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OJT SELF-STUDY GUIDE

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Entry Level Power Plant Technician on-the-job (OJT) self-study training guide is designed to allow you to become fully qualified to operate the equipment associated with the Entry Level PPT position at the Station. The areas covered in this study guide are as follows:

- ❑ Power Plant Fundamentals
- ❑ Equipment Layout
- ❑ Routine Operating Duties
- ❑ ID/FD Fans Units 1 And 2
- ❑ ID Fans Units 3 And 4
- ❑ Sterile Water Tank
- ❑ House Service Cooling Towers and Head Tanks
- ❑ Circulating Water Cooling Tower
- ❑ Traveling Screens
- ❑ River Intake
- ❑ Stack and Met. Tower Lights
- ❑ Subyard Checks
- ❑ Subyard Pump Station
- ❑ FWWT CO2 Storage Tank
- ❑ Fuel Oil Pump House
- ❑ ACI Air Compressors
- ❑ Sewage Treatment Plant
- ❑ Leachate Pump Station
- ❑ Industrial Waste Treatment
- ❑ Final Waste Water Treatment

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Completion of the guide will mean that you are ready to take the Final Written Exam and perform the Operational Exercises associated with the Entry Level PPT position. You are expected to complete this guide within 6 months maximum. Studying this guide should prepare you for the final written exam and operational exercises.

You will perform the activities listed in this guide under the supervision of a qualified operator or a supervisor. The safe and proper operation of this equipment is very important to the successful operation of the Power Plant and is an important part of your job. You must understand the configuration and location of the equipment as well as be able to monitor and inspect the equipment and operate the controls as required. It is imperative that you understand information covered by this guide sufficiently to operate the equipment during normal operation, and also be able to diagnose potential and actual problems and correct them as soon as practical.

Understanding the system layouts, including controls, indications, and routine operating procedures is vital to your success in your job. In addition, being able to foresee a problem before it gets out of your control and knowing the appropriate actions to take can avoid serious accidents and eliminate periods of unscheduled down time.


It is suggested you use this self-study guide and do learning activities such as reviewing the system descriptions and operating procedures in short blocks of time, between 1-2 hours. In the event some job requirements are not covered in the written system descriptions and operating procedures you will need to get assistance from an experienced operator or your supervisor.

1.2 JOB POSITION DUTIES AND RESPONSIBILITIES

The Entry Level PPT may fill the role of an outside operator and is responsible for the outside equipment as well as monitoring the levels of the Sterile Water Tank and the Head Tanks that supply the House Service Cooling Tower Make-up Pumps. The Entry Level PPT is required to acquire a detailed knowledge of the ID Fans for all four units, the FD Fans for Units 1 & 2, the House Service Cooling Towers, the River Intake, Traveling Screens, and be able to operate the equipment as listed in the table below.


As an outside operator, the Entry Level PPT is responsible for making rounds to monitor the outside equipment and complete the check sheet for the Outside Job. The Entry Level PPT must become familiar required logs and checklists that must be completed on each shift. Any abnormal conditions shall be reported to the shift supervisor.

The Entry Level PPT must carry a portable radio at all times and become proficient in its use. The Entry Level PPT must check battery operation and replace batteries with freshly charged batteries when required to ensure continued service during shift.

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The following table summarizes the major tasks and objectives associated with the Entry Level PPT position:

Entry Level PPT Specific Job Responsibilities
Performs pre-start and normal operations checks of the Units 1 & 2 ID fans and FD fans
Performs pre-start and normal operations checks of the Units 3 & 4 ID fans
Ensures Head Tanks have proper operating level and no leaks
Ensures Sterile Water Tank level is normal and no leaks
Performs pre-start and normal operations checks of House Service Cooling Towers and places HSCT make-up pump in service.
Performs normal operations checks of Circulating Water Cooling Towers and associated equipment
Performs pre-start and normal operations checks of River Intake and Traveling Screens
Check that Stack and Met Lights are illuminated
Performs 3Subyard checks, including transformer fans controlling transformer temperature, oil tanks not leaking, 3Subyard pump station pump running smoothly
Monitors FWWT CO2 Storage Tank for proper pressure and temperature
Monitors FWWT Polymer Feed system for proper flow and operation
Performs checks on Fuel Oil Pump House and operates Oil Unloading Pump as required
Performs pre-start and normal operations checks of AIC Air Compressors
Monitor the Sewage Treatment Plant and operate blower and chlorine pump
Operates and monitors the Leachate Pump Station
Check the Industrial Waste Treatment equipment and maintain the tank/pit pH within limits
Make routine checks of Final Wastewater Treatment system and complete FWWT checklist each shift

