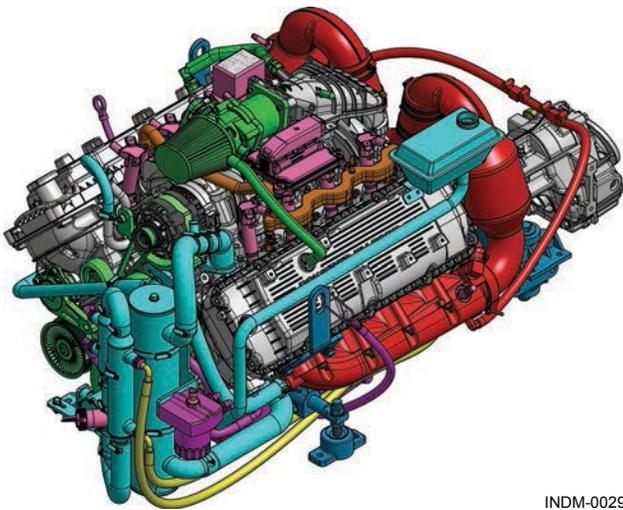
OEM/BOATBUILDER CONTACT INFORMATION

Sales Information

Scott Clack – Business Development Coordinator
Office Phone: 901-353-9930
Cell: 863-258-9301
E-Mail: sclack@indmar.com

Technical Information

Joe Cutberth – Director of Customer Service
Office Phone: 901-353-9930
Cell: 901-451-0656
E-Mail: jcutberth@indmar.com



INDM-0029

Figure 1-1



Section 2

Safety

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The words DANGER, WARNING, CAUTION and NOTICE are used throughout this manual to highlight important information. Be certain that the meanings of these alerts are known to all who work on or near the equipment.

Follow the safety information throughout this manual in addition to the safety policies and procedures of your employer.

This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

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.

NOTICE
<i>Indicates a situation which can cause damage to the engine, personal property and/or the environment, or cause the equipment to operate improperly.</i>

NOTE: *Indicates a procedure, practice or condition that should be followed in order for the engine or component to function in the manner intended.*

CARBON MONOXIDE GAS

DANGER
Carbon monoxide gas (CO) is colorless, odorless and extremely dangerous. All engines and fuel burning appliances produce CO as exhaust. Direct and prolonged exposure to CO will cause BRAIN DAMAGE or DEATH. Signs of exposure to CO include nausea, dizziness and drowsiness. Ensure adequate ventilation to prevent accumulation of CO in the boat.

Each year, boaters are injured or killed by carbon monoxide. Virtually all of these injuries and deaths are preventable. Carbon monoxide is a potentially deadly gas produced anytime a carbon-based fuel, such as gasoline, burns. Carbon monoxide sources on your boat include gasoline engines and generators, cooking ranges, space heaters and water heaters.

Do not confuse carbon monoxide poisoning with seasickness, intoxication or heat stress. If someone complains of irritated eyes, headache, nausea, weakness, dizziness or drowsiness, or you suspect carbon monoxide poisoning, immediately move the person to fresh air, investigate the cause and take corrective action. Seek medical attention if necessary.

Indmar engines are equipped with catalytic converters which significantly reduce harmful CO emissions.

For more information on carbon monoxide and boats, contact the US Coast Guard Office of Boating Safety at 1-800-368-5647 or www.uscgboating.org or your state boating law administrator at 1-800-225-9487 or www.nasbla.org.

FUEL

DANGER
Gasoline is extremely flammable and highly explosive under certain conditions. Explosive gasoline fumes may accumulate in the engine compartment. Failure to properly ventilate fumes with the bilge blower may result in explosive atmosphere.

Indmar marine engines use gasoline for fuel. The area under the engine and around the gasoline tank and supply lines is not open to outside air. Ventilation around these areas must be provided by your bilge blower system and air vents located around the boat. We recommend taking time out to carefully inspect your boat at least once a day for gasoline fumes, oil leaks, and areas where wiring may be worn or damaged.

⚠ DANGER

Never start the engine if a gasoline odor is present or if gasoline can be seen at any point along the fuel line, along the fuel tank, in the bilge or at the engine. Take care not to spill gasoline when fueling. Gasoline and its vapors can cause an explosion.

⚠ WARNING

Always operate the bilge blower at least 4 minutes prior to starting the engine. Raise the engine cover to ventilate fumes. Inspect the engine and compartment for any fluid or fuel leaks.

- Do not smoke or allow open flames or sparks nearby when refueling.
- Always stop the engine before refueling.
- Maintain contact between the fuel nozzle and the fuel tank or container to prevent electrostatic spark. Do not use a plastic funnel.
- Do not block fuel vents.
- Do not store fuel in any containers or compartments which are not designated for fuel storage and do not use these storage areas for any other purpose.

NOTICE

Always use a high-quality gasoline from a reputable source. Damage to the engine by use of low-quality gasoline or gasoline with an octane rating below the minimum level listed for Indmar engines will void the warranty on the engine.

LIFTING**⚠ WARNING**

Always make sure that all lifting components are free of abrasion, wear or defects prior to use. Damaged lifting components may cause the engine to fall and cause personal injury and engine damage.

VENTILATION AND EXHAUST**NOTICE**

Failure to provide adequate air flow for the engine compartment may result in loss of power, vapor lock of the fuel system and/or overheating of the engine.

NOTICE

It is the responsibility of the boat manufacturer or 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, severely damaging the engine. Damage caused by water in the engine will not be covered by Indmar warranty, unless this damage is the result of defective parts.

TRANSMISSION**NOTICE**

Failures or damage resulting from poor or inadequate alignment could result in damage to the boat engine, transmission or drive, which will not be covered under warranty.

BATTERY**⚠ DANGER**

Explosive battery fumes may accumulate in the engine compartment. While the engine is running or the battery is charging, hydrogen gas is being produced by a lead acid battery and can be easily ignited. Failure to properly ventilate fumes with the bilge blower may result in explosive atmosphere.

- Wear personal protective equipment when working on or around batteries.
- Do not smoke or bring a flame near a battery.
- Do not check for a dead battery by placing a metal object between the battery posts. Sparks could cause an explosion.
- Do not place your head directly above a battery when making or breaking electrical connections.

WARNING

- **Always connect the positive (+) battery cable first. After the positive cable is connected, then the negative (-) battery cable can be attached. This minimizes the possibility of electrical contact.**
- **Always disconnect the negative battery cable (-) first before disconnecting the positive battery cable (+). After the negative battery cable is disconnected, the positive battery cable can be disconnected. This minimizes the possibility of electrical contact.**
- **Never allow battery electrolyte to be spilled or placed on any part of the human body. Battery electrolyte fluid is dangerous. It contains sulfuric acid, which is poisonous, corrosive and caustic. If exposed to battery electrolyte, flush the area with large amounts of clean water and immediately seek medical attention.**

ENGINE OIL

WARNING

Wear protective equipment and use caution when checking and changing the engine oil. Engine oil may be hot.

- Prolonged and repeated contact with used engine oil may cause skin cancer.
- Avoid direct skin contact with used engine oil. If skin contact is made, wash thoroughly with soap or hand cleaner as soon as possible.
- Keep used engine oil out of the reach of children.

- Used engine oil is a hazardous material. Dispose of properly.

CLEANING SOLVENTS

WARNING

Always read and comply with the solvent manufacturer's recommendations for proper use and handling of solvents.

- Do not use gasoline, paint thinners or other highly volatile fluids for cleaning.
- Do not mix cleaning agents together; harmful vapors may be released.

ENTANGLEMENT

WARNING

Rotating or moving parts can entangle or sever body parts.

- Do not wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing.
- Tie long hair back when working near moving or rotating parts.
- Keep hands, feet and tools away from all moving parts.

ENVIRONMENTAL

NOTICE

Always be environmentally responsible. Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil and fuel. Consult the local authorities or reclamation facility.



Section 3

Important Information

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EMISSION-RELATED INSTALLATION INSTRUCTIONS

The following installation instructions must be followed to ensure proper operation of Indmar's certified exhaust emission control system.

Failing to follow these instructions when installing a certified engine in a vessel violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

A) Evaporative Emissions

The engine as shipped to you meets all evaporative emission requirements for engine manufacturers. You must connect to the engine fuel system with a fuel line that meets permeation requirements. You must also, as a vessel manufacturer, meet the requirements of 40 CFR 1045.112 and 40 CFR part 1060.

B) Diagnostic System

A visual or audible malfunction indicator must be installed at the helm. The malfunction indicator must be designed such that the operator can readily see or hear it; visible signals may be any color except red. Visible malfunction indicators must display "Check Engine," "Service Engine Soon," or a similar message that Indmar approves.

C) Label Requirements

If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the vessel, as described in 40 CFR 1068.105.

ENGINE BED

An engine mounting bed should be horizontal-type and strong enough to maintain engine alignment during operation of the engine. It must not be able to deflect or twist under any loads and conditions.

The engine bed consists of two stringers that will distribute the load and weight of the engine and transmission evenly. The stringers must be as wide or wider than the engine and transmission mounting isolators. Additional cross braces from the stringers to the hull may be necessary to prevent lateral engine motion. The engine bed must be positioned so that a minimum of 1/4" (6 mm) of vertical adjustment still exists on the engine mounts after final alignment; this will allow for future realigning of the engine.

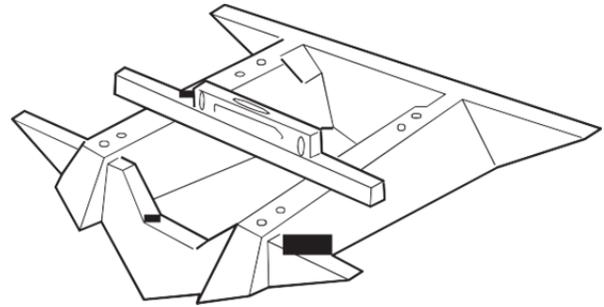


Figure 3-1

ENGINE MOUNTS

Front engine mounts must reside on the engine bed stringers and must be adjustable. Stainless-steel lag screws or bolts are to be used to secure the mounts to the stringers. Selection on grade and length of the mounting bolts will be based on stringer material and expected loading forces.

The rear engine mounts are installed on the transmission and will also bolt to the stringers using similar fasteners.

