Motor Plants II

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The component labeled "A" on the engine reversing device shown in the illustration, performs its function by transmitting _____. Illustration MO-0125
a pneumatic signal which activates a hydraulic control cylinder allowing the camshaft to shift axially

Illustrations: MO0125_WM_101816

The component labeled "A" on the engine reversing device shown in the illustration, performs its function by transmitting _____. Illustration MO-0125
a pneumatic signal which activates a hydraulic control cylinder allowing the camshaft to shift axially

Illustrations: MO0125_WM_101816

The cylinders labeled "B" and "C" in the illustration are used to _____. Illustration MO-0125
supply the force required to shift the engine camshafts axially to reverse engine rotation

Illustrations: MO0125_WM_101816

The cylinders labeled "B" and "C" in the illustration are used to _____. Illustration MO-0125
supply the force required to shift the engine camshafts axially to reverse engine rotation

Illustrations: MO0125_WM_101816

In a direct cylinder admission air starting system, once the engine begins to fire, the air starting check valve illustrated, is closed by _____. Illustration MO-0107
the spring force and cylinder pressure

Illustrations: MO0107_WM_102218

In a direct cylinder admission air starting system, once the engine begins to fire, the air starting check valve illustrated, is closed by _____. Illustration MO-0107
the spring force and cylinder pressure

Illustrations: MO0107_WM_102218

Which of the following statements is true concerning the air starting valve, labeled "III", as shown in the illustration? Illustration MO-0046
The air starting valve is opened by cam action.

Illustrations: MO0046_AO_031115WM

During the starting of a diesel engine, compression gases are prevented from backing into the air starting system, shown in the illustration, by the _____. Illustration MO-0046
cylinder air starting check valves

Illustrations: MO0046_AO_031115WM

Which of the following statements is true concerning the air starting valve, labeled "III", as shown in the illustration? Illustration MO-0046
The air starting valve is opened by cam action.

Illustrations: MO0046_AO_031115WM

During the starting of a diesel engine, compression gases are prevented from backing into the air starting system, shown in the illustration, by the _____. Illustration MO-0046
cylinder air starting check valves

Illustrations: MO0046_AO_031115WM

What will cause valve stem blow-by to the valve section shown in the illustration? Illustration MO-0030
Defective rubber seal rings in the valve guides.

Illustrations: MO0030_AO_020215WM
See REF2300

If a valve seat insert, similar to that shown in the illustration is cracked, this may be indicated by _____. Illustration MO-0043
white vapor in the exhaust gas

Illustrations: MO0043WM_021215
See REF2300

Which of the following statements would apply when checking the valve clearance of the unit shown in the illustration? Illustration MO-0074
Cold valve clearance is measured between components "C" and "D".

Illustrations: MO0074_WM_101918

When inspecting the valve mechanism shown in the illustration, normal maintenance would include _____. Illustration MO-0074
measuring the cold valve clearance between components "C" and "D"

Illustrations: MO0074_WM_101918

Which construction detail is apparent in the connecting rod and piston assembly shown in the illustration? Illustration MO-0011
The piston is designed with a heat dam.

Illustrations: MO0011_WM_101718
See REF2280

Which of the following statements is correct concerning the connecting rod and piston assembly shown in the illustration? Illustration MO-0011
The piston is free to rotate on the carrier thrust washer.
The piston pin is bolted to the connecting rod.
The piston has a heat dam.
All of the above.

Illustrations: MO0011_WM_101718
See REF2280

Item #16 of the piston shown in the illustration is a/an _____. Illustration MO-0011
thrust plate or thrust washer

Illustrations: MO0011_WM_101718
See REF2280

There are two glands provided where the piston rod exits the cylinder shown in the illustration. The purpose of the top gland is to _____. Illustration MO-0083
seal against scavenge air leakage

Illustrations: MO0083WM_060316

There are two glands provided where the piston rod exits the cylinder shown in the illustration. The purpose of the top gland is to _____. Illustration MO-0083
seal against scavenge air leakage

Illustrations: MO0083WM_060316

Which of the following processes is indicated by the flow arrows shown in the illustration? Illustration MO-0026
Relief of excessively high pressure gases from the cylinder.

Illustrations: MO0026_AO_020215WM

The line identified as "I" in the illustration is used to _____. Illustration MO-0066
supply lubricating oil for actuating the exhaust valve

Illustrations: MO0066_WM_101918

The item labeled "T" as shown in figure 4 of the illustration is identified as the _____. Illustration MO-0025
exhaust gas turbine

Illustrations: MO0025_WM_131419
See REF2329

In what figure of the illustration does the crosshead experience the greatest side thrust? Illustration MO-0025
Figure 2

Illustrations: MO0025_WM_131419
See REF2329

Item labeled "L" as shown in section 6 of the illustration is identified as the _____. Illustration MO-0025
after cooler

Illustrations: MO0025_WM_131419
See REF2329

The device shown in the illustration is classified as a/an _____. Illustration MO-0008
comparator type mist detector

Illustrations: MO0008_WM_101718

The device shown in the illustration is classified as a/an _____. Illustration MO-0008
comparator type mist detector

Illustrations: MO0008_WM_101718

The device shown in the illustration is a _____. Illustration MO-0008
comparator type mist detector for large low speed, crosshead type engines

Illustrations: MO0008_WM_101718

The device shown in the illustration is a _____. Illustration MO-0008
comparator type mist detector for large low speed, crosshead type engines

Illustrations: MO0008_WM_101718

The device shown in figure "A" of the illustration is used to _____. Illustration MO-0042
provide lubrication to the cylinder

Illustrations: MO0042_AO_021015WM

The device shown in figure "A" of the illustration is used to _____. Illustration MO-0042
provide lubrication to the cylinder

Illustrations: MO0042_AO_021015WM

Which of the indicator diagrams illustrated depicts the condition that should be corrected by retarding only the timing? Illustration MO-0029
A