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1.3 REFERENCES

For location of plant equipment refer to the following Valhalla Station drawings:

- CI D-48535 – Station General Plot Plan, Units 3 & 4 – Li
- D-34791 - Longitudinal Section Through Plant, Unit 1 & 2 – 10
- D-48539 - Cross Section through Plant. Unit 3

Available references relevant to the Entry Level PPT for your use include System Descriptions, Operating Procedures, and flow path drawings that are listed below.

ID/FD Fans Units 1 and 2

- ID and FD Fans Units 1 & 2 System Description in GUP III Qualification Card Manual
- Draft System Description in Engineering Data Book, Units No. 1 & No. 2

ID Fans Units 3 and 4

- CI ID FD Fans Units 3 & 4 System Description in GUP III Qualification Card Manual
- Li Draft System Description in Engineering Data Book, Units No. 3 & No. 4

Sterile Water Tank

- Sterile Water Tank description in GUP III Qualification Card Manual

House Service Cooling Towers and Head Tanks

- LI House Service Cooling Towers description in GUP III Qualification Card Manual
- Head Tanks System Description in GUP III Qualification Card Manual
- Cooling Towers description in Engineering Data Book, Units No. 3 & No. 4
- House Service Water flow diagram D-48823
- CRO Training & Qualification Manual, Units 1 & 2 Plant Cooling Water Systems
- CRO Training & Qualification Manual, Units 3 & 4 Plant Cooling Water Systems

Traveling Screens


- Li Traveling Screens description in GUP III Qualification Card Manual
- 0P711 - Traveling Screen Operation Procedure

River Intake

- River Intake description in GUP III Qualification Card Manual

Stack and Met Lights

- Li Stack Lights & Met Tower Lights description in GUP III Qualification Card Manual

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Subyard Checks

- Li Subyard Checks in GUP III Qualification Card Manual

Subyard Pump Station

- Li Subyard Pump Station description in GUP III Qualification Card Manual
- CI Ash Disposal Leachate Treatment System O & M Manual
- Waste Treatment Pump Stations flow diagram C-392-052 CI
- Waste Treatment flow diagram E-392-017

CO2 Storage

- Li CO2 Storage Tank description in GUP III Qualification Card Manual
- Li Alarm Response Procedure, Unit 3, Tab G

Fuel Pump House

- CI Fuel Oil Pump House description in GUP III Qualification Card Manual
- CI Fuel Oil Unloading Procedure OP-101
- CI Alarm Response Manual, #3 & #4 Combined Alarm Board

4C Control Air Compressor


- Li 3C & 4C Air Compressors description in GUP III Qualification Card Manual (3C Air Compressor no longer in service)
- Li 3C and 4C Control Air Compressor Operation Procedure OP-717
- Li Alarm Response Procedures, #3 Unit Tab A and Tab G

Sewage Treatment

- Sewage Treatment Plant system description in GUP III Qualification Card Manual.

Leachate Pump Station

- Li Leachate Pump Station description in GUP III Qualification Card Manual.
- Li Ash Disposal Leachate Treatment System O & M Manual
- Industrial Waste Treatment System Description
- Waste Treatment Pump Stations flow diagram C-392-052
- CI Waster Treatment flow diagram E-392-017


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Industrial Waste Treatment

- Industrial Waste Treatment description in CUP III Qualification Card Manual.
- Ash Disposal Leachate Treatment System O & M Manual
- CI Industrial Waste Treatment System Description
- CI Waste Treatment Control Panel arrangement drawing E-292-345

Final Waste Treatment

- Final Waste Water Treatment in CUP III Qualification Card Manual.
- Li FWWT System O & M Manual
- Li Final Waste Treatment System Description with flow diagram FWT-FD-1

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1.4 LEARNING ACTIVITIES


Learning activities are the reading, studying, and in-plant walk-downs that the trainee does to develop the knowledge and skills required as part of the training process. The knowledge and the skills that the trainee must acquire will come from a combination of self-study of the reference material and this guide with On-the-Job Training (OJT).

