

Study Guide

for

Plant Equipment Operator
Steam Generation Division

Performance Assessment Services
Southern California Edison Company

Introduction

The Plant Equipment Operator test is a job knowledge test designed to cover the major knowledge areas necessary to perform the job. This *Guide* contains strategies to use for taking tests and a study outline.

Test Scheduling

Employees who apply for positions, bids, and transfers requiring testing before March 9, 2009, will be scheduled for testing by their Supervisor through Human Resources. For those who apply after March 9, 2009, both the employee and their Supervisor will be notified of a scheduled test date by Human Resources. Test times and dates for positions requiring testing will be specified in the bid/transfer/requisition/job posting. Employees should be prepared to test on the specified dates. Only employees who apply for positions requiring testing, and who meet basic qualifications, will be invited to test. Applicants will be scheduled through the recruiter. If you have any questions, please call 626-302-9830.

Test Session

It is important that you follow the directions of the Test Administrator *exactly*. If you have any questions about the testing session, be sure to ask the Test Administrator before the testing begins. During testing, you may not leave the room, talk, smoke, eat, or drink. Since some tests take several hours, you should consider these factors before the test begins.

All questions on this test are multiple-choice with four possible answers. Prior to March 9, 2009, your answers to the questions are indicated by filling in a circle on an answer sheet with a special mark-sense pencil. For your answers to be read accurately by the scanner, you must fill in the circles completely and erase completely any answer you wish to change. After March 9, 2009 you will take the exam on a computer. For more information on this, please see the next section of this study guide, Computer Based Testing.

The test has a three hour time limit.

You will receive a Test Comment form so that you can make comments about test questions. Write any comments you have and turn it in with your test when you are done.

Study Guide Feedback

At the end of this *Guide* you have been provided with a Study Guide Feedback page. If a procedure or policy has changed, making any part of this *Guide* incorrect, your feedback would be appreciated so that corrections can be made.

Computer Based Testing

Effective **March 9, 2009**, all knowledge tests will be administered on the computer. This information will help prepare you for a knowledge test taken on or after **March 9, 2009**.

Taking an SCE knowledge test on the computer is simple. You do not need any computer experience or typing skills. You will only use the keyboard to enter your candidate ID and password. You'll answer all questions by pressing a single button on the mouse.

Log in Screen

You will be seated at a testing station. When you are seated, the computer will prompt you to enter the candidate ID and password you received in your invitation e-mail. You **MUST** have your candidate ID and password or you will be unable to take the test. Once you have confirmed your identity by entering this information, you will see a list of tests available to you.

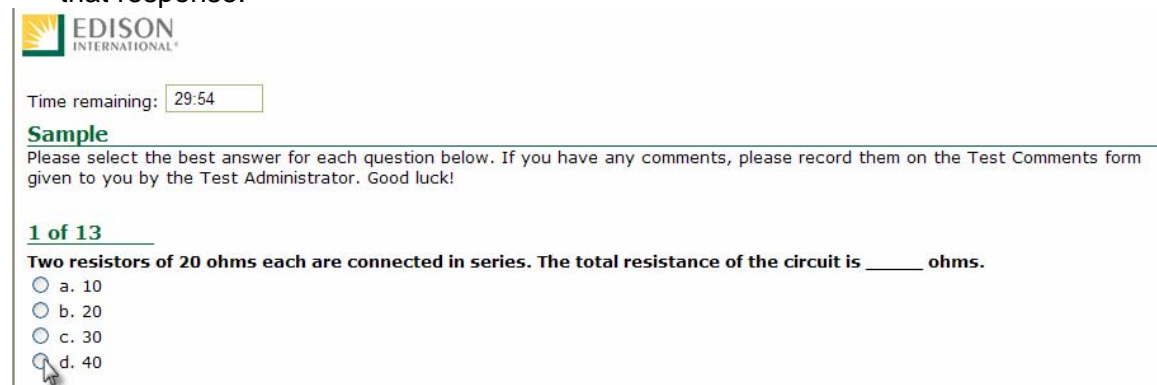
Sample/Tutorial

Before you start your actual test, a Sample/Tutorial Test is provided to help you become familiar with the computer and the mouse. From the list of exams that appear when you complete the log in, you will select Sample/Tutorial. You will have up to 10 minutes to take the Sample/Tutorial Test. The time you spend on this Sample Test DOES NOT count toward your examination time. Sample questions are included so that you may practice answering questions. In the Sample/Tutorial Test, you will get feedback on your answers. You will not receive feedback on your actual test.