Illustrations: MO0029_WM_101818

Which of the indicator diagrams illustrated indicates the condition that should be corrected by retarding the timing, and the fitting of thicker shims to the connecting rod? Illustration MO-0029
D

Illustrations: MO0029_WM_101818

Which of the indicator diagrams illustrated depicts the condition that should be corrected by retarding only the timing? Illustration MO-0029
A

Illustrations: MO0029_WM_101818

On the cylinder indicator diagram illustrated, the maximum rise in pressure occurs during the period labeled as _____. Illustration MO-0033
H

Illustrations: MO0033_WM_101818

On the cylinder indicator diagram illustrated, the dotted line indicated as "L" is describing the _____. Illustration MO-0033
cylinder pressure without injection

Illustrations: MO0033_WM_101818

Which area of the indicator diagram illustrated, indicates the afterburning period in a diesel engine cylinder? Illustration MO-0033
K

Illustrations: MO0033_WM_101818

On the cylinder indicator diagram illustrated, the dotted line indicated as "L" is describing the _____. Illustration MO-0033
cylinder pressure without injection

Illustrations: MO0033_WM_101818

Which area of the indicator diagram illustrated, indicates the ignition delay period in a diesel engine cylinder? Illustration MO-0033
J

Illustrations: MO0033_WM_101818

The indicator card shown in the illustration is produced with a/an _____. Illustration MO-0108
rotating drum

Illustrations: MO0108_WM_102218

On the indicator card shown in the illustration, lines 'A' and 'B' indicate _____. Illustration MO-0108
top dead center

Illustrations: MO0108_WM_102218

On the indicator card shown in the illustration, lines 'A' and 'B' indicate _____. Illustration MO-0108
top dead center

Illustrations: MO0108_WM_102218

In the pressure-volume diagram shown in the illustration, fuel injection occurs at point _____. Illustration MO-0035
c

Illustrations: MO0035_AO_020215WM

In the pressure-volume diagram, shown in the illustration, what occurs between points "e" and "f"? Illustration MO-0035
Pressure in the cylinder decreases.

Illustrations: MO0035_AO_020215WM

In the pressure-volume diagram, shown in the illustration, the volume line is divided into 16 units indicating _____. Illustration MO-0035
a 16 to 1 compression ratio

Illustrations: MO0035_AO_020215WM

In the pressure-volume diagram shown in the illustration, curve 'A-d' indicates _____. Illustration MO-0035
combustion at approximately constant pressure

Illustrations: MO0035_AO_020215WM

In the pressure-volume diagram, shown in the illustration, what is indicated to have occurred by the line connecting points 'd' and 'e'? Illustration MO-0035
The combustion gases have expanded.

Illustrations: MO0035_AO_020215WM

In the pressure-volume diagram shown in the illustration, the atmospheric pressure line is indicated by line _____. Illustration MO-0035
C

Illustrations: MO0035_AO_020215WM

Which of the following conditions would NOT be considered a valid reason for the diesel engine to operate in the area indicated by letter "B" shown in the illustration? Illustration MO-0126
Operating with minimal hull drag and under light draft

Illustrations: MO0126_WM_102218

Line "P" in the illustration is the _____. Illustration MO-0126
propeller curve

Illustrations: MO0126_WM_102218

Which of the following conditions will cause the engine to operate in area "A" of the diagram shown in the illustration? Illustration MO-0126
Excessive propeller cavitation

Illustrations: MO0126_WM_102218

The diagram shown in the illustration may be used to determine the proper operation of the engine. Which of the following statements represents an accurate interpretation of the diagram? Illustration MO-0126
Ideally the engine should be operated in area "A", however, it is permissible to intermittently operate the engine in area "B".

Illustrations: MO0126_WM_102218

If point #1 in the diagram shown is the beginning of gas compression, which of the cycles listed is being illustrated? Illustration MO-0036
Diesel

Illustrations: MO0036_AO_020215WM

The pressure-volume diagrams illustrated are of four internal combustion engine cycles. Which one represents the theoretical diesel cycle? Illustration MO-0102
B

Illustrations: MO0102_WM_102218

Which of the labeled figures illustrated, represents the correct alignment mark relationships of a properly reassembled centrifuge bowl? Illustration MO-0022
A

Illustrations: MO0022_AO_020215WM

The indicated position of the fuel injection pump plunger as shown in the illustration will provide fuel delivery to the diesel engine in an amount approximately equal to _____. Illustration MO-0061
maximum fuel flow

Illustrations: MO0061_WM_101918

Which of the following statements represents the function of the plunger flange labeled "A" shown in the illustration? Illustration MO-0061
It transmits the control rack setting to the plunger.

Illustrations: MO0061_WM_101918

As shown in the illustration of the fuel injection pump, the section designated as "M" is referred to as the _____. Illustration MO-0061
plunger helix

Illustrations: MO0061_WM_101918

As shown in the illustration of the fuel injection pump, the component labeled "N" would be identified as the _____. Illustration MO-0061
Barrel

Illustrations: MO0061_WM_101918

As shown in the illustration of the fuel injection pump, the function of the area designated as "L" is to _____. Illustration MO-0061
allow excess fuel oil to return to the fuel oil system

Illustrations: MO0061_WM_101918

In the illustration shown, moving the component labeled "E", further to the left, will result in _____. Illustration MO-0061
a shorter fuel injection cycle

Illustrations: MO0061_WM_101918

The item labeled #16 in the illustration is a stack of spring washers. Their function is to _____. Illustration MO-0062
maintain the same hold-down force on the injector regardless of varying engine operating temperatures

Illustrations: MO0062_WM_101918

The governor utilized with the device shown in the illustration has become inoperative while the vessel is underway at sea. Which of the following statements describes what action should be taken? Illustration MO-0119
The engine speed can be controlled using the fuel control lever without changing the position of the maximum fuel stop.