Knowledge of equipment and systems will come from available plant documentation, including system descriptions, startup and shutdown procedures, flow diagrams, manufacturer's manuals, and other manuals specific to the system being studied.


The trainee will be initiated to the job through system orientation provided to you by your supervisor or qualified operator. Once provided with the reference materials and the proper direction, the majority of the learning activities will be self-study.

In general, the learning activities for each topic will include four parts:

- System Knowledge Studying and Learning Activities
 - Includes system flow path knowledge.
 - Component locations
 - Routine and abnormal operations
 - Training provided by the NRG Quad
 - Review question to that will prepare the operator for the final written examination
- Walk Downs
 - Includes locating major components associated with each system
 - Includes discussion of major components with an experienced operator
- Round Duties with applicable questions
 - Operational responsibilities and tasks
 - Appropriate values for operating parameters such as normal operating pressures and temperatures and limits of operation such as maximum allowable pressures and temperatures.
- Operational Exercises
 - Includes exercises performed in the plant under guidance of an experienced operator.
 - The trainee may perform startup of a component or system (or simulate startup) under supervision of a qualified operator.

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**Piping Specialties
Entry Level PPT
Qualification Self-Study Guide**

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2.2 PIPING SPECIALTIES

The term piping specialties is used to describe a number of components found in piping systems other than the pipe itself and the connecting components such as elbows and flanges. The piping specialties covered in this Section include the following:

- Steam traps
- Filters and strainers
- Mist eliminators
- Attemperators

2.2.1 Steam Traps

Steam traps are installed in steam line drains to drain condensate from the lines while minimizing the loss of steam. Although there are many different kinds of steam traps, they all consist of a valve and some device or arrangement that will cause the valve to open and close as necessary. Some designs are suitable for low pressures and temperatures, others for high pressures and temperatures. A typical steam trap piping layout is shown in Figure 31.

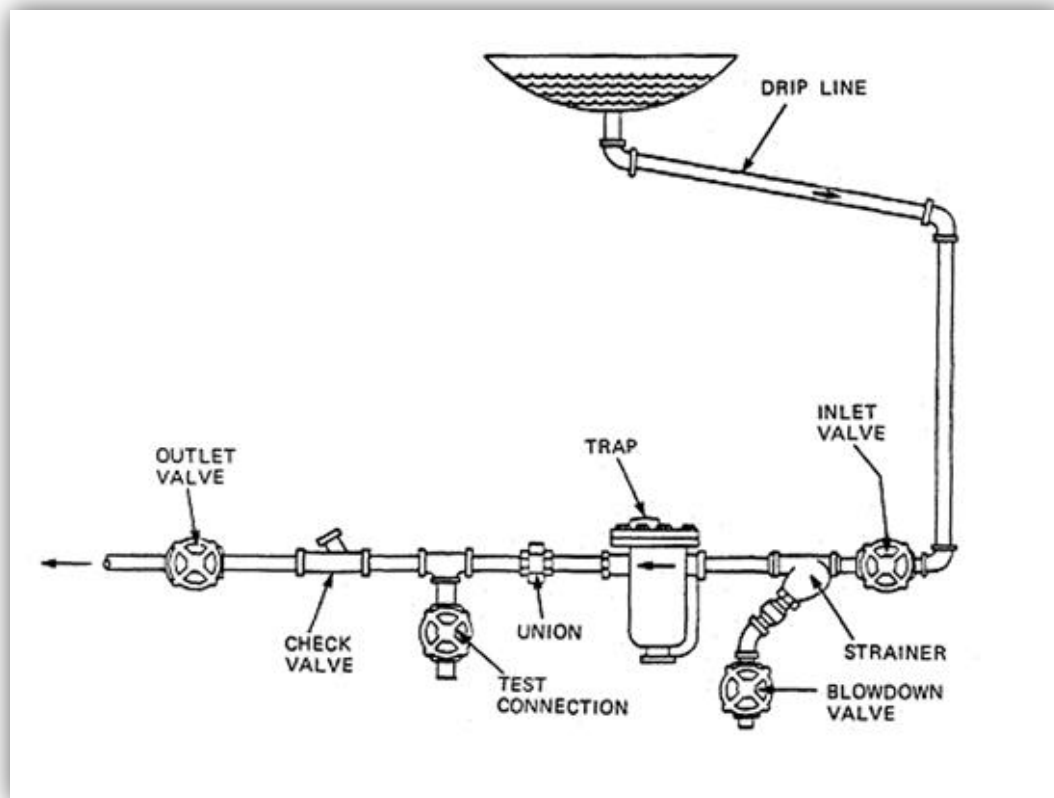



Figure 31 – Steam Trap Piping Layout

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There are three types of steam traps: thermostatic, mechanical and thermodynamic. The principles of operation of these types of steam traps are described in the following Sections.

