

EM2007 Errata – Student Manual

13 April 2008

Replace referenced paragraphs and homework questions with the following:

Chapter 1 Paragraph 7

Internal combustion engines convert about one third of the fuel's energy into useful work. Gasoline engines mix vaporized fuel with air (which contains oxygen) and draw (or force) the mixture into the engine. The mixture is then compressed and ignited with an electrical spark and converted into useful work. Modern diesel engines compress air (which contains oxygen) inside the cylinder to a temperature of 1000° F and then inject fuel into the hot compressed air, where it ignites and is converted into useful work.

Chapter 1 Insert new Paragraph 26

The terms horsepower and torque are often confused. Horsepower is the measure of the amount of work the engine is doing in one second, measured in brake horsepower (bhp) or kilowatts (0.745 kW = 1 hp). Torque is the measure of the rotational force of an engine, measured in pounds-feet (lb-ft) or Newton-meters (Nm). Brake horsepower is the actual amount of power delivered to the flywheel of an inboard engine, or to the propeller shaft of an outboard engine. Brake horsepower is the popular measure used by manufacturers to advertise their engines.

Chapter 1 Insert new Paragraphs 28-29

Caterpillar and *Mercury Marine* have recently introduced a similar drive system called the Zeus Drive. This system is also a pod drive unit with the power unit mounted inside the hull of the boat and the drive mounted through the bottom of the boat's hull. The difference between the *Volvo Penta* IPS and the *Caterpillar/Mercruiser* Zeus is that Zeus propellers face aft and push the boat through the water rather than pull the boat. Both pod systems differ from the traditional I/O in that the transmitting drive shaft pierces the boat's hull below the waterline rather than through the transom.

These pod drive systems have blurred the distinction between inboard and inboard/outboard drives. They are part of a revolution in propulsion system design due to their flexibility and electronic integration. Both systems offer joystick control and dual engine systems can provide highly accurate low speed maneuvering and automatic station keeping when interfaced to the boat's GPS. The skipper must never allow swimmers in the water when these systems are in use, as the propellers may be in motion!

Chapter 1 Renumber remaining Paragraphs

Chapter 1 Homework Question 9

9. The compression of air in a modern four-stroke cycle diesel engine causes:
- a. the temperature to decrease.
 - b. the pressure to decrease.
 - c. air flow in the intake manifold.
 - d. the air temperature in the cylinder to rise to approximately 1000°F.
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Chapter 1

Homework Question 10

10. The three basic methods of installing internal combustion engines to their drive systems are the:
- outboard drive system, the stern drive system, and the inboard drive system.
 - stern drive system, the inboard/outboard drive system, and the outboard drive system.
 - inboard drive system, the inboard/outboard drive system, and the jet drive system.
 - outboard drive system, the jet drive system, and the inboard drive system.
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Chapter 1

Homework Question 11

11. The outboard drive system is unique because it:
- can use a larger propeller than the inboard drive system.
 - is contained in one compact housing.
 - can develop greater horsepower than the stern drive system.
 - is the only drive system with a lower unit.
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Chapter 1

Homework Question 13

13. The stern drive system is unique in that:
- it is always powered by 2-stroke cycle engines.
 - it endows an inboard engine with the maneuverability of an outboard drive system.
 - the engine is always mounted on the stern of the boat.
 - the power transmitting shaft never pierces the hull of the boat.
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Chapter 1

Homework Question 14

14. Propeller size is determined by:
- diameter and engine rpm.
 - diameter and pitch.
 - number of blades and pitch.
 - number of blades and diameter.
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Chapter 1

Homework Question 15

15. Increasing a propeller's pitch will:
- increase the engine's rpm.
 - increase the boat's maneuverability.
 - decrease the engine's rpm.
 - decrease the boat's maneuverability.
-

Chapter 2
Paragraph 68

In the older conventional ignition system, the switching on and off of the primary voltage is done with a set of breaker points contained inside a device called the distributor. The breaker points ride on a cam on the distributor shaft. The cam would have 4, 6, or 8 lobes depending upon the number of cylinders in the engine. When the points are closed, current flows into the primary side of the coil, creating the magnetic field. When the cam causes the points to open, the current stops flowing and the magnetic field in the coil collapses, inducing the high voltage. The distributor also has a rotor attached to the distributor shaft that rotates inside the distributor in sequence with the opening and closing of the breaker points. As the rotor rotates inside the distributor it makes contact with a series of contact terminals inside the distributor cap. Each of the distributor contact terminals is associated with a specific engine spark plug. High voltage from the coil is fed to one end of the rotor and the rotor distributes this high voltage to each spark plug in turn as it rotates inside the distributor cap. Figure 41 is a drawing showing the older conventional distributor ignition system. This system is still in use on many boats, and is generally referred to as a "points and condenser ignition." The condenser, now called a capacitor, was used to prolong the life of the points by reducing arcing when the points opened. This system required high maintenance as the point opening gap was critical to the timing of the entire ignition system, and the points often required replacement.

Chapter 2
Paragraph 77

Starting. Marine starting batteries are used to supply a large amount of current for very short periods of time for starting the boat's engine and then are immediately recharged by the engine driven alternator. They are similar to automobile batteries except they have been constructed to withstand the shock and vibration of the marine environment. Starting batteries are optimized for high engine starting currents and will be ruined by deep discharges.

Chapter 4
Homework Question 9

9. Diesel fuel injection systems can be divided into two basic systems, the:
- indirect and distributor pump systems.
 - direct and distributor pump systems.
 - indirect and direct injection systems.
 - rail and unit injection systems.

Chapter 6
Homework Question 1

1. The device which allows the engine rpm to match the load of the propeller is the:
- flywheel.
 - distributor.
 - skeg.
 - reduction gear.

Chapter 6

Homework Question 2

2. If an engine with a reduction ratio of 2:1 is running at 2000 rpm, at what speed does the propeller turn?
- a. 4000 rpm.
 - b. 2000 rpm.
 - c. 1500 rpm.
 - d. 1000 rpm.

Chapter 6

Homework Question 7

7. As a general rule, the number of blades on a propeller:
- a. decreases as power and weight of a boat increase.
 - b. has no discernable effect on a boat's design.
 - c. increases as power and weight of a boat increase.
 - d. is strictly a matter of personal preference.

Chapter 8

Homework Question 2

2. The most basic throttle control on small boats is the _____ system:
- a. electrical
 - b. hydraulic
 - c. lever and rod
 - d. push-pull cable

Chapter 10

Homework Question 14

14. What is the first thing you should do if your engine has stopped because it overheated?
- a. Call for help.
 - b. Let it cool down, then determine why it stopped.
 - c. Arrange to replace it.
 - d. Call for a tow.
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