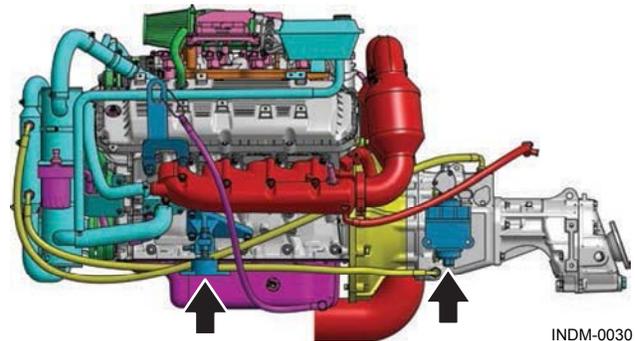


Figure 3-2

SERVICE POINTS

All engines will require preventive maintenance and will need to be serviced under the manufacturer's warranty. It is, therefore, recommended when designing and constructing a boat engine compartment that adequate space be allowed to access maintenance items and service components.

Areas of consideration include, but are not limited to, the following:

- Engine oil filter
- Fluid draining systems
- Starter

- Alternator and drive belt
- Ignition components
- Water pump
- Flushing ports
- Air intake filter

ENGINE COMPARTMENT VENTILATION

WARNING

Boating standards (NMMA, ABYC, etc.) and coast guard regulations must be strictly followed when constructing the engine compartment.

According to ABYC standards and the U.S. Coast Guard, the engine compartment ventilation system has several different jobs. First, it must supply the engine with the proper volume of combustible air. It must maintain an acceptable temperature in the engine compartment and vent fumes and heat from the area.

The engine compartment should be designed so that fresh air enters as low as possible and heated air is exhausted at the highest point possible. Per the ABYC standard, these openings must be separated by at least 24" (61 cm). Design and construction of the engine compartment must be performed in strict accord with the U.S. Coast Guard regulations (33 CFR Section 183, subpart J & K).

ENGINE COMPARTMENT TEMPERATURES

It is important that attention be given to the air temperatures inside the engine compartment while the engine is running and for a period of time after the engine is shut off. According to SAE specification J1223 for Marine Fuel Systems, temperatures in the engine compartment must not exceed 176°F (80°C).

NOTICE

If proper ventilation is not achieved, temperatures in the engine compartment may exceed recommendations and the engine fuel system may experience vapor lock.

COMBUSTION AIR REQUIREMENTS

Engine compartments designed to operate using natural draft ventilation must have vent openings of adequate size and location to supply the engine with a sufficient supply of combustible air.

Combustion Air Requirements and Ventilation Information at WOT: 670 ft³/min (0.320 m³/sec)

This is the amount of air required for complete combustion, not the total engine compartment ventilation requirements.

ENGINE COMPARTMENT PRESSURE DIFFERENTIAL

Engine compartment pressure must be measured using a manometer. This test must be performed on a production standard boat, equipped as it would be when it is delivered to the customer.

The test meter must be of the type that can take measurements remotely during the test without requiring the engine cover to be opened.

FUEL SYSTEM REQUIREMENTS

WARNING

Boating standards (NMMA, ABYC) and coast guard regulations must be adhered to when constructing the fuel delivery system.

FUEL DELIVERY SYSTEM

All fuel lines used must meet U.S. Coast Guard specification USCGA Type A1 or better. The fuel system feed line (high pressure) must be at least 3/8" (10 mm) inside diameter, sheathed in some type of armor and capable of withstanding a minimum of a 100 psi (689 kPa) impact.

The return line must be at least 5/16" (8 mm) inside diameter and capable of withstanding at least 25 psi (172 kPa) pressure minimum. The fuel return line must terminate at the top of the fuel tank, with no dip tube extending into the tank. Hose construction with a PTFE (Teflon) liner is preferable.

All pressure hoses used with in-tank pump systems should be sheathed in some type of armor and preferably encapsulated in a fire sleeve.

All fuel lines must be routed so as to not contact any hot engine components and should be run as low in the bilge as possible to take advantage of cooler ambient temperatures found there. Sharp bends in fuel lines must be avoided.

Fuel lines should be positioned to prevent stress on the line, and all lines must be anchored to prevent vibration and/or rubbing.

If the boat is powered by multiple engines, a separate fuel supply and return line is required for each engine. No worm gear-type hose clamps are to be used anywhere in the fuel system. All high-pressure fuel lines must use a mechanical connection to terminate the fuel line at the fuel pump and the fuel rail.

The fuel pump must be an in-tank design capable of delivering enough fuel volume and pressure to fulfill the specific engine installation requirements.

An in-tank design pump is required; however, this style of pump must be exempted by the coast guard regulation. The fuel pump should be mounted below the level of the fuel system on the engine.

FUEL DELIVERY SYSTEM REQUIREMENTS

All Indmar/Ford-based engines are designed to run with fuel pump-in-tank fuel systems. The fuel delivery requirements are as follows:

- Models 400 and 440: 35 gallons/hour @ 4 bar (58.8 psi)
- Model 575: 55 gallons/hour @ 4 bar (58.8 psi)

EXHAUST SYSTEM REQUIREMENTS

When designing and installing an exhaust system, Indmar recommends the following:

- Exhaust fittings must be equipped with internal or external flapper valves to prevent water from entering the engine through the exhaust.
- Exhaust hoses must have a minimum of 4" (10 cm) of vertical drop between the elbow outlet and the exhaust outlet of the boat.
- Exhaust hose must have a minimum of 6 degrees of downward slope, measured using an inclinometer, between the exhaust elbow outlet and the exhaust outlet of the boat.

- The exhaust outlet height must be at least 1/2" (13 mm) above the water line with the boat fully loaded and at rest in the water.
- The exhaust hose drop must be continual so that no low spots exist at any point in the system. Low spots will collect water and can cause engine damage if water is ingested into the engine.

COOLING SYSTEM REQUIREMENTS

Indmar engines come with either fresh water or closed cooling systems.

In closed cooling systems, the engine is cooled by a mixture of antifreeze and water. Cooling systems must be designed and sized appropriately to provide the engine with an adequate supply of water under all operating conditions.

The cooling system pickup must be capable of flowing 30 gallons per minute (114 liters per minute). It must supply a positive head while underway. It is best to mount the pickup as close to the water pump as possible and in an area where an uninterrupted solid stream of water is available.

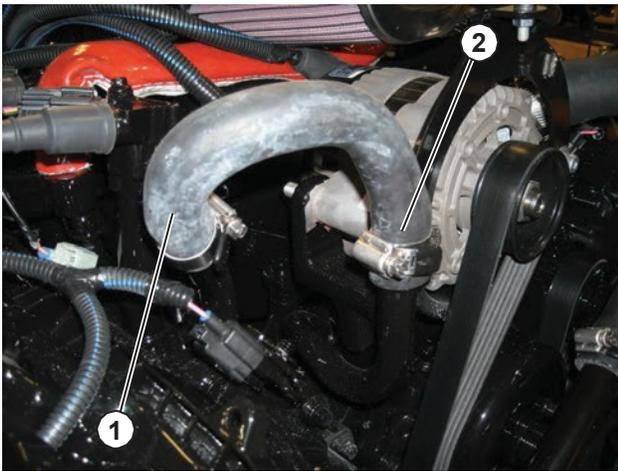
NOTICE

Do not install the pickup directly in line with the propeller. This can cause cavitation at the propeller and will adversely affect boat performance.

The pickup hose must be of at least 1.25" (32 mm) in inner diameter and wire-reinforced. If a seacock is to be used, it must also be at least 1.25" (32 mm) in inner diameter. If a sea strainer is used, it must be capable of flowing 30 gallons per minute (114 liters per minute).

It is very important to have the correct coolant type and level maintained in the engine at all times. Propylene-glycol, environmentally friendly antifreeze mixed at a 50/50 ratio with water will produce the best results.

Auxiliary water heater connections must be made only at specified locations. The supply and return hoses must be 3/4 in inside diameter.



INDM-0031

Figure 3-3

1 - Heater Outlet 2 - Heater Return

There is a looped jumper hose on the engine that must be removed for cabin heater installation. It will be necessary to bleed air from the heater loop to ensure a steady flow of coolant through the heater and engine.

NOTICE

Never install block-offs or close-off valves in the heat exchanger lines. Engine coolant must flow continuously from the engine to the heat exchangers and return to the engine.

NOTICE

Never install the heat exchanger higher than the coolant fill cap on the expansion chamber. Air bubbles could be trapped in the system, resulting in an overheating situation. Engine damage resulting from improper water heater installation will not be covered under the Indmar warranty.

ELECTRICAL SYSTEM

⚠ WARNING

Boating industry standards (ABYC, NMMA), federal standards and coast guard regulations must be followed when installing a battery. Ensure the battery cable meets all pull test requirements and the positive terminal is properly insulated. In some states, the battery must be housed in a battery box or enclosed case. For more information, refer to local regulations.

ENGINE WIRING

Engine control is accomplished through the use of an electronic control module (ECM). This controller is capable of monitoring the various engine sensor inputs and precisely controlling ignition and fuel for improved performance and reduced emissions.

Before adding any accessories to the electrical circuit, verify amp load and voltage drop for each accessory to avoid an overload of the electrical system.

The accessory load circuit is rated for 30 amps only.

NOTICE

Do not overload this circuit. Any damage caused by overloading this circuit will not be covered under the Indmar engine warranty and may void the warranty of certain components.

AUDIO AND VISUAL WARNING SYSTEM

Indmar engines must be equipped with an audible and visual warning system.

The audible system must sound a warning when:

- Engine oil pressure is too low
- Engine temperature is too high
- Drive oil temperature is too high

Select a location for the audio warning buzzer that meets all the following requirements:

- Easily heard, yet out of sight
- Accessible for repair or maintenance
- Protected from the environment

SECTION 3

Mount the buzzer and wire it to 12V + on the switched side of the ignition. No voltage should be present at the buzzer when the ignition is in the OFF position. It is also necessary to provide the ECM with a malfunction indication lamp. This lamp will illuminate whenever a failure with the engine control system occurs. It is the manufacturer's responsibility to install this warning system and the dealer's responsibility to test the operation before retail sale.