2.2.2 Mechanical Steam Traps

Mechanical steam traps use some type of mechanical device to open and close a drain valve. The two types of mechanical steam trap covered in this Section are the ball-float type and the inverted bucket type.

Ball Float Steam Trap

In a ball-float steam trap, the valve of the trap is connected to the float in such a way that the valve opens when the float rises, as shown in Figure 32. When the trap is in operation, the steam and any water that may be mixed with it flows into the chamber. As the water level rises, the float is lifted; this, in turn, lifts the float and opens the valve. The condensate that passes out of the trap is returned to the feed system.

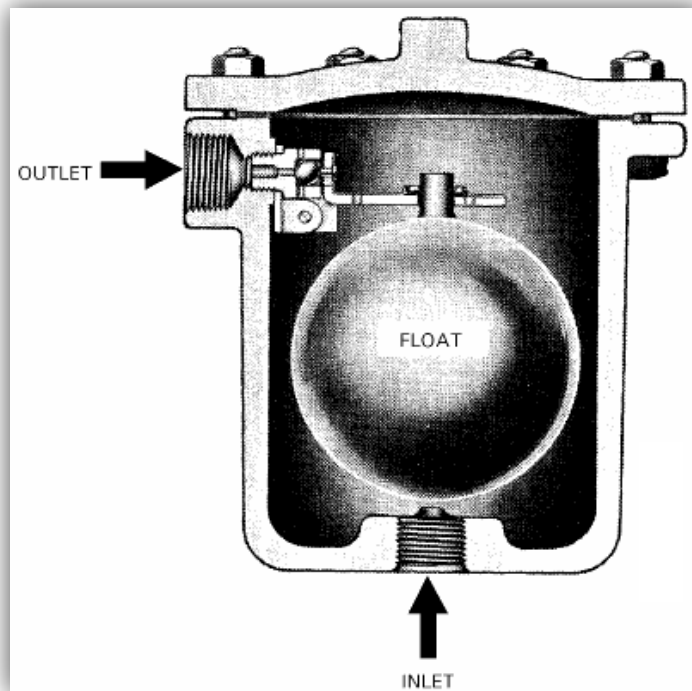



Figure 32 – Steam Trap (Float Type)

Inverted Bucket Steam Trap

The density differential between steam and condensate is used to operate the inverted bucket steam trap, as shown in Figure 33. The inverted bucket is attached to a lever that opens and closes the drain valve located in the cover of the trap. On startup of a system, when only air

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2.2.14 Walk Downs (Completed with Support of Experienced Operator)

The trainee will perform walk downs of Piping Specialties. The trainee should be able to identify and be very familiar with the location of equipment in the plant. The walk down should include locating and a discussion of the equipment.

Walk Downs should be conducted with an experienced operator whenever possible. This will allow for discussion of equipment between the trainee and experienced operator. During the Walk Downs, you are encouraged to ask questions about the equipment and take detailed notes. The knowledge you obtain from experienced operators is extremely important toward your pursuit of Entry Level PPT designation at Valhalla.


Perform Walk Downs of the items listed below. Space is provided below each item for the trainee to take notes for future reference. Track completion of Walk Downs in your Trainee Progress Card.

- Mechanical Steam Traps

- Thermostatic Steam Traps

- Thermodynamic Steam Traps

- Filters and Strainers

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- Basket Filters


- Knife-Edge Filters

- Y-Strainer

- Temporary Strainers

- Mist Eliminators

- Attemperators

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2.2.15 Review Questions

Listed below are several review questions that will prepare you for the final written examination. Answers to these review questions are located in Appendix A of this document.