Illustrations: MO0119_WM_102218

A propulsion engine, using the speed control circuit shown in the illustration, fails to function at speeds lower than the low end of the critical speed range. Which of the following statements describes what should be done to correct this malfunction? Illustration MO-0114
Device 17A needs to be replaced, repaired, or reset to the set point coinciding with the RPM value for the low end of the critical speed range.

Illustrations: MO0114_WM_102218

Excessive wear at part #11, as shown in the illustration, would result in _____. Illustration MO-0027
increased oil consumption

Illustrations: MO0027_WM_101818
See REF2300

Excessive wear at part #11, as shown in the illustration, would result in _____. Illustration MO-0027
increased oil consumption

Illustrations: MO0027_WM_101818
See REF2300

The gear drive, shown in the illustration, can have the backlash determined best by using a _____. Illustration MO-0091
feeler gauge

Illustrations: MO0091_WM_101918

The gasket "U" shown in the illustration, is used to seal the liquid space below the _____. Illustration MO-0112
sliding piston

Illustrations: MO0112_WM_042419

The device labeled "D", as shown in the illustration, is the bowl _____. Illustration MO-0112
top

Illustrations: MO0112_WM_042419

The port "X" shown in the illustration allows water to enter the adjoining chamber. During what cycle of operation will this occur? Illustration MO-0112
Sludge discharge cycle

Illustrations: MO0112_WM_042419

The area indicated by the letter "W", shown in the illustration is correctly termed the _____. Illustration MO-0112
opening chamber

Illustrations: MO0112_WM_042419

The area indicated by the letter "W", shown in the illustration is correctly termed the _____. Illustration MO-0112
opening chamber

Illustrations: MO0112_WM_042419

What terminates the sludge discharge cycle of the device shown in the illustration? Illustration MO-0112
The solenoid valve closes, allows the water in the opening chamber to bleed off through "S", and the sliding piston moves upward due to the force developed in area "J".

Illustrations: MO0112_WM_042419

What is used as the primary operating medium during the sludge discharge cycle, shown in the illustration? Illustration MO-0112
Water

Illustrations: MO0112_WM_042419

Where does the shoot cycle operating liquid first come in contact with the rotating forces of the device shown in the illustration? Illustration MO-0112
In the opening chamber labeled "L".

Illustrations: MO0112_WM_042419

If item "F" begins leaking during operation, which of the following operating conditions will NOT occur? Illustration MO-0112
The oil/water interface will remain in the same neutral position.

Illustrations: MO0112_WM_042419

The unit shown in the illustration is beginning the sludge discharge cycle. The operating liquid solenoid valve has been energized and space "J" is filling up. Which of the following actions should occur next? Illustration MO-0112
The liquid enters via port "X" into the opening space with the net resultant force causing the piston slide to move down.

Illustrations: MO0112_WM_042419

Which of the following statements describes what will occur if the annular spaces, indicated by the letter "K" of the device shown in the illustration, became restricted? Illustration MO0112
The bowl will fail to close when starting and the unit will not shoot when operating.

Illustrations: MO0112_WM_042419

The device labeled 'C' shown in the illustration is known as the _____. Illustration MO-0112
upper locking ring

Illustrations: MO0112_WM_042419

What terminates the sludge discharge cycle of the device shown in the illustration? Illustration MO-0112
The solenoid valve closes, allows the water in the opening chamber to bleed off through "S", and the sliding piston moves upward due to the force developed in area "J".

Illustrations: MO0112_WM_042419

During the normal operation of the centrifuge shown in the illustration, the operating liquid solenoid and bypass valves for the cleaning cycle should be in which position? Illustration MO-0112
The solenoid valve is closed and the bypass valve is closed.

Illustrations: MO0112_WM_042419

The device labeled "B", shown in the illustration, is known as the _____. Illustration MO-0112
centripetal pump chamber cover

Illustrations: MO0112_WM_042419

Which of the following statements describes what will occur if the annular spaces, indicated by the letter "K" of the device shown in the illustration, became restricted? Illustration MO0112
The bowl will fail to close when starting and the unit will not shoot when operating.

Illustrations: MO0112_WM_042419

The device labeled "D", as shown in the illustration, is the bowl _____. Illustration MO-0112
top

Illustrations: MO0112_WM_042419

The device labeled "A", shown in the illustration, is known as the _____. Illustration MO-0112
regulating ring

Illustrations: MO0112_WM_042419

The item indicated by the letter "F" of the device shown in the illustration is the _____. Illustration MO-0112
upper bowl gasket

Illustrations: MO0112_WM_042419

Which of the following statements describes "N" shown in the illustration? Illustration MO-0112
the centrifuge disc stack

Illustrations: MO0112_WM_042419

The device labeled "H", shown in the illustration is referred to as the _____. Illustration MO-0112
centrifugation chamber bottom gasket

Illustrations: MO0112_WM_042419

Item "O" of the device shown in the illustration is the _____. Illustration MO0112
spindle nut

Illustrations: MO0112_WM_042419

The force developed by the liquid within space "J" of the device shown in the illustration depends upon _____. Illustration MO-0112
the speed of the bowl and the condition of seal "U"

Illustrations: MO0112_WM_042419

The wear liner shown in the illustration is indicated by the letter _____. Illustration MO-0112
"R"

Illustrations: MO0112_WM_042419

During normal operation, the liquid retained in space 'J' of the device shown in the illustration is _____. Illustration MO-0112
directly forcing the sliding piston upward to keep the bowl closed

Illustrations: MO0112_WM_042419

After removing the bowl hood of the device shown in the illustration, excessive quantities of sludge are visible. Which of the following statements represents the approach to rectify the situation? Illustration MO-0112
Disassemble the entire unit, clean all components, replace any defective gaskets and use the proper lubricants where required.