Section 4

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GENERAL SPECIFICATIONS

Number of Cylinders	8
Displacement	376 cid (6.2 L)
Bore	4.015" (102 mm)
Stroke	3.74" (95 mm)
Compression Ratio	9.8:1
Compression Pressure	Minimum 100 psi (690 kPa)
Idle RPM in Neutral	650 RPM
Operating Range at WOT	5000-5400 RPM
Oil Pressure at Idle	8 psi (55 kPa)
Oil Filter	Indmar P/N 501021
Fuel Pump Pressure	60 psi (414 kPa)
Electrical System	12V DC Negative (-) Ground
Minimum Battery Requirements	650 CCA/700 MCA/ 120 AH
Firing Order	1-5-4-8-6-3-7-2
Spark Plug Type (16 Plugs Required)	597037
Spark Plug Gap	0.044" (1.12 mm)
Thermostat	160°F (71°C)

FLUID CAPACITIES

Closed Cooling System	12-14 qt (11.4-13.3 L)
In-Line 1:1 Transmission	1.7 qt (1.6 L) ATF
In-Line Reduction Gear	2.12 qt (2 L) 15W40 Motor Oil
ZF Ski Vee Transmission	2.12 qt (2 L) Main Gearbox, 1.0 qt (1.06 L) V-Drive - ATF
ZF V-Drive Transmission	4.2 qt (4 L) 15W40 Motor Oil
Walter V-Drive	0.5 qt (0.5 L) 15W40 Motor Oil

RECOMMENDED FILTERS/FLUIDS AND LUBRICANTS

Engine Oil		
6.2L Ford-Based Engines (Synthetic Blend)	Indmar 5W30 P/N 872004	Case of Quart Bottles (12)
	Indmar 5W30 P/N 872005	Case of 7-Quart Bottles (3)
Oil Filters		
6.2L Ford-Based Engines	Indmar P/N 872012	Case of Quart Bottles (12)
Fuel Treatment/Stabilizer		
6.2L Ford-Based Engines	Indmar P/N 872008	Case of 6 (20 oz)
Fuel Filter		
6.2L Ford-Based Engines	Indmar P/N 556003	Individual Filter
Coolant		
6.2L Ford-Based Engines	Indmar P/N xxxxxx	xxxxxx
Transmission Oil		
Indmar V-Drive (Shifting Transmission) (Multipurpose ATF)	Indmar P/N 872006	Case of Quart Bottles (12)
Indmar V-Drive (V-Drive) (Synthetic 50 Transmission Oil)	Indmar P/N 872009	Case of Quart Bottles (12)
Indmar In-Line Transmission (Multipurpose ATF)	Indmar P/N 872006	Case of Quart Bottles (12)

SPECIAL TOOLS

Diacom Diagnostic Software	Indmar P/N 997422U-2
Oxygen Sensor Socket Offset	Indmar P/N 996747
Fuel Pressure Test Adapter (6.2L Ford)	Indmar P/N 605121FP



Section 5

Engine Installation

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ENGINE LIFT POINTS/METHOD

! WARNING

Always include the weight of the engine, components and lifting device to ensure the lifting equipment capacity is not exceeded.

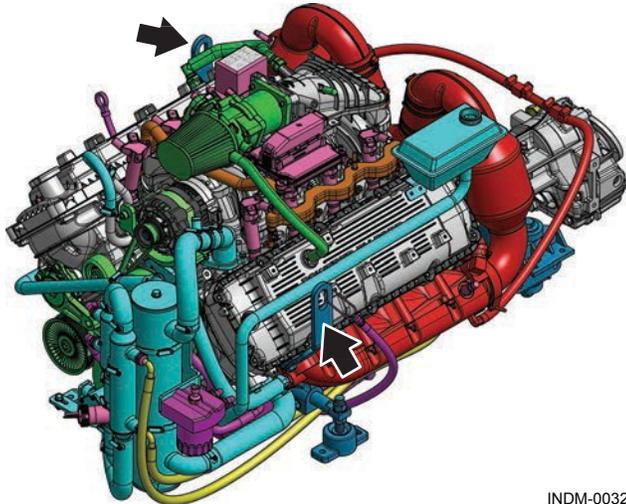
! WARNING

Always inspect all lifting devices and hardware for wear or defects before attempting to lift the engine. Always attach the lifting device to the approved lifting points on the engine when lifting.

1. Locate the lifting eyes on the engine.

! WARNING

Always make sure that all lifting components are free of abrasion, wear or defects prior to use. Damaged lifting components may cause the engine to fall and cause personal injury and engine damage.



INDM-0032

Figure 5-1

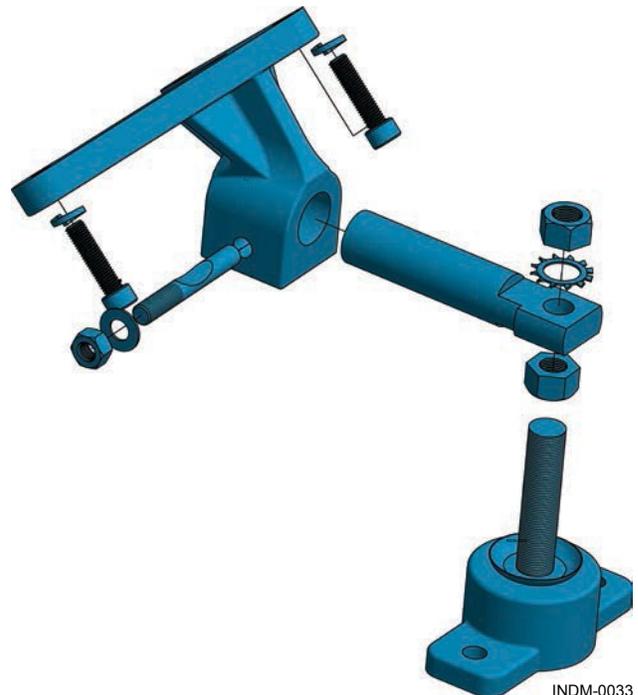
2. Attach the lifting hooks from the lifting device to the lifting points on the engine.
3. Make sure the lifting hooks are secured to the lifting eyes and that the chains and/or straps are not tight against any engine components.
4. Lift the engine into place, taking care not to scratch or damage the surface of the boat.

5. Position the engine on the engine bed so that the propeller shaft protrudes through the transmission output flange coupling and the engine mounts are resting on the stringers.
6. Install the propeller shaft coupling, and then position the engine so that the couplings are visibly aligned. No gap can be seen between the coupling faces when butted together. If necessary, adjust the engine bed height to obtain proper alignment.

NOTICE

Do not use the engine mount adjustments to adjust the engine position at this time.

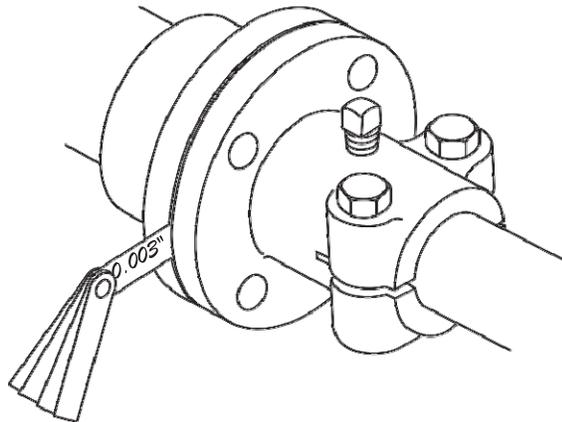
7. Let the engine settle in the hull for 24 hours before performing final alignment. This final measurement must be performed with the boat in the water, with a normal load on board. After waiting at least 24 hours, adjust the engine and transmission mounts properly to ensure correct alignment of the output shaft flange on the transmission and the prop shaft flange.



INDM-0033

Figure 5-2

8. If the maximum feeler gauge that can slip between the flange faces at any point is 0.003" (0.08 mm), the unit is properly aligned. If a thicker gauge can be inserted at any point, the engine must be readjusted until proper alignment is obtained.



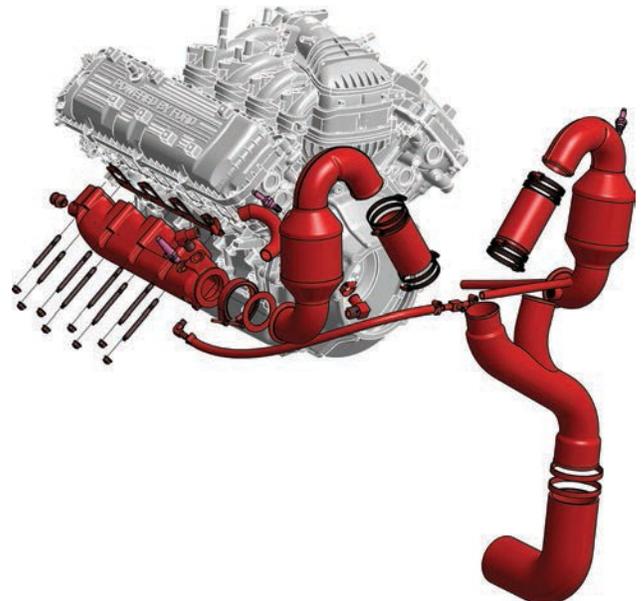
INDM-A037

Figure 5-3

PROPELLER SELECTION

It is the responsibility of the boat manufacturer to install the correct propeller on the prop shaft. The correct propeller will allow the engine to operate at or near the top end of the recommended RPM operation range. The general rule for propeller sizing is that a 2" (5 cm) pitch change will change the engine RPM by 200-300. For better acceleration, such as that needed when pulling skiers, it may be necessary to use a lower pitch propeller. Determine what the boat will be used for when choosing the propeller to get the best overall performance from your Indmar engine.

PLUMBING



INDM-0034

Figure 5-4

SEAWATER HOSES



Figure 5-5

EXHAUST HOSES



Figure 5-6

FUEL LINES



Figure 5-7

CABLES/WIRES

Supplied by OEM. See OEM for installation information.

SHIFT CABLES

Supplied by OEM. See OEM for installation information.

THROTTLE WIRE CABLES

Indmar has available throttle by wire cables in various lengths. Contact Indmar for specific requirements.



Section 6

Electrical Connections

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BATTERY

⚠ WARNING

Always connect the positive (+) cable to the battery first and the negative (-) cable last. Always disconnect the negative (-) cable from the battery first and the positive (+) cable last.

The engine electrical system is a 12-volt negative ground system. It is important that the battery meet all the following minimum specifications.

650 CCA/825 MCA/150 amp-hour rating

Use only a 12-volt marine type battery. Do not use a battery with wing nut terminals. The battery may incorporate a top or side post mounting style. The battery should be mounted as close to the engine as possible. Multiple engine installations will require a separate battery for each engine. It is recommended that the engines be grounded together using a cable of adequate gauge. Battery cable gauge will be determined by the length of the cable needed. Both the positive (+) and negative (-) cables must be the same gauge. Select the proper gauge based on the chart.

Cable Length	Cable Gauge
Up to 3-1/2 ft	4
3-1/2 to 6 ft	2
6 to 7-1/2 ft	1
7-1/2 to 9-1/2 ft	0
9-1/2 to 12 ft	00
12 ft to 15 ft	000
15 to 19 ft	0000

ENGINE WIRING

Engine control is accomplished through the use of an electronic control module (ECM). This controller is capable of monitoring the various engine sensor inputs and precisely controlling ignition and fuel for improved performance and reduced emissions.