1. Which of the following types of steam traps uses a float to open a valve to the drain line?
 - a) Thermostatic Steam Trap
 - b) Mechanical Steam Trap
 - c) Thermodynamic Steam Trap
 - d) Orifice Type Steam Trap
2. Which of the following types of steam traps operates on the principle that different metals expand and contract at different rates?
 - a) Labyrinth Steam Trap
 - b) Inverted Bucket Steam Trap
 - c) Bimetallic Steam Trap
 - d) Bellows Type Steam Trap
3. Which type of steam trap uses the density between steam and condensate to operate?
 - a) Inverted Bucket Steam Trap
 - b) Traditional Thermodynamic Steam Trap
 - c) Ball Float Steam Trap
 - d) Bimetallic Steam Trap
4. The expansion and contraction of volatile liquid is used to open and close the valve in a _____.
 - a) Inverted Bucket Steam Trap
 - b) Impulse Steam Trap
 - c) Traditional Thermodynamic Steam Trap
 - d) Bellows Type Thermostatic Steam Trap
5. What kind of steam trap uses flashing of water to steam to open and close?
 - a) Thermodynamic
 - b) Thermostatic
 - c) Mechanical
 - d) All of the above



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6. What is a possible consequence of failing to replace a filter that has higher than acceptable differential pressure?
 - a) Reduction in system flow
 - b) Filter Collapse
 - c) System Contamination
 - d) All of the above
7. What kind of systems normally use basket filters?
 - a) Air and Ventilation Systems
 - b) Oil and Water Systems
 - c) Refrigeration Systems
 - d) All of the above
8. What type of filter uses a stack of closely placed disks, with a hole drilled through the center, to trap foreign material in the fluid flow?
 - a) Y-Strainer
 - b) Basket Filter
 - c) Knife Edge Filter
 - d) Stacked Disk Filter
9. Which of the following is an assembly that consists of two strainers, connected in parallel, through a common system?
 - a) Double Stacked Y-Strainer
 - b) Duplex Strainer
 - c) Parallel Gravity Filtration Rig
 - d) Impulse Assembly
10. Attenuators are also known as _____.
 - a) Jet Pumps
 - b) Steam Traps
 - c) Desuperheaters
 - d) Temporary Strainers



PPT - POWER PLANT TECHNCIAN ENTRANCE TEST 1 WITH ANSWERS

Qualification Program

Rev 0 - June 2019



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1.0 PLANT OPERATOR ENTRANCE EXAM QUESTIONS

1.1 Fire and Plant Safety

1. Which of the following is a device that uses a positive means to hold switches or valves in a safe position and prevents the equipment from becoming energized?
 - a. Tagout device
 - b. **Lockout device**
 - c. Energy isolating device
 - d. Affected device

2. Which of the following is NOT an appropriate safety fundamental?
 - a. All employees should know their jobs
 - b. Work areas in the plant should be kept neat and orderly
 - c. **Protective equipment should be worn only when performing hazardous tasks**
 - d. All plant personnel should follow safety rules and procedures and use common sense

3. Who has the final responsibility for your safety?
 - a. Your supervisor
 - b. **You**
 - c. The safety director
 - d. Valhalla

4. How should gas cylinders be stored?
 - a. standing on end and propped against a railing
 - b. **standing on end and securely fastened**
 - c. lying down next to each other
 - d. lying down and tied off to a railing

5. Which of the following is NOT information found on an SDS (MSDS)?
 - a. **Expiration Date**
 - b. Physical/Chemical Characteristics
 - c. Health Hazard Data
 - d. Precautions for Safe Handling and Use

6. Which of the following is an example of secondary fall protection?
- a. scaffolds
 - b. aerial lifts
 - c. personnel hoists
 - d. **harnesses**

1.2 Basic Mathematics

1. An oil tank has the dimensions 8 feet long x 4 feet wide by 5 feet tall. If one cubic foot contains 7.5 gallons, how many gallons will the tank hold?
 - a) **1200 gallons**
 - b) 21.33 gallons
 - c) 12,000 gallons
 - d) 213.3 gallons
2. The power factor (PF) for an alternating current circuit is given by the formula:

$$\text{PF} = \frac{\text{KW (Kilowatt)}}{\text{KVA (Kilovolt Amps)}}$$

A 2 pole, 60 cycle generator has a rating of 214,000 KVA at 0.85 Power Factor. What is the load in KW at rated KVA?