Illustrations: MO0112_WM_042419

The discharge nozzle shown in the illustration, is indicated by the letter _____. Illustration MO-0112
S

Illustrations: MO0112_WM_042419

The area indicated by the letter "L" of the device shown in the illustration is properly called the _____. Illustration MO-0112
injection chamber

Illustrations: MO0112_WM_042419

When tightening the lock ring "G" of the device shown in the illustration, two events are simultaneously accomplished. Which of the following statements represents these events? Illustration MO-0112
When tightened, the lock ring allows for movement of the sliding piston and positions the sliding piston within the bowl bottom.

Illustrations: MO0112_WM_042419

The device shown in the illustration can be automatically or manually desludged. The closing sequence at the end of the desludging cycle is initiated by opening which of the labeled components listed below? Illustration MO-0012
Q

Illustrations: MO0012_WM_101718

While operating the fuel oil centrifuge shown in the illustration, the bowl fails to open for sludge ejection. The probable cause is that _____. Illustration MO-0012
the seal ring on the operating slide is defective

Illustrations: MO0012_WM_101718

The greatest difference between the centrifuge bowl shown in the illustration and that of a tubular bowl, with straight, vertical, interior surfaces, is that the illustrated unit _____. Illustration MO-0012
is self desludging

Illustrations: MO0012_WM_101718

While operating the fuel oil centrifuge shown in the illustration, the fuel oil is being continuously ejected with the sludge and the seal water. The probable cause is the _____. Illustration MO-0012
gravity disk inside diameter is too large

Illustrations: MO0012_WM_101718

While operating the fuel oil centrifuge shown in the illustration, the bowl fails to open for sludge ejection. The probable cause is that _____. Illustration MO-0012
the seal ring on the operating slide is defective

Illustrations: MO0012_WM_101718

When reassembling the bowl of the centrifuge, shown in the illustration, the alignment mark on the locking ring passes the bowl cover mark in excess of the manufacturer's specifications. This is due to _____. Illustration MO-0012
excessive wear of the locking ring and/or bowl threads

Illustrations: MO0012_WM_101718

While operating the fuel oil centrifuge shown in the illustration, the fuel oil is being continuously ejected with the sludge and the seal water. The probable cause is the _____. Illustration MO-0012
gravity disk inside diameter is too large

Illustrations: MO0012_WM_101718

In the device shown in the illustration, the component lettered "A" is the _____. Illustration MO-0012
dirty oil input port

Illustrations: MO0012_WM_101718

The temperature of the contaminated fuel oil fed to the centrifuge shown in the illustration should be _____. Illustration MO-0012
203°F to less than 212°F

Illustrations: MO0012_WM_101718

The greatest difference between the centrifuge bowl shown in the illustration and that of a tubular bowl, with straight, vertical, interior surfaces, is that the illustrated unit _____. Illustration MO-0012
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Illustrations: MO0012_WM_101718

The temperature of the contaminated fuel oil fed to the centrifuge shown in the illustration should be _____. Illustration MO-0012
203°F to less than 212°F

Illustrations: MO0012_WM_101718

In the device shown in the illustration, the component lettered "A" is the _____. Illustration MO-0012
dirty oil input port

Illustrations: MO0012_WM_101718

The instrument shown in the illustration would be used on a diesel engine to _____. Illustration MO-0031
measure cylinder compression or firing pressures

Illustrations: MO0031_AO_101818WM
See REF2295

In the illustrated engine, the fuel camshaft gear drive housing is indicated as letter _____. Illustration MO-0003
F

Illustrations: MO0003_WM_030322

The lower end of the piston rod, shown in the illustration, is fitted into the _____. Illustration MO-0003
crosshead

Illustrations: MO0003_WM_030322

The part labeled "X" shown in the illustration is a _____. Illustration MO-0003
lube oil line

Illustrations: MO0003_WM_030322

In the large slow-speed main propulsion diesel engine shown in the illustration, the part labeled "G" is the _____. Illustration MO-0003
fuel oil pump

Illustrations: MO0003_WM_030322

The diesel engine shown in the illustration has the highest fuel pressure developed in the part labeled _____. Illustration MO-0003
E

Illustrations: MO0003_WM_030322

The diesel engine shown in the illustration, the exhaust manifold is indicated by the letter _____. Illustration MO-0003
U

Illustrations: MO0003_WM_030322

REF2161
Heavy fuel oil used in marine main diesel engines is a residue from crude oil refining. Because of the properties of heavy fuel oil it is required be kept at a high storage temperature and for usage. Despite this heavy fuel combustion products remain high in NOx, Sox, and CO2 in the exhaust gases.

REF2176
A lubricating oil with a high viscosity index exhibits a high resistance to viscosity change as the temperature changes, which is a highly desirable property for an oil to have as used in engine applications subject to widely varying ambient temperatures. As the temperature changes, the oil viscosity of oils with a high viscosity index remains relatively stable, providing optimal lubrication and reliable starting. A lubricating oil with a low viscosity index has a low resistance to viscosity change as the temperature changes, which is NOT a desirable property for an oil to have as used in engine applications subject to widely varying ambient temperatures. As the temperature changes, the oil viscosity of oils with a low viscosity index will change signifcantly, providing less-than-optimal lubrication and unreliable starting. Extreme pressure additives are generally associated with reducing tooth wear in reduction gear applications and are generally not associated with motor oils. Geared steam turbine drive lubricating oils would feature extreme pressure additives, for example. High viscosity index oils used in engine applications subject to widely varying ambient temperatures are formulated with additives to improve the viscosity index.

REF2272
Jacket water heaters are used in cold weather to keep an engine warm for ease of starting.

REF2273
Cetane number or CN is a measurement of the combustion quality of diesel fuel during compression ignition. It is a significant expression of the quality of a diesel fuel. A number of other measurements determine overall diesel fuel quality - these other measures of diesel fuel quality include density, lubricity, cold-flow properties, and sulfur content.