Example

During the test, to answer each question, you should move the mouse pointer over the circle (radio button) next to the answer of your choice, and click the left mouse button. The amount of time you have remaining to take the test will always be shown in the top left corner of the screen. A sample is show below:

1. When you begin the test, you can see the total time allowed for completion displayed at the top of the screen. You can scroll up to see that information at any time during the test.
2. In order to answer each question, first read the question and determine the response that best answers the question. Put the mouse pointer directly over the circle corresponding to that response.



The screenshot shows the Edison International test interface. At the top left is the Edison International logo. Below it, a timer displays "Time remaining: 29:54". A section titled "Sample" contains the instruction: "Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!". Below this, it says "1 of 13". The question is: "Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is _____ ohms." The options are: a. 10, b. 20, c. 30, and d. 40. A mouse cursor is pointing at the radio button for option d.

3. While the pointer is over the circle corresponding to the best answer, click the left mouse button.



Click the left button when the pointer icon is over your answer choice.

4. The answer you selected should now have a green dot in the circle. If you need to select an alternate answer, simply move the pointer over that circle, and click again.



Time remaining:

Sample

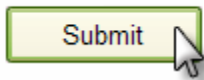
Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!

1 of 13

Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is _____ ohms.

- a. 10
- b. 20
- c. 30
- d. 40

5. You can change your answers at any time during the test until the time runs out, or you click the "Submit" button.



Test Taking Strategies

Introduction

The Apprentice Electrician Third Step test contains multiple-choice questions. The purpose of this section is to help you to identify some special features of a multiple-choice test and to suggest techniques for you to use when taking one.

Your emotional and physical state during the test may determine whether you are prepared to do your best. The following list provides common sense techniques you can use before the test begins.

Technique

Remarks

Be confident

- If you feel confident about passing the test, you may lose some of your anxiety.
- Think of the test as a way of demonstrating how much you know, the skills you can apply, the problems you can solve, and your good judgment capabilities.

Be punctual

- Arrive early enough to feel relaxed and comfortable before the test begins.

Concentrate

- Try to block out all distractions and concentrate only on the test. You will not only finish faster but you will reduce your chances of making careless mistakes.
- If possible, select a seat away from others who might be distracting.
- If lighting in the room is poor, sit under a light fixture.
- If the test room becomes noisy or there are other distractions or irregularities, mention them to the Test Administrator *immediately*.

Budget your time

- Pace yourself carefully to ensure that you will have enough time to complete all items and review your answers.

Read critically

- Read all directions and questions carefully.
- Even though the first or second answer choice looks good, be sure to read all the choices before selecting your answer.

Make educated guesses

- Make an educated guess if you do not know the answer or if you are unsure of it.

Changing answers

- If you need to change an answer, be sure to erase your previous answer completely. On the computer, be sure that the new answer is selected instead of the old one.

Return to difficult questions

- If particular questions seem difficult to understand, make a note of them, continue with the test and return to them later.

Double-check mathematical calculations

- Use scratch paper to double check your mathematical calculations.

Review

- If time permits, review your answers.
- Do the questions you skipped previously.
- Make sure each answer bubble is *completely* filled in. Erase any stray marks on your answer sheet. When testing on the computer, make sure each question has a green dot next to the correct answer.

Remember the techniques described in this section are only suggestions. You should follow the test taking methods that work best for you.

PLANT EQUIPMENT OPERATORS STUDY GUIDE

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I. BOILER

RULE

1. Why are fuel oil strainers necessary?
2. Discuss procedures for changing fuel oil storage tanks suction and returns.
3. What are the important qualities of fuel oil?
4. What are the methods used for obtaining proper atomization of fuel oil?
5. What is the purpose of the diffuser plate or an oil burner?
6. What is the primary purpose of heating fuel oil?
7. What is the advantage of return type fuel oil atomization?
8. How can you determine, by local inspection, which is the return line on a return type fuel oil burner?
9. What function does the "Factory Mutual System" serve?
10. What is the purpose of fuel oil line cathodic protection?
11. What determines the best pumping and burning temperature of fuel oil?
12. What factors limit the firing rate of a boiler prior to rolling the turbine?
13. State several reasons for an oil burner causing smoke.
14. A high combustibles reading in the flue gas from a boiler indicates there is what type of mixture present?
15. When all fuel gas is being burned in a boiler, what is the normal status of the boiler fuel oil system?
16. When burning fuel oil, white smoke indicates what? Black smoke indicates what?
17. What are the indications of dirty fuel oil strainers?
18. A barrel of fuel oil equals how many LI~S. gallons?
19. Is sulfur desirable or undesirable in fuel oil? What does it do?

