

**1. What is the value of the controlled variable that the automatic controller operates to maintain?**

**A. Set Point**

Incorrect: The set point represents a relative position to which the control-point-setting mechanism is set, and is only obtainable when the value of the controlled variable coincides with the physical setting of the controller and achievable without the condition of "offset."

**B. Control Point**

Correct: The control point is the value of the controlled variable, which under any fixed set of conditions; the automatic controller operates to maintain the value of the controlled variable.

**C. Deviation**

Incorrect: Deviation is the instantaneous difference between the actual value of the controlled variable and the value of the controlled variable corresponding with the set point.

**D. Offset**

Incorrect: Is the steady-state difference between the desired control point and the value of the controlled variable that corresponds to the set point.

## **2. Which ring dam arrangement should be used for centrifugal purification?**

*Note: If the oil discharged from a purifier is to be free of water, dirt, and sludge, and if the water discharged from the bowl is not to be mixed with oil, the proper size discharge ring (ring dam) must be used. The position of the oil and water layer (interface) in the purifier bowl is a function of the specific gravity of the oil, and ring dam size. As a rule, the higher the specific gravity of the oil, the smaller is the inside diameter of the ring dam. Hence, an oil with a specific gravity closer to water, will need to have a relatively small inside diameter ring than a lighter oil. While the outside diameter of the discharge ring is fixed, the inside diameter may vary. The inside diameter, in millimeters, is stamped on each ring. Nomograms, provided in manufacturers' manuals, specify the proper ring dam size to use with an oil of a given specific gravity at a specified temperature.*

### **A. The largest inside diameter ring without loss of oil.**

Correct: The use of the largest inside diameter discharge ring results in the positioning of the oil-water interface towards the outer edge of the purifier bowl. The closer the interface is to the outer edge of the purifier bowl, the smaller the seal water layer depth and the larger the oil layer depth. These factors result in the oil being subjected to centrifugal force for a longer period of time, due to the larger radius of the oil layer. As the increased radius allows for a higher centrifugal force to be applied, this results in a more complete separation.

### **B. The largest outside diameter ring without loss of oil.**

Incorrect: The outside diameter of the ring dam is fixed, and does not change for the specific centrifuge model.

### **C. The smallest inside diameter ring without loss of oil.**

Incorrect: The use of the smallest inside diameter discharge ring results in the positioning of the oil-water interface towards the center of the purifier bowl. The closer the interface is to the center of the purifier bowl, the greater the water layer depth, and the smaller the oil layer depth. This results in the oil being subjected to a lower value of centrifugal force for a shorter period of time, and as the time of separation of water from the oil is reduced, more water entrained with the oil would tend to carry over.

### **D. The smallest outside diameter ring without loss of oil.**

Incorrect: The outside diameter of the ring dam is fixed, and does not change for the specific centrifuge model.

**3. You are attempting to parallel two AC generators and the synchroscope pointer stops at a position other than 0° prior to closing the circuit breaker. This indicates \_\_\_\_\_.**

**A. the frequency of the incoming machine is the same as the bus frequency**

Correct: The speed and direction at which the synchroscope pointer rotates is a function of the "difference" in frequency between the bus and oncoming generator. The stopping of the pointer indicates that both oncoming generator and bus frequencies are identical but are not necessarily in phase. Since the pointer is at a position other than 0°, this indicates that the on-coming "generator phase relationship" is out of step with the "bus phase relationship" by a fixed number of electrical degrees. The proper procedure for paralleling should be to slightly accelerate the oncoming generator to match the bus phase relationship and close the circuit breaker when the pointer reaches a position slightly before 12 o'clock.

**B. the incoming machine is in phase with the bus, but the frequency is not the same**

Incorrect: Since the pointer has stopped, the generator and bus frequencies are identical, but the two are out of phase with each other and are not ready to be paralleled.

**C. the circuit breaker may be closed after breaker has been reset**

Incorrect: The action of "resetting" the breaker is a preparatory requirement to be able to "close" the breaker and is unrelated to synchroscope operation.

**D. there is an existing cross current between generators**

Incorrect: Cross current conditions can only exist between generators which are operating under parallel conditions. The cross current is the result of having unequal field excitation values between generators and is the interchange of reactive power.