- a) **181,900 KW**
 - b) 2,447.1 KW
 - c) 4,078.4 KW
 - d) 530,400 KW
3. If a lube reservoir has three temperature instruments reading 80°F, 90°F and 94°F. What is the average reading?
 - a) 83°F
 - b) 85°F
 - c) **88°F**
 - d) 90°F

1.3 Chemistry and Water Treatment

1. The amount of impurities in water is commonly measured in terms of its_____.
 - a) pH
 - b) **Conductivity**
 - c) Turbidity
 - d) Hardness

2. When a cover is placed over a fire, it goes out because:
- a) It loses its ignition temperature.
 - b) The radiant energy is used up.
 - c) The oxygen supply is used up.**
 - d) The fuel is changed chemically.
3. Which of the following water treatment methods has a correct function listed?
- a) Chlorination – Removes undesirable cations and anions from water
 - b) Coagulation – Controls growth of biological fouling
 - c) Filtration – Removes suspended solids but not dissolved solids**
 - d) Ion Exchange – Removes impurities from the water by allowing them to settle out of solution
4. Which of the following is the most common chemical treatment used to remove biological contaminants that could cause fouling in heat exchangers?
- a) Ion Exchange
 - b) Coagulation
 - c) Sedimentation
 - d) Chlorination**
5. Which of the following is the most likely cause of high dissolved oxygen in the boiler water?
- a) A condenser tube leak
 - b) High pH in the boiler water
 - c) Deaerator problems**
 - d) Excessive injection of hydrazine/Eliminox



ENTRY LEVEL PPT FINAL EXAM ANSWER KEY

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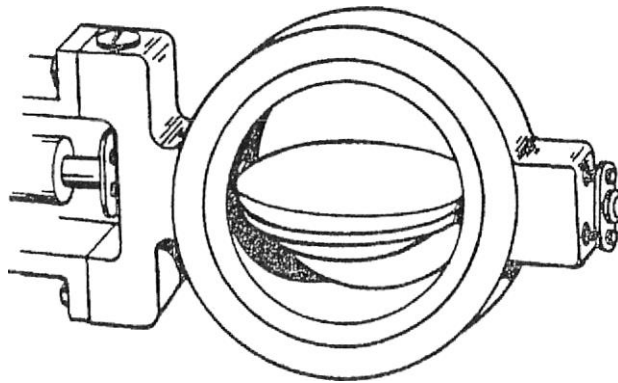
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1.0 ENTRY LEVEL PPT FINAL EXAM ANSWER KEY

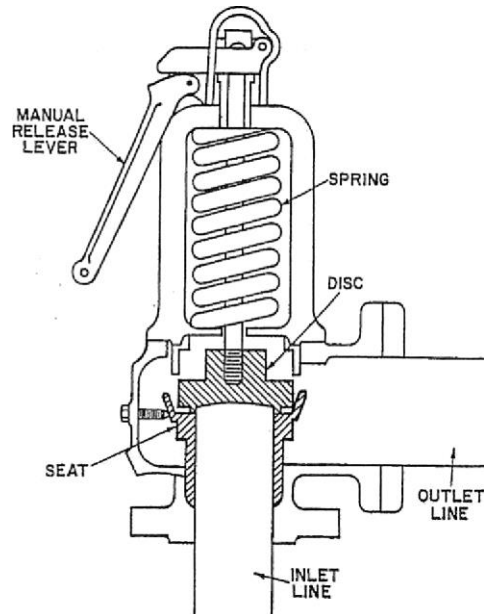
1.1 Power Plant Fundamentals and Routine Operating Duties

1. Which of the following types of valves is illustrated in the figure below?
 - a) Gate Valve
 - b) Globe Valve
 - c) Swing Check Valve
 - d) **Butterfly Valve**



2. Which of the following types of valves are designed to throttle flow?
 - a) Gate Valves
 - b) **Globe Valves**
 - c) Check Valves
 - d) Stop Valves
3. What is the purpose of a check valve?
 - a) To shut off flow
 - b) **To allow flow in only one direction**
 - c) To relieve system pressure
 - d) To regulate flow of a liquid
4. Which of the following is NOT a type of valve actuator?
 - a) Motor Operated
 - b) Hand (manual) Operated
 - c) **Plug Operated**
 - d) Air Operated

5. Which of the following types of valves is illustrated in the figure below?
- a) Relief Valve
 - b) **Safety Valve**
 - c) Swing Check Valve
 - d) Diaphragm Valve



6. Which of the following types of valves CANNOT be opened or closed quickly by only turning the valve handle 90°?
- a) **Globe Valve**
 - b) Ball Valve
 - c) Plug Valve
 - d) Butterfly Valve