FANS AND DAMPERS

1. Why is a boiler furnace purged before firing?
2. Does the burning of fuel gas require more or less air than fuel oil does?
3. What type fans are not required in pressurized furnace boilers?
4. How does the operation of flue gas re-circulation fans, increase the steam temperature?
5. How are the openings in a pressurized furnace sealed and what is the source? What is the source of the backup?
6. When a forced draft fan motor relays, what automatic actions take place?
7. When an induced draft fan motor relays; what automatic actions take place?
8. If a flue gas re-circulating fan damper will not completely shut off, can the fan be stopped?
9. Describe the automatic action of the fan dampers if all fans are lost?
10. What damper action should occur on the loss of a re-circulation fan motor?

REBOILERS

1. What is the purpose of a reboiler system in a modern reheat steam plant?
2. Where does a reboiler get its heat?
3. List two of the three systems supplied by a reboiler.
4. Where does the reboiler get its makeup water supply?

AIR PREHEATERS AND ECONOMIZERS

1. Briefly explain the operating principle of the Ljungstrom Regenerative Air Pre-heater.
2. What is the purpose of an economizer in a boiler?
3. What other source of drive power do air pre-heaters have if the electric motor drive should fail?
4. What are the indications if an air pre-heater ceased to rotate?
5. What conditions might lead to a fire in an air pre-heater?
6. What condition might cause a rotating air pre-heater to rub and damage the seals?
7. What lubrication is required for a regenerative air pre-heater?

8. What are the indications of an air pre-heater that is starting to foul?
9. Can an air pre-heater be washed while the boiler is in service?
10. What conditions could cause boiling in an economizer? What would be the indication that this is occurring?

COMBUSTION CONTROL AND BOILER OPERATION

1. Name several things that will cause a boiler to smoke?
2. What color smoke indicates an excess air condition?
3. Why are the drum vents and the superheater and steam lead drains opened when starting a unit?
4. When a large load is suddenly imposed on a boiler with minimum fire; what happens to the drum level?
5. Excessively hot fuel oil supply to the burners will cause what reaction of the fires?
6. During normal operation, why should the water not be allowed to go cut of sight high in the drum glass?
7. Why should the furnace be inspected very frequently when lighting a boiler off on gas fuel? On Oil fuel?
8. Why should oil burner flame pattern be inspected frequently?
9. What are the four methods used by Edison to control superheat steam temperature?
10. How do you detect a fuel oil clinker?
11. What should be done if a clinker in the furnace is discovered?
12. What is the function of the boiler purge interlock? What is necessary to start a purge? (5 basic conditions required).
13. What would be the cause for boiler pressure restriction on startup?
14. Why is purge steam piped to the fuel oil burners?
15. What provision is made for expansion of steam lines?
16. Should a natural circulation high pressure boiler be blown down with the bottom blown down valves when the unit is on the line.
17. Under what circumstances would a bottom blown down be put on a steaming natural circulation boiler?
18. How are steam flow rates expressed? Water flow? Compare with pump flow rating.

19. Is it necessary to purge a boiler if fires are lost with an emergency trip? Without an emergency trip?
20. How are air flow rates expressed?
21. Can a boiler smoke with instruments accurately showing adequate excess air?
22. Are combustibles possible in the flue gas with instruments accurately showing more than adequate excess air?
23. Is it possible to have insufficient air with resultant unburned fuel leaving the boiler, without smoke?
24. What would be the most likely first sign of a small boiler leak?
 - A. In a water wall?
 - B. In a superheater or re-heater?
 - C. In an economizer?
25. What primary function causes a boiler combustion control system to respond to a turbine-generator load change?

STEAM TEMPERATURE CONTROL

1. What protects the reheater from excessive metal temperature when a sudden loss of load occurs?
2. Discuss the various ways that steam temperature is controlled within required limits?
3. Is steam temperature leaving a boiler normally controlled by changing the firing rate (fuel input) or some other method?

FEED WATER CONTROL

1. What is meant by shrink and swell in a boiler?
2. What elements are used to control boiler water level in a three element system?
3. What action should be taken if the water level indicator and sight glass show no water in sight?
4. What local inspections should an operator make on a boiler gauge glass.
5. Would water in a steaming boiler be lost faster due to a water tube rupture or a superheater tube failure?
6. A Plant Equipment Operator would be requested to perform what operation in case of high boiler water level; with unit off the line?
7. How is a hydrostatic test on a modern reheat steam generator applied to:
 - A. Boiler
 - B. Superheater?
 - C. Reheater?
8. How many ways are usually provided to check water level in the drum of a sub-critical boiler?
9. When tending water manually, what two guides should be used to assist in controlling drum level in addition to the indicated drum level?
10. If no water can be fed to a boiler due to inadequate pressure as a result of low voltage and frequency, what action can be taken to restore feedwater flow?
11. If the feedwater control valve to a boiler failed open, and water level was rising, what action could be taken to prevent high level?
12. What would be the ultimate result of insufficient feed to a boiler of a continued oversupply?