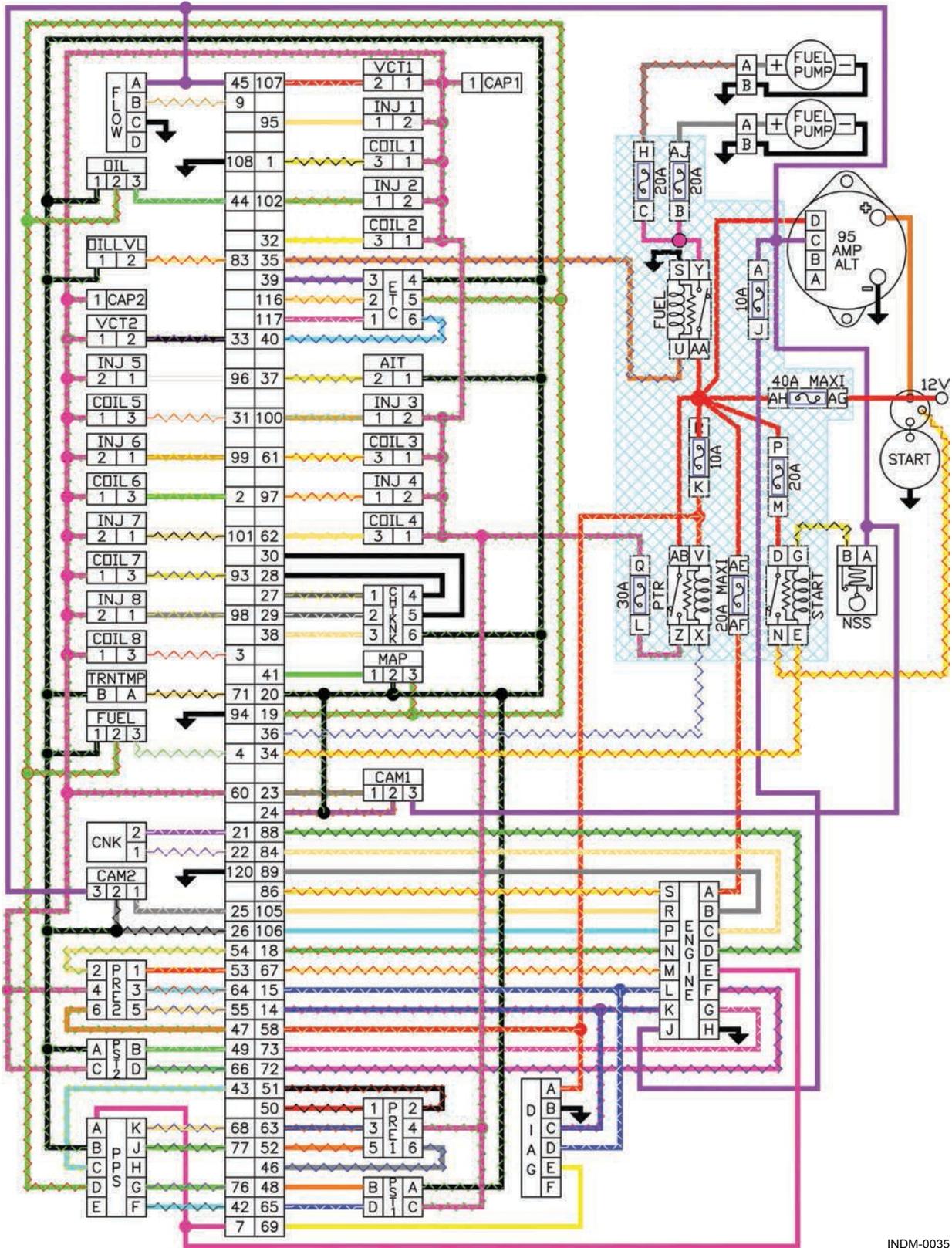
NOTICE

Do not attempt to access the ECM data without the use of approved service tools. Otherwise, damage to the ECM will result.

The ECM also provides a CAN bus communication line that can supply the instrumentation and other accessories used on board the boat with data and information.

When installing the instrumentation harness back to the engine, ensure the harness is routed so it will not rub through and cannot be pinched. Fasten the harness to the boat at least every 18" (46 cm) using the appropriate fasteners.

WIRING DIAGRAM 6.2L FORD



INDM-0035

Figure 3-1

SECTION 6

INDMAR ECM 120-PIN CONNECTOR

PIN	Function	Color	PIN	Function	Color	PIN	Function	Color	PIN	Function	Color
1	Coil 1	YW/BK	31	Coil 5	WE/OE	61	Coil 3	YW/RD	91	NA	
2	Coil 6	GN/YW	32	Coil 2	YW/TN	62	Coil 4	TN/YW	92	NA	
3	Coil 8	WE/RD	33	CamPhase2	BK/PE	63	Pre O2 1	LTBE/OE	93	Coil 7	YW/LTBE
4	Fuel Press	WE/LTGN	34	Start Out	YW/RD	64	Pre O2 2	LTBE/RD	94	Ground	BK
5	NA		35	Fuel Pump	OE/BE	65	Post O2 1	LTBE/WE	95	Injector 1	TN
6	NA		36	Power Relay	WE/LTBE	66	Post O2 2	GN/PE	96	Injector 5	WE
7	Fuel Level	PK	37	Air Temp	YW/GY	67	Buzzer	TN/RD	97	Injector 4	TN/RD
8	NA		38	Head Temp	TN/WE	68	MIL	TN/BK	98	Injector 8	GY/YW
9	Water Flow	WE/TN	39	TPS1	PE/LTBE	69	Master	YW	99	Injector 6	BN/YW
10	NA		40	TPS2	LTBE/BE	70	NA		100	Injector 3	BN/LTBE
11	NA		41	MAP	LTGN	71	Tran Temp	TN/BK	101	Injector 7	TN/BK
12	NA		42	PPS1	LTBE/BK	72	Cruise +	PK/BK	102	Injector 2	LTGN/OE
13	NA		43	PPS2	LTBE/YW	73	Cruise -	PK/WE	103	NA	
14	CAN +	BE/PK	44	Oil Press	GN/WE	74	NA		104	NA	
15	CAN -	BE/WE	45	Ignition	PE	75	NA		105	Temp Gauge	TN
16	NA		46	Pre O2 1	GY/LTBE	76	5V 2 Pos	LTGN/PE	106	Oil Gauge	LTBE
17	NA		47	Pre O2 2	OE/LTGN	77	5V 2 Gnd	LTGN/BK	107	CamPhase1	RD/WE
18	Paddle	GN/RD	48	Post O2 1	OE	78	NA		108	Ground	BK
19	5V Pos	LTGN/RD	49	Post O2 2	GN/WE	79	NA		109	NA	
20	5V Gnd	BK/LTGN	50	Pre O2 1	RD/BK	80	NA		110	NA	
21	Crank +	PE/WE	51	Pre O2 1	BK/RD	81	NA		111	NA	
22	Crank -	WE/PE	52	Pre O2 1	OE/RD	82	NA		112	NA	
23	CAM1 +	GY/BN	53	Pre O2 2	RD/YW	83	Oil Level	TN/RD	113	NA	
24	CAM1 -	PE/OE	54	Pre O2 2	TN/GN	84	Cruise	TN/WE	114	NA	
25	CAM2 +	GY/WE	55	Pre O2 2	TN/LTBE	85	NA		115	NA	
26	CAM2 -	GY/BK	56	NA		86	Start In	YW/RD	116	ETC -	TN/OE
27	Knock1 +	BK/YW	57	NA		87	NA		117	ETC +	PK/WE
28	Knock1 -	BK	58	Battery	RD/TN	88	Cruise Ind	LTGN/BK	118	NA	
29	Knock2 +	BK/WE	59	NA		89	Tach	GY	119	NA	
30	Knock2 -	BK	60	Relay Sense	PK/GN	90	NA		120	Ground	BK

Color Chart:

BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
OE	Orange

PE	Purple
PK	Pink
RD	Red
TN	Tan
WE	White
YW	Yellow
LT	Light

Modifier:

ENGINE TO HELM CONNECTIONS

TBD



Section 7

Installation Checklist

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SECTION 7

BOAT BUILDER CHECKLIST (AUDIT) FORM

Customer	
Boat Model	
Date	
Customer Rep	
Indmar Rep	

CHECK ALL BOXES THAT APPLY

COOLING

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Connection- Main Water pickup Engine to Boat Location				
Connection- Main Water pickup Engine to Boat Size				
Location- Expansion Bottle				
Location- Heat Exchanger				
Location- Oil Cooler				
Location- Transmission Cooler				

ELECTRICAL

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Alarm Circuit				
Analog Data- Charging \geq 14 VDC				
Analog Data- Coolant Temp				
Analog Data- Fuel Level				
Analog Data- Oil Pressure				
Analog Data- Vessel Speed (Paddlewheel)				
Battery Connection- Ground				
Battery Connection- Positive				
Harness Connector- Fuel Level				
Harness Connector- Main Engine Connection				
Harness Connector- Vessel Speed (Paddlewheel)				
Ignition Circuit				
J1939 Engine Data to Dash				
Start Circuit- Transmission in neutral/Engine Start				
Start Circuit- Transmission in gear/ NO Engine Start				

ENGINE

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Clearance- Engine Cover				
Clearance- Engine to Engine Compartment Bow side				
Clearance- Engine to Engine Compartment Port side				
Clearance- Engine to Engine Compartment Starboard side				
Clearance- Engine to Engine Compartment Stern side				
Clearance- Oil Dipstick				
Clearance- Oil Filter				
Clearance- Raw Water Pump				

EXHAUST

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Clearance- Exhaust to Engine Hatch				
Clearance- Muffler				
Fitment- Exhaust Tips				
Installation- Clamps				
Location- Exhaust Exit				
System- Total Exhaust ΔP				

FUEL SYSTEM

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Fuel Connection- Fitting Size				
Fuel Connection- Line clamps and supports				
Fuel Connection- Location On Engine to Boat				
Fuel Pump Placement - In Tank				

MOUNTS

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Location- Engine Mounts				
Location- Transmission Mounts				
Installation- Adjustment of Engine Mount				
Installation- Adjustment of Transmission Mount				
Installation- Attachment of Engine Mount to Stringer				
Installation- Attachment of Transmission Mounts to Stringer				

MISC

DESCRIPTION	APPROVED	DISAPPROVED	N/A	NOTES
Customer Logo				
Customer Logo Location				
Paint Colors				
Owners Manual- Electronic				

APPROVED	
APPROVED WITH CHANGES	
NOT APPROVED	
CUSTOMER SIGNATURE	

Rev 3-4/7/14

PRE-DELIVERY INSPECTION/CHECKS

Pre-delivery inspection ensures the safety and reliability of Indmar engines. It provides the retail purchasers with the peace of mind that their new boat has been inspected and tested for proper operation before delivery. Indmar recommends that the inspection be done in a timely manner, allowing time for repairs that may be necessary prior to the retail delivery of the boat. The inspection is carried out in two stages. Stage one is a static, pre-operational inspection. Stage two is a sea trial/operational inspection performed with the boat in the water and underway. After completion of the inspection, it is very important to complete the inspection form and warranty registration and return it to Indmar within 10 days of retail delivery.