REF2278
This illustration shows a cutaway view of an Electromotive Diesel (EMD) engine. This engine is installed on many vessels under 1, 600 gross tons. These EMD engines come in 8, 12, 16 and 20 cylinder models as main propulsion as well as electrical generation plants. They are "V"-type, two-stroke/cycle, positive scavenging air system (with uniflow scavenging exhaust valves), turbocharged with solid unit injection. They are designed with "power packs" so that their integral liners, pistons and connecting rods can be removed as a "cylinder power assembly." In a two stroke cycle engine there is only a Compression stroke and a Power stroke. The intake and exhaust of the gases occurs near Bottom Dead Center (BDC). when the piston is farthest from the cylinder head. The cylinder fIres for every revolution of the crankshaft. All two-stroke engines must have ports (i.e., holes) in the lower part of the cylinder that become exposed as the piston approaches Bottom Dead Center (BDC).

REF2279
Bleed all pressure from the system before opening any part to service or repair a hydraulic starting system.

REF2280
Note: The crankshaft assembly of a diesel engine must be statically and dynamically balanced in order to minimize vibration and component wear. When a stationary crankshaft’s center of mass is on the axis of rotation, it is said to be statically balanced. With the crankshaft supported on two horizontal knife edges, the shaft will be stable at any position of the cranks, and will have no tendency to roll.

REF2281
A crankcase explosion is caused by ignition of oil mist, itself created by the presence of a hot spot, which led to the evaporation of lubricating oil and its condensation into an oil mist. Its consequences can be severe, including death and serious injury to personnel and extensive damage to the engine.

REF2282
Lube oil pumps of most diesel engines are most commonly positive-displacement type gear pumps .

REF2283
46 CFR 112

REF2284

Which of the following test indicators should be considered a determining factor as to whether or not a diesel generator's lube oil should be drained and renewed? Note: The results of several tests must be considered concurrently, i.e. precipitation number, neutralization number, increase in viscosity, etc., when determining whether or not the engine oil should be changed. A. An extremely "low" neutralization number. Incorrect: The neutralization number of a lube oil is used to indicate the level of acidity in the oil. Lubricating oil will normally become more acidic over a period of time in a diesel due to its contact with combustion by-products. The neutralization number is established by measuring the number of milligrams of potassium hydroxide (KOH) required to titrate and neutralize the acidity of a one gram sample of the lube oil. A low "neutralization number" represents the fewest number of milligrams needed to neutralize the sample and would have a pH value approaching 7. A high neutralization number indicates a high level of acidity and will result in acidic corrosion of bearing surfaces and other internal parts of the engine. B. An extremely high precipitation number. Correct: A high precipitation number indicates that an excessive amount of suspended insoluble particles have accumulated in the oil from a variety of sources such as: combustion by-products, contaminated air charge due to defective air filtration, etc. C. The oil appears black in color. Incorrect: A dark color change is usually the result of piston blow-by or from excessive valve guide clearance. This color change is normal due to normal stopping and starting an engine, especially if it is allowed to cool before being restarted. D. A minor increase in flash point. Incorrect: An increase in the flash point of a lube oil may be the result of water mixing with the oil and/or an increase in emulsions. A minor increase in flash point should not be a cause for concern or require replacement of the oil.

REF2285
Valve springs close the intake and exhaust valves. Valve springs are always under compression when installed in an engine.

REF2286
Knurling - A method of placing ridges in a surface, thereby forcing the areas between these ridges to rise.

REF2287
Engines equipped with a turbocharger also have an aftercooler (also called an intercooler) to remove the heat of compression produced by compressing the air. This increases the amount of air intake pushed into the cylinder. The aftercooler uses cool water passing through water jackets to cool the air passing through its air passages. If the aftercooler becomes clogged, the water will not flow through its water jackets and the air fed into the engine's air intake will not be cooled. In hot climates, diesel engines require air that is cool and dense for most efficient operation.

REF2288
Black smoke is caused by incomplete combustion. Common causes of black smoke are engine overloading, too much fuel, or insufficient air caused by a clogged air filter.

REF2289
Internal combustion piston engines require four (4) "events" to take place: 1. Intake of fresh air. 2. Compression of the air charge. 3. Expansion (Power) of the gases, after the air-fuel mixture is ignited. 4. Exhaust of the products of combustion (i.e., exhaust gases). In a four-stroke cycle engine each of the "events" occurs mainly in one of four strokes - Intake. Compression. Power and Exhaust. The piston makes two strokes - one down and one up - for each revolution of the crankshaft. Therefore the crank makes two revolutions for each "firing" of cylinders of four stroke engines.

REF2290
Cetane number (cetane rating) is an indicator of the combustion speed of diesel fuel and compression needed for ignition. It plays a similar role for diesel as octane rating does for gasoline. The CN is an important factor in determining the quality of diesel fuel, but not the only one; other measurements of diesel fuel's quality include (but are not limited to) energy content, density, lubricity, cold-flow properties and sulphur content. The cetane number (or CN) of a fuel is defined by finding a blend of cetane and heptamethylnonane with the same ignition delay. Cetane has a cetane number defined to be 100, while heptamethylnonane's measured cetane number is 15, replacing the former reference fuel alpha-methylnaphthalene, which was assigned a cetane number of 0. Once the blend is known, the cetane number is calculated as a volume-weighted average, rounded to the nearest whole number, of cetane's 100 and heptamethylnonane's 15. cetane number = % n-cetane + 0.15(% heptamethylnonane) Cetane number is an inverse function of a fuel's ignition delay, the time period between the start of ignition and the first identifiable pressure increase during combustion of the fuel. In a particular diesel engine, higher cetane fuels will have shorter ignition delay periods than lower Cetane fuels. Cetane numbers are only used for the relatively light distillate diesel oils. For heavy (residual) fuel oil two other scales are used, CCAI and CII. Generally, diesel engines operate well with a CN from 48 to 50. Fuels with lower cetane number have longer ignition delays, requiring more time for the fuel combustion process to be completed. Hence,

higher speed diesel engines operate more effectively with higher cetane number fuels.