SAFETY VALVES

1. What is "blow back" on a boiler safety valve?
2. What does it mean to gag a safety valve?
3. Why are superheat safety valves set lower than drum safety valves?
4. What percent of the boiler rated output can the safety valves handle?
5. What safety valves on a boiler can be valved off?
6. What is the purpose of a safety valve?
7. What is a power relief valve? Describe its operation.
8. What will be the result on drum level of a blowing safety valve on a boiler with three-element feed water control? Why?
- 9.. Which safety valves would you expect to lift if a turbine-generator went up to 63 cycles due to loss of a system load or separation from the system (105 percent speed)?

II. TURBINE GENERATORS

TURBINE PROTECTION

1. What is the purpose of the initial pressure regulator?
2. How is the initial pressure regulator put in and out of service?
3. The action of the initial pressure regulator closes what valves?
4. What is the purpose of the under speed release?
5. How is the rotor of a turbine held in correct axial clearance?
6. What is meant by the speed regulation of a turbine?
7. The overspeed device on a turbine is usually set to trip at what percent above normal speed?
8. Why are overspeed tests made at regular intervals? What are the regular intervals?
9. On a reheat type unit, should the pre-emergency governor be run out of range before making overspeed tests? Why?
10. A central control reheat steam turbine is supplied with the following devices. What is their principal name?
 - A. A steam flow limit device to control the maximum output established for the turbine.
 - B. A low steam pressure limit device to reduce the load in order to permit the boiler to restore steam pressures.
 - C. A low frequency device to provide for rapid increase of steam flow should the frequency drop?

VALVES

1. The turbine control valves are operated by what type of fluid?
2. The intercept valves are operated by action of what device?
3. The main stop valves will shut off all steam entering which section of a tandem or a cross compound turbine?
4. What could happen to a unit's speed if the extraction non-return valves failed to close on a unit trip?
5. The closing of what valves will initiate the governor runback timer?

6. If unable to open the main stop valves after an overspeed test on a unit with a boiler up to pressure and the hydraulic pressure normal, what would be one of the first things to look for?
7. What devices will shut off steam to the reheat section of a tandem or a cross compound turbine?

TURBINE

1. During a unit start-up what factors determine the best time to start a turbine rolling?
2. State two principle reasons why it is desirable when starting a cold reheat unit, to start the turbine generator at as low a boiler pressure as possible?
3. How is the load changed on an AC generator?
4. What is one of the operations to be performed by an operator, on a unit with a reheater before the turbine valves can be latched following a unit trip under full load conditions?
5. Why is it necessary to keep the front standard base guides of a turbine lubricated?
6. What is the purpose of the routine turbine oil pump and valves test?
7. Why is it important to report leak-off from the turbine stop valves and intercept valves?
8. What is the normal lube oil temperature to the bearings with the unit on the line? On turning gear? How is the temperature controlled?

GOVERNORS

1. What is an emergency governor?
2. What will initiate action of the underspeed release?
3. How can the under speed release be reset after it has tripped?
4. How can the load limit device on a turbine be reset after an emergency governor operation?
5. By what method can the turbine emergency governor be made to operate at normal speed?
6. How are the turbine control valves tested during a shutdown period with steam pressure up to the stop valves?
7. Would closing of the stop valves and extraction valves alone guarantee preventing overspeed of a unit?

8. Why is there a maximum allowable speed for a turbine generator during overspeed testing?
- 9- What is the purpose of the pre-emergency governor on a reheat unit?
10. At what percent speed does the pre-emergency governor start to perform its function?
11. On some reheat type units can the emergency governor be tested with the machine on the line and carrying load?

SEALS

1. Why is it necessary to keep turbine gland seals on until the vacuum reaches zero?
2. What is the purpose of the turbine shaft water seal?
3. When steam seals only are used on a turbine, what special provisions are made for shaft grounding?
4. A turbine gland seal leakoff regulator serves what purpose?

SUPERVISORY INSTRUMENTS

1. If a turbine bearing vibration should increase together with a steam temperature drop, what would be the most likely cause?
2. Name four supervisory Instruments and explain the function of each.
3. Will the eccentricity generally be affected by a change in lube oil temperature?
4. What do the red bands at each end of the shell and differential expansion instrument indicate? Does this apply to either shell or differential expansion?