Stage One – Static Inspection

1. Record the engine and transmission model and serial numbers.
2. Check the engine for service updates, recalls and calibration changes that are located on the Indmar Website??
3. Record the diameter, pitch and direction of rotation of the propeller. Also verify proper torque of the engine and transmission mounting bolts and other installed hardware.
4. Check for fuel and oil leaks. Visually and manually touch each fuel and oil line to check for leaks. Note the location of any leaks and correct the deficiencies.

NOTICE

The fuel tank and lines to the engine are selected and installed by the boat manufacturer, not Indmar. Any leaks associated with this part of the fuel system should be corrected at the direction of the boat manufacturer and are not an Indmar warranty item.

5. Visually inspect all the wiring in the engine compartment. Check to ensure that all the engine wiring harness connectors are plugged in and seated completely. Inspect the remaining wiring in the engine compartment for proper routing and connections. Make sure all harnesses are not touching any hot engine components.

NOTICE

The wiring harness coming from the boat to the engine is fabricated and installed by the boat manufacturer, not Indmar. Any problems associated with this part of the wiring system should be corrected at the direction of the boat manufacturer and are not an Indmar warranty item.

6. Engine and transmission oil levels must be verified prior to engine operation. Levels must be at correct operating range.
7. Check the cooling and exhaust hoses for proper connections. Attach any hoses removed for winterization. Inspect all hoses for proper routing, rubbing and cuts. If the engine is equipped with a hull seacock, ensure the hull seacock is in the open position.
8. Install and tighten all drain plugs. If the engine drain plugs have been removed for shipping or winterization, coat all drain plugs with Loctite PST pipe sealant with Teflon and insert them into each drain location. Do not over tighten drain plugs. Damage to the plugs and threads may occur.
9. Check the drive belt for proper alignment and tension. Also inspect the belt and pulleys for damage.
10. Check the battery for proper installation. The battery must be secured and not able to move around when the boat is in operation. Check to make sure the battery is properly charged.
11. Check the shift and throttle controls for proper operation. They should move freely with no sticking or binding. The boat manufacturer selects and installs the throttle and shift control cables. Please follow their recommended procedure for verifying proper installation and operation.

NOTICE

Improper adjustment of the throttle and shift controls can cause engine and/or transmission damage. Damage resulting from the improper installation and adjustment of these cables is not covered under Indmar warranty.

Stage Two – Sea Trial / Operational Inspection (Boat in the Water Tests)

NOTE: Engine alignment must be checked at this time with the boat in the water, fuel tanks filled and a normal load on board.

1. With the boat in the water and secured in a slip, locate the Data Link Connector (DLC) on the engine and connect the Diacom data cable from a laptop computer to the engine.

NOTE: On twin-engine applications, Diacom can read data only on the engine it is connected to. Disconnect from the current Data Link Connector and reconnect to the other engine when instructed.

WARNING

Never run the engine with any fuel leaks. If any fuel leaks are found during the initial priming of the fuel system or while running the engine, repair them before continuing to operate the engine.

2. Prime the fuel system by turning the ignition switch to the ON position. Allow the fuel pump to run for 10 seconds. Turn the ignition switch to the OFF position for 10 seconds. Turn the switch back on for 10 seconds. Repeat this cycle twice to ensure complete priming of the fuel system.
3. Check for fuel leaks at all lines and fittings. If any leaks are found, they must be repaired before proceeding.
4. Follow the boat manufacturer's starting procedures regarding blowers, etc., before starting the engine. Start that engine and allow it to idle. Verify the raw water pump is operating and water is exiting the engine at the exhaust.

WARNING

Never check for a leak using your hands. Always use a piece of wood or cardboard. High-pressure fuel can penetrate your skin and result in serious injury.

5. Check each fuel line and fitting for leaks by running a piece of cardboard around and under each line and fitting. If a leak is present, shut off the engine immediately and correct the problem before proceeding.
 6. Check each oil and water line for leaks in the same manner. Shut off the engine and correct any leaks before proceeding.
 7. With the engine running, also check for exhaust leaks at each hose and fitting.
 8. Check the drive belt and pulleys for abnormal movement.
 9. Cycle the shifter through the forward and reverse gears and back to neutral.
 10. Shut off the engine.
 11. Check the transmission fluid. Follow the transmission manufacturer's recommendation for checking the fluid level and add fluid if needed.
 12. Check the engine oil level with the dipstick. Add oil if required using the correct type and specification of engine oil per the engine specifications.
 13. Check the engine management system using Diacom software. With the engine off, key on, check the ECM for trouble codes. If any codes are present, write them down. Using Diacom, clear the trouble codes. Turn the key off and wait 15 seconds. Turn the ignition back on and check for codes again.
- NOTE:** For twin-engine applications, disconnect Diacom from the first engine and repeat step 7 for the second engine, making sure to note any trouble codes before clearing.
14. Perform an engine performance test while underway. After the engine has reached normal operating temperature, accelerate the boat until on plane and a cruising speed of about 3600 RPM has been reached.
 15. Operate the boat at this speed for 5 minutes. While the boat is running at this speed, verify normal readings on all gauges, listen for any abnormal sounds or vibrations, smell for any signs of fuel, smoke, etc., and look for any abnormal operational characteristics.

NOTICE

Do not run the engine at wide open throttle for more than 1 minute until the engine is properly broken in.

16. After 5 minutes, accelerate to wide open throttle. Run at wide open throttle until the RPMs of the engine have stopped increasing. Note this reading on the tachometer.
17. Reduce throttle to 3600 RPM and operate the boat for an additional 5 minutes. During this time, frequently observe the gauges and the malfunction indicator lamp. If all readings appear normal, return the engine to idle.
18. Using the Diacom software, take a snapshot recording of the normal readings of the engine management system. Start the record function of the Diacom software. Idle the engine for 10 seconds. Operate the boat underway at 1000, 2000, 3000 and 4000 RPM for 10 seconds each. Return to idle for 10 seconds, and then accelerate to 3600 RPM and run for 30 seconds.
19. Accelerate to wide open throttle and run until the RPMs stop increasing. Do not exceed 30 seconds at wide open throttle. Return to idle, and idle for 10 seconds. Stop the Diacom recording. Save the recordings using the date and the engine serial number as the file name.

NOTE: *On twin-engine applications, make a similar recording of the second engine using the Diacom software and store it on the same memory device as the first recording.*

PRE-DELIVERY INSPECTION (PDI) FORM

A complete pre-delivery inspection must be performed before the boat is delivered to the retail customer. A thorough PDI will identify any concerns or faults with the powertrain system that can then be corrected before delivery of the vessel. This process, when properly implemented, will improve customer satisfaction and lower warranty costs. See the PDI section of the engine installation manual for the proper procedures necessary to perform the pre-delivery inspection. See “*Certified Pre-Delivery Inspection By Dealership*” on page 7-10.

Certified Pre-Delivery Inspection By Dealership

Authorized Indmar dealers will perform the following procedure prior to releasing boat for operation.

Dealer Name: _____

Owner's Name: _____

Engine Serial Number: _____ Delivery Date: _____

- _____ Engine Oil Level
- _____ Fuel Lines Tight - No Leakage
- _____ Oil Lines & Filter Tight - No Leaks
- _____ Water Lines Tight - No Leaks
- _____ Trans Fluid Level - No Leakage
- _____ *Fresh Water (Closed) System Only.* Check that system is filled with an appropriate mixture of propylene glycol antifreeze and distilled water.
- _____ Alternator Belt - Proper Tension
- _____ Exhaust Hoses and Clamps Tight
- _____ Engine Properly Aligned and Installed
- _____ Engine Mounts Tight
- _____ Electrical Connections Tight and Properly Installed
- _____ Water Drain Plugs Tight
- _____ Throttle Control Properly Adjusted
- _____ Shift Control Properly Adjusted
- _____ Steering Properly Installed & Operational
- _____ Battery Charged and Properly Connected
- _____ Engine Compartment Clean & Vented

Dealer Operational Inspection

- _____ Boat Launched or Backed into Pit
- _____ Examine All Engine Mounts to Make Sure They are Properly Aligned and Tight
- _____ Check Shaft Alignment/Jet Pump CV Joint
- _____ Check Bilge for Water Leaks
- _____ Prime EFI Fuel System
- _____ Operate Blower for 4 Minutes Minimum
- _____ Start Engine - Check Instruments Etc.
- _____ Check Engine Timing _____ degrees
- _____ Check Cooling System
- _____ Check WOT RPM _____ RPM

Consumer Delivery Items

- _____ Discuss Operator's Manual with Customer
- _____ Explain Warranty Coverage & Requirements
- _____ Discuss Maintenance & Other Procedures
 - _____ Oil Change Intervals
 - _____ Oil Requirements
 - _____ Winterization
 - _____ Fuel Requirements
 - _____ Break-In Requirements
 - _____ Fuses and Circuit Breaker
 - _____ Propping & WOT RPM Req.

Dealer Certification

I have completed the above inspection on this date _____

Dealer Signature: _____

Owner Signature: _____

Attention Owner - be certain your dealer has completed and signed the pre-delivery inspection.
Please be sure to sign the delivery confirmation above.



Section 8

Testing Procedures

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ENGINE COMPARTMENT TEMPERATURE TEST	8-2
FUEL SYSTEM PRESSURE TEST	8-3
EXHAUST BACK PRESSURE TEST	8-3

ENGINE COMPARTMENT PRESSURE DIFFERENTIAL TEST

The test should be performed on a production boat outfitted with all options and accessories as it would be delivered to the customer.

Engine compartment pressure must be measured using a manometer. The test meter must be able to take measurements remotely without requiring the engine cover to be opened.

NOTE: *During the testing session, no outside air is to be forced into the engine compartment, the bilge blower should not be operated and the engine cover must remain closed.*

Install the manometer per the manufacturer's recommendations under the engine cover and run the boat at wide open throttle under normal boat load underway for 10 minutes.

The maximum pressure differential between the inside and outside of the engine compartment must be less than 2" (51 mm) of water.