**4. When a megohmmeter is used to test the insulation of a large motor, the initial dip of the pointer toward 'zero' is caused by \_\_\_\_\_.**

**A. good insulation**

Incorrect: if the insulation is clean and not defective or deteriorated, especially with smaller motors, the megohmmeter will register a high value of ohmic resistance and will not indicate any appreciable dip toward "zero" ohms.

**B. the capacitance of the winding**

Correct: large motors with proper insulation values will show a considerable capacitive effect between the conductors and the frame during the initial operation of the megohmmeter. As the meters voltage charge is transferred to the windings, the pointer will dip toward zero due to the flow of charging current.

**C. the leakage of the current along the surface of dirty insulation**

Incorrect: dirty or defective insulation will be indicated by slight kicks downscale toward zero

**D. the dielectric-absorption effect of the insulation**

Incorrect: this will not cause the initial dip, but will cause the pointer to slowly increase in value before reaching steady state.

**5. Boiler water hardness in modern high pressure boilers should be kept as close to 'zero' as possibly by chemically treating with \_\_\_\_\_.**

*Note: Hardness is a measure of the mineral content of water generally expressed in parts per million (ppm). Calcium and magnesium are the primary minerals found in "hard water", and will separate out of solution to form scale that adheres to the boiler tube surfaces. The scale deposits act as insulators and reduce the heat transfer rate across the tube surface at the point of deposition, which results in the increase of the tube metal temperature until overheating, softening, blistering, or tube failure may occur.*

**A. trisodium phosphate**

Correct: Chemically treating the boiler water with trisodium phosphate maintains the hardness of the water at close to zero. Trisodium phosphate reacts with water to form sodium hydroxide and disodium phosphate. The sodium hydroxide increases the alkalinity to minimize boiler tube corrosion, while the disodium phosphate reacts with the scale forming sulfates of calcium and magnesium to form a sludge that is removed by the process of blow down.

**B. soda ash**

Incorrect: Soda ash, or sodium carbonate, is an alkaline compound that neutralizes corrosive acid salts and increases the alkalinity of boiler water. In addition, soda ash reacts with the scale forming sulfates of calcium and magnesium to form sludge. However, soda ash decomposes to caustic soda at elevated temperatures and pressures, which could lead to caustic embrittlement of metal surfaces, thus it is not normally used in high-pressure boilers.

**C. caustic soda**

Incorrect: Caustic soda, or sodium hydroxide, is an alkali that neutralizes corrosive acid salts and increases the alkalinity of boiler water. Caustic soda is rarely used as the primary treatment chemical for high-pressure boilers due to the fact that excess quantities of it can lead to caustic embrittlement.

**D. all of the above**

Incorrect: Choice "A" is the only correct answer.

**6. Any feedwater testing done on a routine basis would normally include testing for \_\_\_\_\_.**

*Note: Feed-water is the heated and deaerated water between the deaerating feed heater and the boiler. Boiler water is the water actually contained within the boiler.*

**A. chloride**

Correct: Feed water testing done on a routine basis would include a chloride test to monitor the purity of the incoming water to the boiler. A high chloride (salinity) reading would indicate salt water contamination from a leaking condenser, malfunctioning evaporator, and/or contaminated make-up water tank.

**B. phosphate**

Incorrect: Boiler water is treated with phosphate, and must be tested on a routine basis for phosphate content.

**C. electrical conductivity (total dissolved solids)**

Incorrect: Total dissolved solids (TDS) refers to the combined content of all inorganic and organic substances contained in the boiler water, and is generally measured using the electrical conductivity method.

**D. all of the above**

Incorrect: Choice "A" is the only correct answer.

**7. 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.

**8. In readying an auxiliary water-tube boiler for a routine hydrostatic test, which of the following procedures should be undertaken prior to filling the boiler with fresh water?**

**A. The safety valve escape piping should be disconnected from the valve body and a blank inserted.**

Incorrect: Designated safety valve gags should be used when a boiler is being hydrostatically tested. If a blank is to be used, it should be placed on the inlet side of the safety valve, and not on the outlet.

**B. The boiler vent valves should be opened.**

Correct: The vent valves should remain open while filling the boiler with water to ensure that all air is expelled. Once water exits the vent valves, the valves must be closed to ensure that the hydrostatic pressure will be maintained if all else is tight.