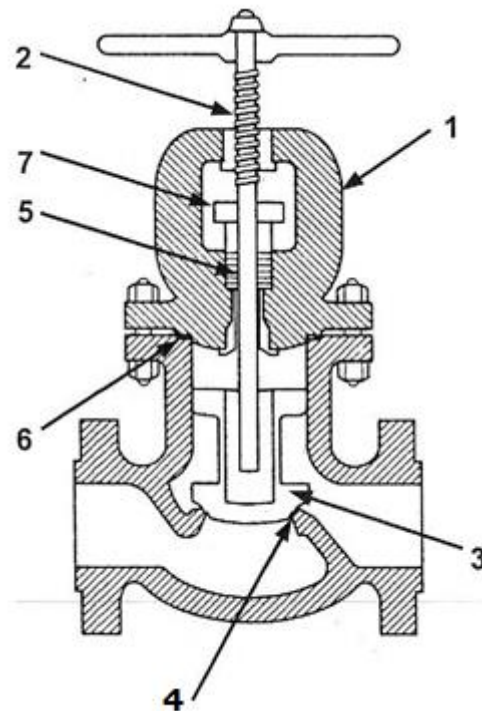
7. Match each of the applications listed below with the proper valve type.

Application Number	Application
1	Allows flow in one direction only.
2	Commonly used as a control valve.
3	Normally used as a block (isolation valve).
4	Used to automatically relieve pressure in steam and gas systems.
5	Used to automatically relieve pressure in liquid systems.

Valve Type	Answer
Gate Valve	3
Relief Valve	5
Check Valve	1
Safety Valve	4
Globe Valve	2

8. Match each part of the valve below to the proper title.

- 6 Bonnet Seal
- 5 Packing
- 1 Yoke
- 4 Body Seats
- 7 Packing Gland
- 3 Disk
- 2 Stem



9. Which of the following types of steam traps operates on the principle that different metals expand and contract at different rates?
- a) Labyrinth Steam Trap
 - b) Inverted Bucket Steam Trap
 - c) **Bimetallic Steam Trap**
 - d) Bellows Type Steam Trap
10. What kind of systems normally use basket filters?
- a) Air and Ventilation Systems
 - b) **Oil and Water Systems**
 - c) Refrigeration Systems
 - d) All of the above
11. What type of filter uses a stack of closely placed disks, with a hole drilled through the center, to trap foreign material in the fluid flow?
- a) Y-Strainer
 - b) Basket Filter
 - c) **Knife Edge Filter**
 - d) Stacked Disk Filter
12. Which of the following is an assembly that consists of two strainers, connected in parallel, through a common system?
- a) Double Stacked Y-Strainer
 - b) **Duplex Strainer**
 - c) Parallel Gravity Filtration Rig
 - d) Impulse Assembly
13. Attemperators are also known as _____.
- a) Jet Pumps
 - b) Steam Traps
 - c) **Desuperheaters**
 - d) Temporary Strainers
14. Which of the following is an example of a direct contact heat exchanger?
- a) Lube Oil Coolers
 - b) Feedwater Heaters
 - c) Condensers
 - d) **Cooling Towers**

15. What type of heat exchanger is the main condenser?
- a) Parallel Flow Heat Exchanger
 - b) Counter Flow Heat Exchanger
 - c) Cross Flow Heat Exchanger**
 - d) Direct Contact Heat Exchanger
16. What are the two major types of positive displacement pumps?
- a) Single and Multi-Stage Centrifugal Pumps
 - b) Radial and Axial Flow Pumps
 - c) Reciprocating and Rotary Pumps**
 - d) Jet and Mixed Flow Pumps
17. Liquids are prevented from leaking to the atmosphere in the areas where a pump shaft penetrates the casing through the use of _____.
- a) Wear Rings
 - b) Lantern Rings
 - c) Shaft Seals**
 - d) Silicone
18. What is used to provide a location where clean water can be injected in the pump seals to prevent dirty water from damaging the shaft?
- a) Lantern Ring**
 - b) Clean Water Ring
 - c) Preformed Packing
 - d) Packing Yarn
19. Place the following steps for starting a centrifugal pump with a positive suction in chronological order.
- 4 : Close the casing vent when air free water discharges from the vent
 - 7 : Open the discharge valve
 - 6 : Start the pump
 - 2 : Open the casing vents
 - 1 : Close the casing drains
 - 3 : Crack open the suction valve
 - 5 : Open the suction valve fully