GENERATOR HYDROGEN SYSTEM

1. Why is hydrogen gas used as a cooling medium in generators?
2. By what means is hydrogen retained within the generator casing?
3. Hydrogen is explosive in air when it exists in what proportions?
4. How is the generator seal oil supply treated to prevent accumulation of moisture and other contaminants?
5. How is moisture detected in the generator hydrogen gas system?
6. What is the source of the cooling medium supplied to the generator hydrogen coolers?
7. How is the hydrogen gas circulated within a running generator?
8. How do the hydrogen and air detrain tanks of the seal oil system operate?
9. How is hydrogen purged from the generator? What is used and is it injected at the top or the bottom of the generator.
10. After the generator has been subjected to an air test. How is the hydrogen replaced in the generator?
11. What are the three sources of oil to the generator hydrogen seals?

GENERATORS FIELD

1. How are generator temperatures controlled?
2. What are collector rings and commutators checked for?
3. What is the purpose of the field in an A.C. Generator?

MISCELLANEOUS

1. What is the purpose of a turbine turning gear?
2. What is the purpose of the turbine auxiliary oil pump? The main oil pump?
3. What does synchronizing a generator to the system mean? Who does it?
4. What is the purpose of the exhaust hood sprays?
5. What is the purpose of vapor extractors on the main oil reservoirs and the oil filter tanks?
6. How may oil be added to the main lubricating oil reservoir with unit in service?
7. The turning gear rotates the turbine shaft at approximately what speed?
8. What supports a turbine shaft when it is rotating?
9. What is the function of a Bowser filter?
10. When a turbine generator is off the line, but still rotating and no steam is supplied to the turbine, what would be the result if a strong field was applied?
11. What effect will low steam pressure to the turbine inlet have on unit capability?
12. What is the difference between the load limit device and the initial pressure regulator?
13. How would the opening of the main stop valves be effected by the position of the after seat drain valves?

III. ELECTRICAL

RELAYS

1. What is the function of an overload relay?
2. What are fuses?
3. A negative phase sequence relay protects generators against what type of fault?
4. Name several types of equipment that are protected by CO relays.
5. Voltage relays operate under what conditions?
6. What is the function of balance type relays for power line protection?
7. Who adjusts and checks the setting of electrical protection relays?
8. What equipment is protected by the unit differential relays? By the generator differential relay? What device is used to supply the differential?
9. What is the difference between a fuse and a disconnect?
10. What is the difference between overload and differential relays?
11. What does a generator armature ground alarm indicate? What operation is required? What is the danger?
12. Where would you find Emergency Orders covering 66-kV and 220-kV lines?
13. What is the primary side of a transformer?
14. What is the secondary side of a transformer?
15. When voltage is stepped up through a transformer does current increase or decrease in the same proportion?
16. What controls the speed when a generator is on the line?
17. Why is the secondary of a P.T. opened when a clearance is issued on a piece of electrical equipment?
18. What is the danger in simultaneous use of two synchronizing plugs?
19. What indicates that both incoming and running synchronizing circuits are complete after the synchronizing plug is inserted and turned.
20. Where are the fuses for the synchronizing circuits normally located?

METERING

1. How are potential transformers used in Connection with protective relays?
2. How are current transformers used in connection with protective relays?
3. What is the difference between a current transformer and a potential transformer?
4. What is meant by “in phase” when transferring auxiliaries?
5. Can a current transformer be used to measure direct current?
6. What does “VARS” mean? What equipment generates VARS? How?
7. Name the type of visual indicators that give an operator the measure of flow and strength of electricity?

SWITCHING

1. Can a line be dropped with disconnects? Can a bank be dropped with disconnects? Can a bank be picked up with disconnect switches?
2. What does OCB mean?
3. What does ACB mean?
4. What is a limit switch?
5. What is meant by switch?
6. What is meant by synchronizes parallels drop and pick up methods of transferring auxiliaries?
7. Generally speaking is it desirable to switch auxiliary busses by paralleling or by drop and pick up? Why?
8. Who issues a switching order?
9. Why is it necessary to repeat a Switching order back “word for word”?
10. What would you do when you arrived in the switchyard and the equipment signs did not correspond to the switching order or the sequence did not seem correct?
11. When making a routine test on a carrier type line relay and the relay tests bad, what should you do?
12. What do you do to the equipment when you open a DC knife switch on a relay?
13. Following a relay operation why should the targets be read, and reported as soon as possible?
14. What three important things should you do before turning any control switch?