REF2291
Regarding centrifuge questions: Refer to illustration MO-0113 and remember that all four questions give the temperature in °F but illustration MO-0113 uses °C. Therefore you must covert all °F to °C using the formula °C = (°F – 32) * 5 / 9 Fuel must be heated to ensure proper separation. When fuel is heated its specific gravity (kg/dm3) decreases. The downward, left to right sloping lines on the graph are the fall in specific gravity (kg/dm3) as the fuel is heated in degrees Celsius (°C). Therefore larger sized regulating rings are designed to be used with lower specific gravities. Note: dm3 = decimeters cubed i.e., 1/10th of a meter cubed Example For a given separating temperature, the inner diameter of the regulating ring can be determined from the diagram, provided that the specific gravity of the oil at a temperature ranging between 15° and 90° C is known. Given: Specific Gravity of oil @ 15° C (59° F) = .98 kg/dm3 Separating temperature = 167° F = 75° C Plot of values on the graph indicate that a 92 mm inner diameter regulating ring is required (where solid arrows intersect on graph). Example For a given separating temperature, the inner diameter of the regulating ring can be determined from the diagram, provided that the specific gravity of the oil at a temperature ranging between 15° and 90° C is known. Given: Specific Gravity of oil @ 15° C (59° F) = .98 kg/dm3 Separating temperature = 167° F = 75° C Plot of values on the graph indicate that a 92 mm inner diameter regulating ring is required (where solid arrows intersect on graph).

REF2292
The diameter of the fuel injector nozzle orifces is a critical factor in■uencing the degree of fuel atomization. With all other factors remaining unchanged, the smaller the diameter of the orifces, the greater the degree of fuel atomization. Note: The degree of atomization of fuel entering a diesel engine cylinder is a function of the diameter and shape of the nozzle orifces, injection pressure, and the density of the air charge in the combustion chamber.

REF2293
A jerk pump injection system has an individual injection pump and a separate spray needle valve nozzle for each cylinder. Note: Plunger-type fuel injection pumps incorporate a fuel delivery check valve situated between the top of the pump housing and the high-pressure fuel line leading to the injector nozzle. For the purposes of this discussion, it will be assumed that the port and helix metering principle is used. When seated, the area of exposure to the fuel pressure above the fuel injection pump plunger is relatively small. The rapid buildup in pressure that occurs when supply and spill valve ports are closed and the plunger is moving upward becomes sufficiently high in pressure to overcome the delivery spring valve compression allowing the delivery valve to open and begin injection. Once the delivery valve opens, the area of exposure is significantly increased, which requires a significant drop in fuel pressure in order for the delivery valve to reseat. This rapid drop in pressure will occur when the spill port opens as a result of the plunger moving still higher. The closing spring force is much stronger than the now relatively low fuel pressure, resulting in very rapid cutoff (ending) of fuel injection. The delivery valve also functions as a check valve preventing the backflow of fuel from the high-pressure fuel line back into the pump housing, thus keeping the high-pressure fuel line full of fuel.

REF2294
A unit injector. It contains the injector pump in its top portion and the injector nozzle in its tip at the bottom of the illustration.

REF2295
This device takes compression and firing pressure readings. To do this the gauge must be connected to the blow-down valves. Low compression pressure can be caused by bearing wear or by reducing the compression ratio (i.e., the clearance between the piston crown and the cylinder head at Top Dead Center (TDC).

REF2296
Idle a Diesel engine for several minutes before shut down to allow coolant to circulate and prevent damage from localized overheating after shut down.

REF2297
White smoke in diesel engines is most commonly condensed water vapor. This is normal in cold engines at start up. However, in an operating engine, white smoke may indicate a cracked liner, a leaking exhaust valve, etc.

REF2298
The ash content is related to the amount of inorganic material in the fuel. For distillate fuel the ash content is defined as the residue remaining after all the combustible components of the oil have been burned and is negligible. It is the incombustible material which remains after the combustion, which mainly consists of the material such as vanadium,

sulphur, silicon, aluminum, nickel, sodium, and iron content present in the fuel. The maximum limit of ash content in the fuel is 0.2% m/m.

REF2299
Do not operate an electric starting motor for more than 30 seconds without allowing it to cool for at least two (2) minutes.

REF2300
Valve lash, or clearance, is the distance between the valve stem and rocker arm when the cam is in a "neutral" position. Use Feeler Gauges to measure this clearance when the engine is cold. When valve lash is less than normal the valve will open early and close late. Worn cylinder head valve seats will have less valve lash. A clicking noise from the valve gear indicates there is too much valve lash. Without cold valve clearance, expansion of heated parts, would cause the valves to remain partially open during engine operation. "Clearance" refers to tappet clearance. A clicking noise may also indicate that valve train parts are hammering against each other which will reduce camshaft and valve lifter life.

REF2301
Note: While diesel engine cylinder head test cocks may be used to remove moisture accumulations from the cylinders prior to starting, as the name implies, the primary function of the cylinder head test cocks is to provide a place of attachment for a cylinder pressure indicating device.

REF2302
Control and safety devices for marine diesel engine The principal control device on any engine is the governor. It governs or controls the engine speed at some fixed value while power output changes to meet demand. This is achieved by the governor automatically adjusting the engine fuel pump settings to meet the desired load at the set speed. Governors for diesel engines are usually made up of two systems: a speed sensing arrangement and a hydraulic unit which operates on the fuel pumps to change the engine power output. Mechanical governor A flyweight assembly is used to detect engine speed. Two flyweights are fitted to a plate or ballhead which rotates about a vertical axis driven by a gear wheel . The action of centrifugal force throws the weights outwards; this lifts the vertical spindle and compresses the spring until an equilibrium situation is reached. The equilibrium position or set speed may be changed by the speed selector which alters the spring compression. As the engine speed increases the weights move outwards and raise the spindle; a speed decrease will lower the spindle. The hydraulic unit is connected to this vertical spindle and acts as a power source to move the engine fuel controls. A piston valve connected to the vertical spindle supplies or drains oil from the power piston which moves the fuel controls depending upon the flyweight movement. If the engine speed increases the vertical spindle rises, the piston valve rises and oil is drained from the power piston which results in a fuel control movement. This reduces fuel supply to the engine and slows it down. It is, in effect, a proportional controller . The actual arrangement of mechanical engine governors will vary considerably but most will operate as described above. Electric governor The electric governor uses a combination of electrical and mechanical components in its operation. The speed sensing device is a small magnetic pick-up coil. The rectified, or d.c., voltage signal is used in conjunction with a desired or set speed signal to operate a hydraulic unit. This unit will then move the fuel controls in the appropriate direction to control the engine speed. Governors and Over-speed Trips These must be fully operational and regularly tested in accordance with manufacturers' instructions. Attention is drawn to the testing of over speed trip and protection devices. The condition of the linkage coupling the engine's fuel pump actuating levers and the governor is also to be regularly examined. The governor cannot compensate for either seized fulcrum pins or excessive clearances.