The recommended manometers used to perform this test are:

- Dwyer instruments model 475-0FM
- Fluke instruments model 922

ENGINE COMPARTMENT TEMPERATURE TEST

The test should be performed on a production boat outfitted with all options and accessories as it would be delivered to the customer. This test must be performed with the boat in the water and underway. Do not perform this test on the trailer or by "free-revving" the engine.

This test should be performed on a day when ambient temperatures exceed 90°F (32°C). Preferable conditions will be measured on a "full sun" day to maximize sun load during the hot soak process.

NOTE: *During the testing session, no outside air is to be forced into the engine compartment, the bilge blower should not be operated and the engine cover must remain closed.*

1. Mount at least two type K thermocouples (attached to the appropriate display device) in the engine compartment. The first will be mounted 1" (2.5 cm) above the flame arrestor to measure air intake temperature. The second will be mounted to the highest point of the engine compartment cover. If the fuel pump is mounted on the engine, a third thermocouple should be placed directly on the fuel pump body.
2. Start the engine and operate at light loads under 2500 RPM until normal operating temperature ??°F (??°C) is reached.
3. Run the engine under normal operating load at 4000 RPM for 30 minutes while taking temperature readings every 5 minutes. Record the results.
4. After 30 minutes of continuous operation, move the throttle to idle and immediately turn off the key. Do not idle the boat; let the boat coast to a stop.
5. Allow the engine to "hot soak" for 30 minutes without lifting the engine cover. Continue taking temperature readings every 5 minutes and record your results.

NOTICE

If any temperature readings exceed the specifications, the engine compartment will need to have additional ventilation designed into it and the test must be performed again to verify compliance.

6. After completion of the 30-minute hot soak, start the engine and immediately throttle in gear to wide open throttle. If the engine stumbles or will not accept full acceleration, the fuel system may be vapor locked and it must be corrected. Completion of this test will ensure that the boat owner will not experience vapor lock conditions.

FUEL SYSTEM PRESSURE TEST

It is important to check the fuel pressure after installing the fuel system. This test must be performed with the boat in the water and underway. Do not perform this test on the trailer or by “free-revving” the engine.

NOTE: *The engine must be capable of reaching the specified wide open throttle RPM maximum, which must be verified using a scan tool.*

1. Connect a high-pressure fuel tester to the fuel line and run the engine at idle. Observe the pressure readings.
2. Operate the boat at wide open throttle underway at full load for at least 2 minutes. Observe the pressure readings.
3. These readings must be within specifications at idle and full throttle. If the readings are out of specification, the fuel system must be corrected to be within specifications.

Fuel Pump Pressure Specification:
60 psi (414 kPa) minimum

Fuel Specific Gravity	0.71
Pump Duty Cycle	0.80
BSFC	0.50

EXHAUST BACK PRESSURE TEST

The exhaust system design must be of the correct size to prevent excessive back pressure. Back pressure is defined as a restriction in the flow of exhaust.

All engines have some back pressure; however, power output can be directly related to the amount of exhaust that can flow from an engine.

It is important to check the fuel pressure after installing the fuel system. This test must be performed with the boat in the water and underway. Do not perform this test on the trailer or by “free-revving” the engine.

NOTE: *The engine must be capable to reaching the specified wide open throttle RPM maximum, which must be verified using a scan tool. Both exhaust manifolds must be tested, with the highest reading of the two being the final reading.*

1. Drill a hole in the exhaust pipe 12-24" (30-61 cm) from the elbow at the 12 o'clock position (facing up), and install a 5/16" flare fitting in the pipe.
2. Attach the pressure transducer Fluke model PV350 or similar to the fitting.
3. Run the engine until normal operating temperature is reached.
4. Operate the engine at 2000, 3000, 4000 and full throttle RPM respectively. Record the back pressure reading for each RPM specification.
5. Repeat steps 1-4 for the second exhaust manifold, noting all readings. The highest reading achieved is the maximum back pressure for the engine.
6. The back pressure must not exceed 2 psi (14 kPa) when measured 12-24" (30-61 cm) from the exhaust elbow.

If the readings exceed the specifications, exhaust system changes must be made. These may include but are not limited to:

- Reducing exhaust system length
- Increasing diameter of exhaust hoses
- Reducing muffler restriction if equipped
- Ensuring exhaust outlet ports are above the water line



Section 9

Engine Dimensions

CONTENTS

TBD



Section 10

OBD-M Trouble Codes

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OBD-MII DIAGNOSTIC TROUBLE CODES.....	10-2
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OBD-MII DIAGNOSTIC TROUBLE CODES

Variable Description	J2012 DTC Code	CAN-J1939 Recommended Diagnostic (Manufacture Cal Specific in 4G)	
		SPN	FMI
<i>DTC 108: MAP pressure high</i>	0108	106	16
<i>DTC 107: MAP voltage low</i>	0107	106	4
<i>DTC 118: ECT voltage high</i>	0118	110	3
<i>DTC 117: ECT voltage low</i>	0117	110	4
<i>DTC 116: ECT higher than expected stage 1</i>	0116	110	15
<i>DTC 113: IAT voltage high</i>	0113	105	3
<i>DTC 112: IAT voltage low</i>	0112	105	4
<i>DTC 2229: BP pressure high</i>	2229	108	0
<i>DTC 129: BP pressure low</i>	0129	108	1
<i>DTC 563: Vbat voltage high</i>	0563	168	15
<i>DTC 562: Vbat voltage low</i>	0562	168	17
<i>DTC 643: Sensor supply voltage 1 high</i>	0643	1079	3
<i>DTC 642: Sensor supply voltage 1 low</i>	0642	1079	4
<i>DTC 123: TPS1 voltage high</i>	0123	51	3
<i>DTC 122: TPS1 voltage low</i>	0122	51	4
<i>DTC 223: TPS2 voltage high</i>	0223	3673	3
<i>DTC 222: TPS2 voltage low</i>	0222	3673	4
<i>DTC 221: TPS1-2 higher than expected</i>	0221	51	0
<i>DTC 121: TPS1-2 lower than expected</i>	0121	51	1
<i>DTC 2122: FPP1 voltage high</i>	2122	91	3
<i>DTC 2123: FPP1 voltage low</i>	2123	91	4
<i>DTC 2128: FPP2 voltage high</i>	2128	29	3
<i>DTC 2127: FPP2 voltage low</i>	2127	29	4
<i>DTC 2115: FPP1 higher than IVS</i>	2115	91	0
<i>DTC 2139: FPP1 lower than IVS</i>	2139	91	1
<i>DTC 2116: FPP2 higher than IVS</i>	2116	29	0
<i>DTC 2140: FPP2 lower than IVS</i>	2140	29	1
<i>DTC 2126: FPP1-2 higher than expected</i>	2126	91	16
<i>DTC 2121: FPP1-2 lower than expected</i>	2121	91	18
<i>DTC 524: Oil pressure low</i>	0524	100	1
<i>DTC 171: Adaptive-learn gasoline bank1 high</i>	0171	4237	0
<i>DTC 172: Adaptive-learn gasoline bank1 low</i>	0172	4237	1
<i>DTC 1155: Closed-loop gasoline bank1 high</i>	1155	4236	0
<i>DTC 1156: Closed-loop gasoline bank1 low</i>	1156	4236	1
<i>DTC 1157: Closed-loop gasoline bank2 high</i>	1157	4238	0
<i>DTC 1158: Closed-loop gasoline bank2 low</i>	1158	4238	1
<i>DTC 174: Adaptive-learn gasoline bank2 high</i>	0174	4239	0
<i>DTC 175: Adaptive-learn gasoline bank2 low</i>	0175	4239	1
<i>DTC 261: Injector 1 open or short to ground</i>	0261	651	5
<i>DTC 264: Injector 2 open or short to ground</i>	0264	652	5
<i>DTC 267: Injector 3 open or short to ground</i>	0267	653	5
<i>DTC 270: Injector 4 open or short to ground</i>	0270	654	5
<i>DTC 273: Injector 5 open or short to ground</i>	0273	655	5
<i>DTC 276: Injector 6 open or short to ground</i>	0276	656	5
<i>DTC 279: Injector 7 open or short to ground</i>	0279	657	5
<i>DTC 282: Injector 8 open or short to ground</i>	0282	658	5
<i>DTC 262: Injector 1 coil shorted</i>	0262	651	6
<i>DTC 265: Injector 2 coil shorted</i>	0265	652	6
<i>DTC 268: Injector 3 coil shorted</i>	0268	653	6
<i>DTC 271: Injector 4 coil shorted</i>	0271	654	6
<i>DTC 274: Injector 5 coil shorted</i>	0274	655	6
<i>DTC 277: Injector 6 coil shorted</i>	0277	656	6
<i>DTC 280: Injector 7 coil shorted</i>	0280	657	6
<i>DTC 283: Injector 8 coil shorted</i>	0283	658	6
<i>DTC 2300: Spark coil 1 primary open or short to ground</i>	2300	1268	5
<i>DTC 2303: Spark coil 2 primary open or short to ground</i>	2303	1269	5
<i>DTC 2306: Spark coil 3 primary open or short to ground</i>	2306	1270	5
<i>DTC 2309: Spark coil 4 primary open or short to ground</i>	2309	1271	5
<i>DTC 2312: Spark coil 5 primary open or short to ground</i>	2312	1272	5
<i>DTC 2315: Spark coil 6 primary open or short to ground</i>	2315	1273	5
<i>DTC 2318: Spark coil 7 primary open or short to ground</i>	2318	1274	5
<i>DTC 2321: Spark coil 8 primary open or short to ground</i>	2321	1275	5
<i>DTC 2301: Spark coil 1 primary shorted</i>	2301	1268	6