GENERAL

1. Why is it necessary to delay between starts, on large electric motors?
2. What is another name for magnetic lines of force?
3. Commutators should be checked for what, when the machine is in service?
4. When paralleling two exciters, should the voltage always be equal?
5. What should be used to pull cartridge fuses?
 - A. What is a pallet switch fuse?
 - B. What is a pallet switch used for?
 - C. What is an "a" and "b" pallet switch?
6. When referring to an elementary diagram, in what position is the equipment shown?
7. What is the symbol for each of the following as it would be shown on an elementary diagram?
 - A. Normally open contact
 - B. Normally closed contact
 - C. Relay operating coil
 - D. Control switch with reference to switch breakdown
 - E. Resistor
 - F. Red and green lights with control contacts
8. How do you determine which contacts are closed in the various positions on a control switch?
9. What does a double brilliancy green light indicate on a control switch? What do half brilliancy red and green lights indicate on a control switch?
10. What are personal grounds?
11. What are switching orders? Why are they important and how are they red?
12. Under what circumstances is it safe to work on capacitors?
13. How can you tell if the high or low side of a transformer is wound star or delta?
14. What determines the current carrying ability of a line? What determines the operating voltage level of a line?
15. What is the effect of an overload on a line and what is the danger?
16. What is the effect of an overload on a transformer? What is the danger or result an overload? How can an overload be carried for short periods without damage?
17. Should a commutator be lubricated? What care should a commutator have? What indicates overheating of brushes?
18. Does a commutator generally indicate an A.C. or a D.C. machine?
19. How does a generator produce electricity?
20. Why are storage batteries used in a steam plant? What general types of

equipment are supplied by the various batteries?

21. What is the indication in the Control room of an open D.C. knife switch in an OCB mechanism or that an ACB is out of operating position?
- 22.. What is a dummy bus and what is it used for?
23. What should you look for in the event of a unit differential operation?
24. What is an ampdyne and what does it do? Where does it get its initiating or signal voltage?
25. How is the total resistance of a series circuit calculated?
26. What is the purpose of a rheostat?
27. What is the unit of measurement of electrical power?
28. What is the larger, No.8 or No. 12 wire?
29. What determines the current carrying capacity of a copper wire?
30. What useful functions are served by grounding an electrical system?
31. What is the purpose of thermal overload links on a motor starter?
32. "°C rise" on a transformer name plate means what?
33. What are the advantages of alternating current?
34. What is a megavar meter?
35. What is the major advantage of high voltage power transmission?
36. What two factors determine the frequency of the voltage developed by an alternator?
37. What is a synchroscope?
38. $kVa = kV \times a \times 1.73$. How would you find the full load amps on a transformer on the 66kV Side of a 60 kVa bank? What is the full load amps?

IV. AUXILIARIES

PUMPS

1. What is the purpose of the main circulating Water pumps?
2. What are drip or drain pumps used for?
3. What does it mean to prime a pump?
4. Why do condensate and drip pumps have vent lines?
5. Why do some pumps have re-circulation lines?
6. Why do some pump shaft packings have a leakoff line?
7. What is the difference between a centrifugal pump and a positive displacement pump?
8. The failure of what valve could cause a pump to rotate backwards after the pump has been stopped?
9. What would happen if the discharge valve was closed on a positive displacement pump while the pump was in operation?
10. How is the capacity of a centrifugal related to discharge pressure?
11. If the output of a pump is increased would the motor ammeter increase or decrease?
12. For a given condition with reference to suction head of a pump, an increase in water temperature will do what to the discharge
13. What does an oil ring do in a pump? A stuck oil ring will do -what to the bearing and the ring?
14. What are possible reasons for fluctuating current on boiler feed pump motors?

EVAPORATORS

1. Why is it necessary to vent the evaporator condenser?
2. What is the most common cause of an evaporator carry-over or priming?

HEAT EXCHANGERS

1. What is the meaning of flash with reference to hot water?
2. Why are non-return check valves placed In turbine extractions steam lines?
3. What could cause salt water heat exchangers to lose efficiency?
4. What two common things will cause feedwater heaters to load up on the shell side?
5. What could cause an extraction feedwater shell side safety valve to lift?
6. What is the purpose of a deaerator?
7. Would a unit load increase or decrease if an extraction feedwater heater is removed from service?
8. How do you valve into service a feedwater heat exchanger that has been cleared on both steam and water side?
9. What would happen to a feedwater heater if the inlet and outlet water valves were closed while the steam valves were left open?
10. What effect upon unit efficiency does loss of an extraction feedwater heater have?
11. What is the purpose of a vacuum pump on a deaerating heater?
12. What is meant by “pegging” a deaerating heater?

CONDENSERS

1. What does it mean to prime a main condenser?
2. What are air ejectors?
3. What is make-up and draw-off?
4. What conditions would indicate a dirty main condenser?
5. Motor driven air evacuation pumps are primarily used for what purpose on a unit?
6. How is one-half of a main condenser removed from service?
7. When taking an air ejector out of Service, what valves should be closed first?
8. If the main condenser hotwell level was out of sight high and could not be brought down after some effort what actions should be taken?
9. What protective device on the main condenser shell is used to protect it against overpressure In the event cooling water is lost?
10. If the jet air flow is normal, and the condenser vacuum is dropping what medium should be checked first?