REF2303
A jerk pump injection system has an individual injection pump and a separate spray needle valve nozzle for each cylinder.

REF2304
The ignition delay in a diesel engine is defined as the time interval between the start of injection and the start of combustion. This delay period consists of (a) physical delay, wherein atomisation, vaporization and mixing of air fuel occur and (b) of chemical delay attributed to pre-combustion reactions.

REF2305
A disk type centrifugal purifier must have a water seal to operate properly. When starting the unit you must add water (i.e. , prime the unit) to establish the water seal. If you do not do this, or if you lose the water during operation (for example - through a deteriorated bowl ring gasket), oil will leak from the water (heavy phase) discharge port and be wasted. Water escaping from the water discharge of an operating centrifuge indicates a loss of the water seal. You must add water to the centrifuge bowl to seal it.

REF2306
The cylinder "bore" refers to the inside diameter of the cylinder.

REF2307
Brake horsepower is the horsepower of an engine measured by the degree of resistance offered by a brake, that represents the useful power that the machine can develop. For an electric motor, brake horsepower is the mechanical horsepower available at the shaft at specified rpm and full load current. The difference between the brake horsepower and the indicated horsepower represents the rate at which energy is absorbed in overcoming mechanical friction of the moving parts of the engine. Brake horsepower is the horsepower of an engine measured by the degree of resistance offered by a brake, that represents the useful power that the machine can develop.

REF2308
During compression the pressure and temperature both increase. In a diesel engine this temperature rise, called the "Heat of Compression." causes the fuel to ignite as it is injected into the cylinder. The highest pressure in a Diesel engine occurs after Top Dead Center (TDC).

REF2309
Note: In the theoretical Diesel cycle, ignition is achieved by the heat of compression of air. The fuel used has relatively low volatility and burns very slowly. During the entire ignition/combustion event, the cylinder pressure is held essentially constant, as fuel continues to be injected and burned. In the theoretical Otto cycle, ignition is achieved by means of a spark. The fuel utilized has a relatively high volatility and burns instantly, resulting in a rapid build up in cylinder pressure. During the extremely brief ignition/combustion event, the cylinder volume is essentially constant. In an actual diesel engine, the cycle behavior takes on characteristics of both the Diesel and Otto cycles. Since the diesel fuel has a moderately low volatility, a fair amount of diesel fuel accumulates in the cylinder before ignition actually begins. This results in a rapid pressure rise at constant volume. As the piston descends downward on the power stroke, fuel continues to be injected and continues to burn moderately slowly. This results in combustion ending on a constant pressure basis.

REF2310
The bore of 29.5 inches is irrelevant as is the five cylinder info, those are meant to throw you off. 63 inches x 2 (up stroke and down stroke) = 126 inches of travel per rpm. 126 inches x 123 RPM = 15,498 inches 15,498 inches/12 inches = 1,291.5 ft/min The best answer is 1291 ft/min Reply

REF2311
The key to this question is realizing that the scale of the indicator spring is basically a conversion factor with: 1 mm = 1 kg/cm2 and recall that 1 cm = 10 mm The cylinder mean effective pressure = Area (cm2) / length (cm) * 10 mm/cm / 1 kg/cm2/mm MEP = 22 cm2 / 12.5 cm * 10 mm/cm / 1 mm/1kg/cm2 MEP = 17.6 kg/cm2

REF2312
2 stroke, N = 100 rpm The problem asks for total brake horsepower and gives a cylinder constant of .998 and a mechanical efficiency of 83%. Recall that BHP = IHP * (mechanical efficiency % /100) The cylinder constant equals .998 therefore although the bore and the stroke are not given you have to assume that: .998 = π * D2 / 4 / 100 mm2/cm2 * length of stroke in mm / 1000 mm/m * 3.28083 ft/meter * 2.20462 lb./kg / 33,000 ft-lb./min-hp * .746 kW/hp Metric Brake horsepower (kW) = 15 kg/cm2 * 6 cyl * .998 * 100 rpm * .83 Metric Brake horsepower = 7,455 kW Reference Material for this question courtesy of the FAME Foundation, Inc. Mass. Maritime Academy.

REF2313
4-stroke N = 50 rpm LONG WAY kW = 30 kg/cm2 * 2.20462 lb./kg * 1400 mm / 1000 mm/meter * 3.28083 ft/meter * π * (650 mm)2 / 4 / 100 mm2/cm2 * 50 rpm * 8 cyl * .746 kW/hp / 33000 ft-lb./min-hp Indicated metric horsepower = 9,115 kW SHORTCUT IHP = P*L*D2*N*C*1.28410-9 IHP = 30 * 1400 * (650)2 * 50 * 8 * 1.28410-9 IHP = 9113 kW

REF2314
Two-stroke engine Camshaft speed = crankshaft speed = 950 rpm Reference Material for this question courtesy of the FAME Foundation, Inc. Mass. Maritime Academy.