DTC 2304: Spark coil 2 primary shorted	2304	1269	6
DTC 2307: Spark coil 3 primary shorted	2307	1270	6
DTC 2310: Spark coil 4 primary shorted	2310	1271	6
DTC 2313: Spark coil 5 primary shorted	2313	1272	6
DTC 2316: Spark coil 6 primary shorted	2316	1273	6
DTC 2319: Spark coil 7 primary shorted	2319	1274	6
DTC 2322: Spark coil 8 primary shorted	2322	1275	6
DTC 217: ECT higher than expected stage 2	0217	110	0
DTC 111: IAT higher than expected stage 1	0111	105	15
DTC 127: IAT higher than expected stage 2	0127	105	0
DTC 327: Knock1 sensor open or not present	0327	731	4
DTC 2112: Unable to reach higher TPS	2112	51	7
DTC 2111: Unable to reach lower TPS	2111	51	7
DTC 628: Fuel-pump high-side open or short to ground	0628	1347	5
DTC 629: Fuel-pump high-side short to power	0629	1347	6
DTC 342: Loss of CAM input signal	0342	723	4
DTC 341: CAM input signal noise	0341	723	2
DTC 336: CRANK input signal noise	0336	636	2
DTC 16: Crank and/or cam could not synchronize during start	0016	636	8
DTC 606: Microprocessor failure - COP	0606	629	31
DTC 1612: Microprocessor failure - RTI 1	1612	629	31
DTC 1613: Microprocessor failure - RTI 2	1613	629	31
DTC 1614: Microprocessor failure - RTI 3	1614	629	31
DTC 1615: Microprocessor failure - A/D	1615	629	31
DTC 1616: Microprocessor failure - Interrupt	1616	629	31
DTC 601: Microprocessor failure - FLASH	0601	628	13
DTC 604: Microprocessor failure - RAM	0604	630	12
DTC 326: Knock1 excessive or erratic signal	0326	731	2
DTC 219: RPM higher than max allowed govern speed	0219	515	15
DTC 1111: RPM above fuel rev limit level	1111	515	16
DTC 1112: RPM above spark rev limit level	1112	515	0
DTC 134: EGO1 open / lazy	0134	3217	5
DTC 154: EGO2 open / lazy	0154	3227	5
DTC 140: EGO3 open / lazy	0140	3256	5
DTC 1521: CHT higher than expected stage 1	1521	110	16
DTC 1522: CHT higher than expected stage 2	1522	110	0
DTC 1515: AUX analog Pull-Down 1 high voltage	1515	710	3
DTC 1516: AUX analog Pull-Down 1 low voltage	1516	710	4
DTC 1511: AUX analog Pull-Up 1 high voltage	1511	701	3
DTC 1512: AUX analog Pull-Up 1 low voltage	1512	701	4
DTC 1513: AUX analog Pull-Up 2 high voltage	1513	702	3
DTC 1514: AUX analog Pull-Up 2 low voltage	1514	702	4
DTC 92: FP high voltage	0092	94	3
DTC 91: FP low voltage	0091	94	4
DTC 420: Catalyst inactive on gasoline (Bank 1)	0420	3050	11
DTC 524: Oil pressure sender low pressure stage 2	0524	100	1
DTC 521: Oil pressure sender high pressure	0521	100	0
DTC 523: Oil pressure sender high voltage	0523	100	3
DTC 522: Oil pressure sender low voltage	0522	100	4
DTC 337: Crank signal loss	0337	636	4
DTC 1625: J1939 shutdown request	1625	1110	31
DTC 1626: CAN-J1939 Tx fault	1626	639	12
DTC 1627: CAN-J1939 Rx fault	1627	639	12
DTC 508: IAC ground short	0508	520201	6
DTC 509: IAC coil open/short	0509	520201	5
DTC 686: Power relay ground short	0686	1485	4
DTC 685: Power relay coil open	0685	1485	5
DTC 687: Power relay coil short to power	0687	1485	3
DTC 616: Start relay ground short	0616	1321	4
DTC 615: Start relay coil open	0615	1321	5
DTC 617: Start relay coil short to power	0617	1321	3
DTC 1641: Buzzer control ground short	1641	920	4
DTC 1642: Buzzer open	1642	920	5
DTC 1643: Buzzer control short to power	1643	920	3
DTC 628: Fuel pump relay control ground short	0628	1348	4
DTC 627: Fuel pump relay coil open	0627	1348	5
DTC 629: Fuel pump relay coil short to power	0629	1348	3
DTC 1644: MIL control ground short	1644	1213	4
DTC 650: MIL open	0650	1213	5
DTC 1645: MIL control short to power	1645	1213	3

DTC 2618: Tach output ground short	2618	645	4
DTC 2619: Tach output short to power	2619	645	3
DTC 1121: FPP1/2 simultaneous voltages out-of-range (redundancy lost)	1121	91	31
DTC 2120: FPP1 invalid voltage and FPP2 disagrees with IVS (redundancy lost)	2120	520199	11
DTC 2125: FPP2 invalid voltage and FPP1 disagrees with IVS (redundancy lost)	2125	520199	11
DTC 1122: FPP1/2 do not match each other or IVS (redundancy lost)	1122	520199	11
DTC 653: Sensor supply voltage 2 high	0653	1080	3
DTC 652: Sensor supply voltage 2 low	0652	1080	4
DTC 1611: Sensor supply voltage 1 and 2 out-of-range	1611	1079	31
DTC 332: Knock2 sensor open or not present	0332	520197	4
DTC 331: Knock2 excessive or erratic signal	0331	520197	2
DTC 2135: TPS1/2 simultaneous voltages out-of-range	2135	51	31
DTC 1628: J1939 CAN address / engine-number conflict	1628	639	13
DTC 1631: PWM1-Gauge1 open / ground short	1631	697	5
DTC 1632: PWM1-Gauge1 short to power	1632	697	3
DTC 1633: PWM2-Gauge2 open / ground short	1633	698	5
DTC 1634: PWM2-Gauge2 short to power	1634	698	3
DTC 1635: PWM3-Gauge3 open / ground short	1635	699	5
DTC 1636: PWM3-Gauge3 short to power	1636	699	3
DTC 1637: PWM4 open / ground short	1637	700	5
DTC 1638: PWM4 short to power	1638	700	3
DTC 1639: PWM5 open / ground short	1639	924	5
DTC 1640: PWM5 short to power	1640	924	3
DTC 430: Catalyst inactive on gasoline (Bank 2)	0430	3051	11
DTC 160: EGO4 open / lazy	0160	3266	5
DTC 1517: AUX analog Pull-Up 3 high voltage	1517	703	3
DTC 1518: AUX analog Pull-Up 3 low voltage	1518	703	4
DTC 1541: AUX analog Pull-Up/Down 1 high voltage	1541	704	3
DTC 1542: AUX analog Pull-Up/Down 1 low voltage	1542	704	4
DTC 1543: AUX analog Pull-Up/Down 2 high voltage	1543	705	3
DTC 1544: AUX analog Pull-Up/Down 2 low voltage	1544	705	4
DTC 1545: AUX analog Pull-Up/Down 3 high voltage	1545	706	3
DTC 1546: AUX analog Pull-Up/Down 3 low voltage	1546	706	4
DTC 1551: AUX digital 1 high voltage	1551	707	3
DTC 1552: AUX digital 1 low voltage	1552	707	4
DTC 1553: AUX digital 2 high voltage	1553	708	3
DTC 1554: AUX digital 2 low voltage	1554	708	4
DTC 1555: AUX digital 3 high voltage	1555	709	3
DTC 1556: AUX digital 3 low voltage	1556	709	4
DTC 1629: J1939 TSC1 message receipt loss	1629	695	9
DTC 1630: J1939 ETC message receipt loss	1630	91	19
DTC 502: Roadspeed input loss of signal	0502	84	8
DTC 1561: AUX analog Pull-Down 2 high voltage	1561	711	3
DTC 1562: AUX analog Pull-Down 2 low voltage	1562	711	4
DTC 1563: AUX analog Pull-Down 3 high voltage	1563	712	3
DTC 1564: AUX analog Pull-Down 3 low voltage	1564	712	4
DTC 8901: UEGO1 microprocessor internal fault	8901	3221	31
DTC 8902: UEGO1 heater supply high voltage	8902	3222	3
DTC 8903: UEGO1 heater supply low voltage	8903	3222	4
DTC 8904: UEGO1 cal resistor voltage high	8904	3221	3
DTC 8905: UEGO1 cal resistor voltage low	8905	3221	4
DTC 8906: UEGO1 return voltage shorted high	8906	3056	3
DTC 8907: UEGO1 return voltage shorted low	8907	3056	4
DTC 8908: UEGO1 pump voltage shorted high	8908	3218	3
DTC 8909: UEGO1 pump voltage shorted low	8909	3218	4
DTC 8910: UEGO1 sense cell voltage high	8910	3217	3
DTC 8911: UEGO1 sense cell voltage low	8911	3217	4
DTC 8912: UEGO1 pump voltage at high drive limit	8912	3225	3
DTC 8913: UEGO1 pump voltage at low drive limit	8913	3225	4
DTC 8914: UEGO1 sense cell slow to warm up	8914	3222	10
DTC 8915: UEGO1 pump cell slow to warm up	8915	3225	10
DTC 8916: UEGO1 sense cell impedance high	8916	3222	0
DTC 8917: UEGO1 pump cell impedance high	8917	3225	0
DTC 8918: UEGO1 pump cell impedance low	8918	3225	1
DTC 1311: Cylinder 1 misfire detected	1311	1323	11
DTC 1312: Cylinder 2 misfire detected	1312	1324	11
DTC 1313: Cylinder 3 misfire detected	1313	1325	11
DTC 1314: Cylinder 4 misfire detected	1314	1326	11
DTC 1315: Cylinder 5 misfire detected	1315	1327	11
DTC 1316: Cylinder 6 misfire detected	1316	1328	11