11. What air removal jet troubles could cause the lets to backfire?
12. What would be the result of leaving the air removal valve open on one-half a condenser taken out of service for cleaning?
13. List four common causes for loss of condenser vacuum.
14. What is meant by absolute pressure in a condenser?
15. Name several causes that would increase the absolute pressure in a condenser shell?
16. Why is it important to control air leakage into a condenser?

GENERAL

1. What is meant by extraction steam?
2. What is condensate?
3. What are vents and drips?

V. CLEARANCE AND GENERAL SAFETY

1. Why is it mandatory to wear a hard hat when working or switching in the switch yard?
2. What is the reason for standardizing safety rules?
3. Why is it necessary to have a set standard clearance procedure?
4. Why open safety switches and pull fuses when clearing equipment for work?
5. What is the main object of a safety program?
6. Why is a checker required when working in the switchyard?
7. Why is it best to stand to the side when opening or closing a manually operated switch or breaker?
8. When is red and white barrier tape used? When is yellow and black barrier tape used?
9. What is the best method to use to keep a ladder from falling?
10. Why are rubber gloves, apron, and face shield provided at the chemical feed area?
11. Who is responsible for enforcement of the safety rules?
12. When should unsafe tools be used? What are unsafe tools?
13. Why is smoking prohibited in close Proximity during the purging or filling of a hydrogen cooled generator?
14. Why is it important when pouring or pumping gasoline from one container into another, metal contact shall be maintained between the pouring and receiving containers?
15. What type of extinguisher should be used on electrical fires?
16. What type of extinguishing agents are used on "Class A" fires?
17. What are "Class B" fires?
18. Why is it undesirable to use carbon tetrachloride on fires in a confined space?
19. Why is it necessary to prevent grease and oil from coming in contact with valves and regulators of oxygen cylinders and Systems?
20. Why is it necessary to prevent exposure of compressed gas cylinders to excessive heat or rough handling?
21. Why is it necessary to store gas cylinders with the caps in place?
22. What is the approved type of hard hat for use in switchyards?
23. For a clearance to be issued on the coupling of a motor-driven pumps is the selector switch being in the OFF position sufficient?
24. Is it safe to work on an ACB when the D.C. power supply is opened?

25. What is the safe working distance from conductor energized in excess of 750 volts?
26. When a clearance is to be issued on an electrical motor, does the heater Circuit need to be de-energized?
27. What is the minimum number of personnel needed to perform work in a restricted or confined vessel or area?
28. Are personal grounds required on an OCB cleared for work when the line and bus disconnects are opened?
29. Is it safe to apply one set of personal grounds on an OCB cleared for work and depend on the OCB to stay closed to ground the other side?
30. Is it necessary to use rubber gloves when using a clamp-on ammeter on a feeder cable above 480 volts?
31. When is it permissible to stand on the top rung of a stepladder?
32. Why should metal stepladders not be used in a steam station?
33. What are the restrictions on painting ladders?
34. What are the approved measuring tapes for use near electrical equipment?
35. How are combustibles and dirty rags to be stored?
36. What is the proper method of lifting heavy objects?
37. What is a "Tailboard"?
38. Why are telephone lines considered energized lines?
39. What are the symptoms of shock and how is it treated?
40. To whom may a clearance be issued?
41. When working in switchyards, how are personnel to carry material or tools?
42. What are the limits of an outside clearance?
43. What are the limits of an inside clearance?
44. May clearances be transferred from one person to another?
45. Why should a tailboard be held with the Operator who is to perform switching?
48. How are clearances released?
47. What type warning block is hung on "hot blades?"
48. What is a clearance?
49. What does "cleared for work" mean?
50. Can more than one clearance be issued on a particular piece of equipment?
51. If an electrician or a mechanic has a clearance on a piece of equipment, can others work on the same equipment without taking a separate clearance?
52. What is the difference between an outage and clearance?

53. How would you proceed to clear an OCB for work?
54. What is the difference between a clearance and permission?
55. Why is it important to precisely follow the clearance procedure?
56. Who authorizes taking the following equipment out of service?

229 kV line	Circulating Water Pump
66 kV line	Instrument Air Chiller
Unit	Drip Pump
Boiler Feed Pump	Auxiliary or Reserve Power Bank
57. What type of hose should be used for draining feed water heaters?
58. How is the necessity for the services of a checker determined?
59. If a checker is watching the work, can a workman feel free to move about as he wishes?
60. When men are working on a switchrack, what should be done prior to operating disconnect switches?
61. What are the responsibilities of a checker?
62. Name three elements that must be present to support ignition?
63. What is the most important thing to consider when fighting an electrical equipment fire?
64. What type of extinguisher should or should not be used to extinguish the fire caused by escaping gas from a ruptured line?
65. Why should a plant equipment operator read the Control operator's log book when coming on shift?