REF2315
Piston speed is velocity and is commonly referred to in ft/min. L = piston stroke = 10.5 in N = 720 rpm Recall that for each revolution the piston completes 2 strokes. Therefore Piston speed in ft/min = 10.5 in / 12 in/ft * 720 rev/min * 2 strokes/rev Piston speed = 1260 ft/min Reference Material for this question courtesy of the FAME Foundation, Inc. Mass. Maritime

Academy.

REF2316
4 stroke, N = 45 rpm LONG WAY kW = 18 kg/cm2 * 2.20462 lb./kg * 1500 mm / 1000 mm/meter * 3.28083 ft/meter * π * (740 mm)2 / 4 / 100 mm2/cm2 * 45 rpm * 4 cyl * .746 kW/hp / 33000 ft-lb./min-hp Indicated metric horsepower = 3417 kW SHORTCUT IHP = P*L*D2*N*C*1.28410-9 IHP = 18 * 1500 * (740)2 * 45 * 4 * 1.28410-9 IHP = 3417 kW Reference Material for this question courtesy of the FAME Foundation, Inc. Mass. Maritime Academy.

REF2317
Atomization (i.e., the process of breaking fuel down into very small droplets) normally takes place at the injector nozzle tip. Proper fuel oil temperature is required for improved atomization.

REF2318
The extent of distribution of fuel in the combustion chamber is called fuel penetration.

REF2319
The lower the load on a diesel engine, the less fuel is injected per compression/ power event. This, in turn, will cause the air/fuel ratio to be higher. Note: Diesel engines, in contrast to gasoline engines, do not run under constant air/fuel ratio conditions. The actual air/fuel ratio of a diesel engine is the actual weight of air supplied to the weight of fuel injected. Although the air/fuel ratio characteristics for a naturally aspirated engine will be different than that for a turbocharged engine, in both cases, far more air will be introduced into the cylinder than is required for complete combustion.

REF2320
Well-lubricated bearing surfaces will appear highly polished.

REF2321
The main bearings of a diesel engine normally are the first components lubricated in the lube oil system. In a by-pass type lube oil system, the oil that by-passes the filter is sent directly to the bearings.

REF2322
Lube oil should be hot to lower its viscosity (i.e., thickness) to insure efficient filtering. Lube oil strainers are nonnally located before the oil cooler since hot oil filters more easily than cold oil. They are also commonly located at the pump suction.

REF2323
Always check oil levels before starting a diesel engine. Check the oil pressure as soon as the engine starts.

REF2324
Before starting, pressurize (i.e .. "pre-lube") a Diesel engine's lube oil system with an engine-driven or hand-operated lube oil pump.

REF2325
Magnetic strainers are located in the lube oil discharge piping to protect the bearings from iron or steel particles.

REF2326
Lube oil strainers are nonnally located before the oil cooler since hot oil filters more easily than cold oil. They are also commonly located at the pump suction.

REF2327
In internal combustion engines, the gudgeon pin (UK, wrist pin US) connects the piston to the connecting rod and provides a bearing for the connecting rod to pivot upon as the piston moves. In very early engine designs (including those driven by steam and also many very large stationary or marine engines), the gudgeon pin is located in a sliding crosshead that connects to the piston via a rod.

REF2328
When oil vapor, oxygen, and hot spots occurring at the same time, they can cause a crankcase explosion. The purpose of crankcase explosion vent (Illustration MO-OI05) is to protect the engine crankcase from overpressure damage in an explosion. Do not open crankcase inspection covers after an engine stops as a result of piston seizure caused by severe

overheating until the engine cools. Opening an inspection cover invites a crankcase explosion as fresh air pours into the crankcase.

REF2329
"Scavenging" replaces the products of combustion that linger in a cylinder after it receives a charge of fresh air. On a two stroke engine scavenging is accomplished by a mechanical blower since the engine has no intake or exhaust stroke to remove these gases .

REF2330
A crankcase ventilation system is a one way passage for gases to escape in a controlled manner from the crankcase of an internal combustion engine. This is necessary because internal combustion inevitably involves a small but continual amount of blow-by, which occurs when some of the gases from the combustion leak past the piston rings (that is, blow by them) to end up inside the crankcase, causing pressure to build up in the crank case.

REF2331
A diesel engine's main bearings connect the crankshaft with the engine block. Precision insert bearings are widely used as main and connection rod bearings.

REF2332
Leaking intake or exhaust valves result in high cylinder exhaust temperature, cause loss of compression, misfiring or rough running, or valve damage. Low compression pressure can be caused by bearing wear or by reducing the compression ratio (i.e., the clearance between the piston crown and the cylinder head at Top Dead Center (TDC). Clogged air filters, burned exhaust valves, and leaky valve cages can cause low compression pressure in Diesel engines. At light loads, misfiring can occur as a result of excessive cylinder cooling in engines with lower compression ratios.

REF2333
Blue smoke is a sign of lubricating oil being burned by your engine. If you have blue smoke mainly at start up and it is very minor while running, this points to worn valve guides. When the engine sits for a bit (over night etc), oil left in the head after running can seep down into the combustion chamber. Upon start the bulk of it is burned quickly.

REF2334
Note: On V-type medium-speed diesel engines, typically only one bank of cylinders is ftted with air starting valves. operation is under higher compression : Incorrect answer. Compression pressures are essentially the same for all cylinders, whether or not they are ftted with air starting valves. fuel is admitted only to these cylinders during cranking : Incorrect answer. During cranking, fuel is admitted to all cylinders in the sequence of their fring order. compression is released during starting by opening the exhaust valve : Incorrect answer. During cranking, compression is not released by any means. The exhaust valves open toward the end of the power stroke, as they would normally when the engine is in operation. cylinders are not chilled by the expansion of the starting air : Correct answer. Even though the compression pressures are essentially the same for all cylinders — whether or not ftted with air starting valves — those cylinders ftted with air starting valves would tend to have a lower fnal compression temperature due to the chilling effect of starting air. Therefore, those cylinders not fitted with air starting valves would tend to fire frst.