DTC 1317: Cylinder 7 misfire detected	1317	1329	11
DTC 1318: Cylinder 8 misfire detected	1318	1330	11
DTC 301: Cylinder 1 emissions/catalyst damaging misfire	0301	1323	31
DTC 302: Cylinder 2 emissions/catalyst damaging misfire	0302	1324	31
DTC 303: Cylinder 3 emissions/catalyst damaging misfire	0303	1325	31
DTC 304: Cylinder 4 emissions/catalyst damaging misfire	0304	1326	31
DTC 305: Cylinder 5 emissions/catalyst damaging misfire	0305	1327	31
DTC 306: Cylinder 6 emissions/catalyst damaging misfire	0306	1328	31
DTC 307: Cylinder 7 emissions/catalyst damaging misfire	0307	1329	31
DTC 308: Cylinder 8 emissions/catalyst damaging misfire	0308	1330	31
DTC 1661: PWM6 open / ground short	1661	925	5
DTC 1662: PWM6 short to power	1662	925	3
DTC 1663: PWM7 open / ground short	1663	926	5
DTC 1664: PWM7 short to power	1664	926	3
DTC 1547: AUX analog Pull-Up/Down 4 high voltage	1547	713	3
DTC 1548: AUX analog Pull-Up/Down 4 low voltage	1548	713	4
DTC 1182: Fuel impurity level high	1182	520401	0
DTC 1665: PWM8 open / ground short	1665	2646	5
DTC 1666: PWM8 short to power	1666	2646	3
DTC 1669: PWM9 open / ground short	1669	2647	5
DTC 1670: PWM9 short to power	1670	2647	3
DTC 11: Intake cam / distributor position error	0011	520800	7
DTC 24: Exhaust cam position error	0024	520801	7
DTC 88 Fuel pressure higher than expected	0088	94	0
DTC 87 Fuel pressure lower than expected	0087	94	1
DTC 520: Oil pressure sender low pressure stage 1	0520	100	18
DTC 0350: External spark module failure	0350	1268	31
DTC 0351: External spark module coil 1 failure	0351	1268	31
DTC 0352: External spark module coil 2 failure	0352	1269	31
DTC 0353: External spark module coil 3 failure	0353	1270	31
DTC 0354: External spark module coil 4 failure	0354	1271	31
DTC 0355: External spark module coil 5 failure	0355	1272	31
DTC 0356: External spark module coil 6 failure	0356	1273	31
DTC 0357: External spark module coil 7 failure	0357	1274	31
DTC 0358: External spark module coil 8 failure	0358	1275	31
DTC 1674: Hardware ID failure: MOT update required	1674	1634	2
DTC 1673: Calibration configuration error	1673	1634	13
DTC 1675: Start command stuck active	1675	1675	3
DTC 0031: EGOH1 open/ground short	0031	3222	4
DTC 0032: EGOH1 short to power	0032	3222	3
DTC 0051: EGOH2 open/ground short	0051	3232	4
DTC 0052: EGOH2 short to power	0052	3232	3
DTC 0037: EGOH3 open/ground short	0037	3261	4
DTC 0038: EGOH3 short to power	0038	3261	3
DTC 0057: EGOH4 open/ground short	0057	3271	4
DTC 0058: EGOH4 short to power	0058	3271	3
DTC 1565: AUX analog Pull-Up/Down 5 high voltage	1565	717	3
DTC 1566: AUX analog Pull-Up/Down 5 low voltage	1566	717	4
DTC 1567: AUX analog Pull-Up/Down 6 high voltage	1567	714	3
DTC 1568: AUX analog Pull-Up/Down 6 low voltage	1568	714	4
DTC 1569: AUX analog Pull-Up/Down 7 high voltage	1569	715	3
DTC 1571: AUX analog Pull-Up/Down 7 low voltage	1571	715	4
DTC 1572: AUX digital 4 high voltage	1572	716	3
DTC 1573: AUX digital 4 low voltage	1573	716	4
DTC 1574: AUX digital 5 high voltage	1574	520202	3
DTC 1575: AUX digital 5 low voltage	1575	520202	4
DTC 1576: AUX digital 6 high voltage	1576	520203	3
DTC 1577: AUX digital 6 low voltage	1577	520203	4
DTC 1578: AUX digital 7 high voltage	1578	520204	3
DTC 1579: AUX digital 7 low voltage	1579	520204	4
DTC 1581: AUX digital 8 high voltage	1581	520205	3
DTC 1582: AUX digital 8 low voltage	1582	520205	4
DTC 1583: AUX digital 9 high voltage	1583	520206	3
DTC 1584: AUX digital 9 low voltage	1584	520206	4
DTC 1585: AUX digital 10 high voltage	1585	520207	3
DTC 1586: AUX digital 10 low voltage	1586	520207	4
DTC 1113: RPM higher than expected	1113	515	31
DTC 1587: AUX analog Pull-Up/Down 8 high voltage	1587	520208	3
DTC 1588: AUX analog Pull-Up/Down 8 low voltage	1588	520208	4
DTC 1589: AUX digital 11 high voltage	1589	520209	3

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<i>DTC 1587: AUX analog Pull-Up/Down 8 high voltage</i>	1587	520208	3
<i>DTC 1588: AUX analog Pull-Up/Down 8 low voltage</i>	1588	520208	4
<i>DTC 1589: AUX digital 11 high voltage</i>	1589	520209	3
<i>DTC 1591: AUX digital 11 low voltage</i>	1591	520209	4
<i>DTC 1592: AUX digital 12 high voltage</i>	1592	520210	3
<i>DTC 1593: AUX digital 12 low voltage</i>	1593	520210	4
<i>DTC 9999: AUX analog Pull-Up/Down 9 high voltage</i>	1595	67000	3
<i>DTC 9999: AUX analog Pull-Up/Down 9 low voltage</i>	1596	67001	4
<i>DTC 9999: AUX analog Pull-Up/Down 10 high voltage</i>	1597	67002	3
<i>DTC 9999: AUX analog Pull-Up/Down 10 low voltage</i>	1598	67003	4
<i>DTC 9999: AUX analog Pull-Up/Down 11 high voltage</i>	1599	67004	3
<i>DTC 9999: AUX analog Pull-Up/Down 11 low voltage</i>	1600	67005	4
<i>DTC 9999: AUX analog Pull-Up/Down 12 high voltage</i>	1601	67006	3
<i>DTC 9999: AUX analog Pull-Up/Down 12 low voltage</i>	1602	67007	4
<i>DTC 9999: AUX analog Pull-Up/Down 13 high voltage</i>	1603	67008	3
<i>DTC 9999: AUX analog Pull-Up/Down 13 low voltage</i>	1604	67009	4
<i>DTC 9999: AUX analog Pull-Up/Down 14 high voltage</i>	1605	67010	3
<i>DTC 9999: AUX analog Pull-Up/Down 14 low voltage</i>	1606	67011	4
<i>DTC 9999: AUX analog Pull-Up/Down 15 high voltage</i>	1607	67012	3
<i>DTC 9999: AUX analog Pull-Up/Down 15 low voltage</i>	1608	67013	4
<i>DTC 9999: AUX analog Pull-Up/Down 16 high voltage</i>	1609	67014	3
<i>DTC 9999: AUX analog Pull-Up/Down 16 low voltage</i>	1610	67015	4
<i>DTC 9999: AUX analog Pull-Up/Down 17 high voltage</i>	1676	67016	3
<i>DTC 9999: AUX analog Pull-Up/Down 17 low voltage</i>	1677	67017	4
<i>DTC 9999: AUX analog Pull-Up/Down 18 high voltage</i>	1678	67018	3
<i>DTC 9999: AUX analog Pull-Up/Down 18 low voltage</i>	1679	67019	4
<i>DTC 9999: AUX analog Pull-Up/Down 19 high voltage</i>	1680	67020	3
<i>DTC 9999: AUX analog Pull-Up/Down 19 low voltage</i>	1681	67021	4
<i>DTC 9999: AUX analog Pull-Up/Down 20 high voltage</i>	1682	67022	3
<i>DTC 9999: AUX analog Pull-Up/Down 20 low voltage</i>	1683	67023	4
<i>DTC 9999: AUX analog Pull-Up/Down 21 high voltage</i>	1684	67024	3
<i>DTC 9999: AUX analog Pull-Up/Down 21 low voltage</i>	1685	67025	4
<i>DTC 9999: AUX analog Pull-Up/Down 22 high voltage</i>	1686	67026	3
<i>DTC 9999: AUX analog Pull-Up/Down 22 low voltage</i>	1687	67027	4
<i>DTC 9999: AUX analog Pull-Up/Down 23 high voltage</i>	1688	67028	3
<i>DTC 9999: AUX analog Pull-Up/Down 23 low voltage</i>	1689	67029	4
<i>DTC 9999: AUX analog Pull-Up/Down 24 high voltage</i>	1690	67030	3
<i>DTC 9999: AUX analog Pull-Up/Down 24 low voltage</i>	1691	67031	4
<i>DTC 9999: AUX analog Pull-Up/Down 25 high voltage</i>	1692	67032	3
<i>DTC 9999: AUX analog Pull-Up/Down 25 low voltage</i>	1693	67033	4
<i>DTC 9999: AUX digital 13 high voltage</i>	1694	67034	3
<i>DTC 9999: AUX digital 13 low voltage</i>	1695	67035	4
<i>DTC 9999: AUX digital 14 high voltage</i>	1696	67036	3
<i>DTC 9999: AUX digital 14 low voltage</i>	1697	67037	4
<i>DTC 9999: AUX digital 15 high voltage</i>	1698	67038	3
<i>DTC 9999: AUX digital 15 low voltage</i>	1699	67039	4
<i>DTC 9999: AUX digital 16 high voltage</i>	1700	67040	3
<i>DTC 9999: AUX digital 16 low voltage</i>	1701	67041	4
<i>DTC 9999: AUX digital 17 high voltage</i>	1702	67042	3
<i>DTC 9999: AUX digital 17 low voltage</i>	1703	67043	4
<i>DTC 9999: AUX digital 18 high voltage</i>	1704	67044	3
<i>DTC 9999: AUX digital 18 low voltage</i>	1705	67045	4
<i>DTC 9999: AUX digital 19 high voltage</i>	1706	67046	3
<i>DTC 9999: AUX digital 19 low voltage</i>	1707	67047	4
<i>DTC 9999: Water flow fault</i>	0128	110	1
<i>DTC 9999: Failed to reach operating temperature</i>	0128	110	7
<i>DTC 9999: UEGO2 microprocessor internal fault</i>	8919	67049	31
<i>DTC 9999: UEGO2 heater supply high voltage</i>	8920	67050	3
<i>DTC 9999: UEGO2 heater supply low voltage</i>	8921	67051	4
<i>DTC 9999: UEGO2 cal resistor voltage high</i>	8922	67052	3
<i>DTC 9999: UEGO2 cal resistor voltage low</i>	8923	67053	4
<i>DTC 9999: UEGO2 return voltage shorted high</i>	8924	67054	3
<i>DTC 9999: UEGO2 return voltage shorted low</i>	8925	67055	4
<i>DTC 9999: UEGO2 pump voltage shorted high</i>	8926	67056	3
<i>DTC 9999: UEGO2 pump voltage shorted low</i>	8927	67057	4
<i>DTC 9999: UEGO2 sense cell voltage high</i>	8928	67058	3
<i>DTC 9999: UEGO2 sense cell voltage low</i>	8929	67059	4
<i>DTC 9999: UEGO2 pump voltage at high drive limit</i>	8930	67060	3
<i>DTC 9999: UEGO2 pump voltage at low drive limit</i>	8931	67061	4
<i>DTC 9999: UEGO2 sense cell slow to warm up</i>	8932	67062	10

<i>DTC 9999: UEGO2 pump cell impedance high</i>	8935	67065	0
<i>DTC 9999: UEGO2 pump cell impedance low</i>	8936	67066	1
<i>DTC 9999: UEGO1 heater open/ground short</i>	8937	3222	4
<i>DTC 9999: UEGO1 heater short to power</i>	8938	3222	3
<i>DTC 9999: UEGO2 heater open/ground short</i>	8940	3232	4
<i>DTC 9999: UEGO2 heater short to power</i>	8941	3232	3
<i>DTC 9999: Power relay off high voltage</i>	0690	2634	3
<i>DTC 9999: Power relay on low voltage</i>	0689	2634	4

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