**C. All handhole/manhole covers should be tightened up as much as possible to preclude any leaks.**

Incorrect: All handhole/manhole cover gaskets should be sufficiently tightened to ensure a leak proof mating surface. Over-tightening could result in gasket failure and/or handhole damage.

**D. All of the above.**

Incorrect: Choice "B" is the only correct answer

**9. Which of the following statements is correct concerning the “flash point of a liquid”?**

*Note: Flash point is the lowest temperature at which a liquid produces sufficient vapor to form an ignitable mixture that can be ignited by an external source, but is immediately extinguished. This is a result of the rate of vaporization of a liquid at the flash point is usually insufficient to maintain the presence of a continuous quantity of an ignitable mixture.*

**A. It is lower than the ignition temperature.**

Correct: The flash point is the lowest temperature a flammable liquid can form an ignitable mixture and burn when ignited by an external source. The rate of vaporization at the flash point is usually insufficient to maintain continuous burning. If the flammable liquid is heated to a much higher temperature, the vapors produce at the liquid’s surface will continue to ignite without needing the application of an external source of ignition. The temperature at which the vapors self-ignite is referred to as the ignition temperature, and it is higher than the flash point temperature.

**B. It is the temperature at which a substance will spontaneously ignite.**

Incorrect: Certain substances, such as animal and vegetable oils, create their own heat due to slow oxidation, and if kept in a poorly ventilated area, will self-ignite when the ignition temperature of the oil is reached. This process of slow oxidation and self-ignition is known as spontaneous ignition (combustion).

**C. It is the temperature at which a substance, when ignited, will continue to burn.**

Incorrect: The fire point is the temperature at which a liquid will produce sufficient vapor and when ignited by an external source, will continue to burn. The fire point lies between the flash point and ignition temperature of a flammable liquid.

**D. It is the temperature at which the released vapor will fall within the explosive range.**

Incorrect: The flammable vapor of a liquid must mix with the air in a certain proportion to produce an ignitable mixture. The flammable, or explosive range, is the percentage of gas or vapor in the air that forms an ignitable mixture. The explosive range of a gas or vapor lies between the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL). The LEL is the smallest percentage of vapor mixing with air that will form an ignitable mixture. If the percentage of vapor is below the LEL, the mixture is considered too “lean” to support combustion. The UEL is the greatest percentage of vapor in air that will support combustion. If the percentage of vapor in the air exceeds the UEL, the mixture is considered too “rich” to support combustion. The combustible gas indicator is utilized to measure the percentage of flammable vapor in a closed or confined space.

**10. Where will you find the procedures for the reporting of oil discharge into the water?**

**A. The vessel's Certificate of Inspection**

Incorrect: The vessel's Certificate of Inspection describes the route(s) that it may travel, the minimum manning requirements, the survival and rescue craft carried, the minimum fire extinguishing equipment and lifejackets required to be carried, the maximum number of passengers that may be carried, and the name of the owner and managing operator.

**B. The vessel's Oil Record Book**

Incorrect: 33 CFR 151.25(g) states "In the event of an emergency, accidental or other exceptional discharge of oil or oily mixture, a statement shall be made in the Oil Record Book of the circumstances of, and the reasons for, the discharge."

**C. The vessel's Oil Transfer Procedures**

Correct: 33 CFR 155.750(a) states "The transfer procedures required by 155.720 must contain, either in the order listed or by use of a cross-reference index page: (9) Procedures for reporting discharges of oil or hazardous material into the water;"

**D. The vessel's International Oil Pollution Certificate**

Incorrect: 33 CFR 151.19 (a) states "Each U.S. oil tanker of 150 gross tons and above and each other U.S. ship of 400 gross tons and above; that engages in voyages to ports or off-shore terminals under the jurisdiction of other parties to MARPOL 73/78 must have on board a valid International Oil Pollution Prevention (IOPP) Certificate." Before an IOPP Certificate is issued, a survey that includes a complete examination of the ship's structure, equipment, systems, fittings, arrangements and material must be conducted in accordance with the provisions of 33 CFR 151.17. The IOPP Certificate is valid for a maximum period of 5 years from the date of issue.