SYSTEM OPERATING BULLETINS

1. What is the dispatcher's function with respect to the Edison system? ENERGY CONTROL CENTER'S
2. What are Station emergency orders?
3. What is the most important operation for a steam plant to do in a major case of trouble when the generators become separated from the system?
4. In trouble, should you call the ENERGY CONTROL CENTER dispatcher before carrying out the emergency orders for your station?
5. What is the function of a switching center?

OUTAGES

1. What is an A, B, and C outage?
2. For what reason are outages required?
3. Can outages be extended beyond their time limit?

ARCO

1. What are the laws governing smoke?
2. What is the rule number enforced during smog alerts?
3. Who should accompany an APCD representative in the station?

ARITHMETIC

1. What is the decimal equivalent of $\frac{7}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$?
2. What is the fraction equivalent of 0.5000, .75, .1?
3. 33,000 ft. lbs. per minute is equal to how many horsepower?
4. $\frac{3}{8} \times \frac{3}{8} =$
5. If a difference of one foot level in a fuel oil storage tank equals 1,000 bbls., how much oil would have been burned if the level dropped from 28' 3" to 27' 6"?

PHYSICS

1. What is the temperature of freezing and boiling at atmospheric pressure in Centigrade and Fahrenheit?
2. What is the principle by which water is cooled in a cooling tower?
3. Under what climatic conditions is the water temperature the lowest from a cooling tower?
4. The flow of a given quantity will increase or decrease as the pipe size is decreased?
5. What is the principle of measuring flow with an orifice?
6. How do you convert head feet of water to pounds per square inch?
7. If the pressure of saturated steam is raised, what will happen to the temperature?
8. What is the unit of heat value in fuels?
9. One electrical horsepower equals how many watts?

10. What would you use to tell the temperature of water in a boiler drum if the pressure is known?
11. How does the saturated steam temperature in a boiler drum compare with the water temperature?
12. What is meant by BTU?
13. How many BTU's would it take to raise one pound of water one degree Fahrenheit?
14. What is static electricity?
15. What is the rule for magnetic attraction and repulsion?
16. What is the term for any Pressure less than atmospheric?
17. For what reason will the top surface of water freeze first?
18. Explain the following types of heat transfer: Convection, conduction, and radiation.
19. Does the presence of water vapor in the atmosphere increase or decrease atmospheric pressure?
20. What is the common unit of potential?
21. What is the voltage of a common dry cell?
22. What is the voltage of a lead storage cell?
23. What is the unit of electrical resistance?
24. What is Ohms Law?
25. What is the difference between resistance and conductance?

MISCELLANEOUS

1. Why are outdoor central control stations built in preference to indoor stations?
2. How are steam-electric generator efficiencies compared?
3. How is system frequency controlled?

VII. WATER AND CHEMICAL TREATMENT

1. To help control slime, etc., in condenser tubes, what chemical is used?
2. What chemical is used in an ion exchange water softener?
3. With what solution is the zeolite in softeners regenerated?
4. Why is the bearing cooling water system chemically treated?
5. Name three causes of evaporator carry-over?
6. If a softener does not complete its regeneration cycle what is the first operation required to protect the water system?
7. What would cause an evaporator condenser condensate to raise in PH and conductivity?
8. What would cause an evaporator Condenser conductivity to raise and PH to drop?
9. Amine is used to adjust what in the condensate system?
10. What chemical is used to raise the PH of boiler water?
11. A solution of sludge with Calcium or magnesium salts that may be present in boiler water₁ may be removed by what method?
12. To what places may boiler blow down be directed?
13. What happens when hydrating is introduced into a boiler feedwater system containing small quantities of dissolved oxygen?
14. Silver nitrate is added to a Solution to test for what mineral?
15. What would a continuous and rapid lowering of boiler conductivity signify?
16. Briefly state the purpose of adding each of the following chemicals to the condensate or boiler water?
 - a. Sodium Hydroxide (NaOH)
 - b. Hydrazine (N₂H₄)
 - c. Phosphate (P₀₄)
17. Can silica carryover be reduced by' reducing steam pressure?
18. Silica is reduced in the boiler by what methods?
19. What is the purpose of a demineralizer?
20. In measuring hardness, how many parts per million are represented by one grain per gallon?
21. What is meant by PH that is over or under 7.0?
22. How is dissolved oxygen measured?
23. How is evaporator shell conductivity controlled?

