



Naval Education and
Training Command

NAVEDTRA 43103
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PERSONNEL QUALIFICATION STANDARD

FOR

ENGINEERING FUNDAMENTALS

NOTE: This PQS contains Fundamentals only.

NAME (Rate / Rank) _____

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Although the words “he,” “him,” and “his” are used sparingly in this manual to enhance communication, they are not intended to be gender driven nor to affront or discriminate against anyone reading this material.

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NOTE: The purpose of this Engineering Fundamentals PQS book is to eliminate the redundancy of completing the same engineering fundamentals over and over. These fundamentals will be satisfactorily completed only once unless command direction or directives dictate otherwise.



ACKNOWLEDGEMENTS

The PQS Development Group recognizes the following command for the time and effort put forth reviewing and providing feedback to improve this Standard:

NAVOSHENVTRACEN, Norfolk, VA



INTRODUCTION

PQS PROGRAM

PQS is a system for qualifying officers and enlisted personnel to perform certain duties. It is a compilation of the knowledge and skills required to qualify for specific watchstations/ workstations, maintain specific equipment or perform as a team member within your unit. The PQS Program is not designed as a training program, but provides many training objectives.

APPLICABILITY

This PQS is applicable to all Naval units and shore installations.

TAILORING

To command tailor this package, first have it reviewed by one or more of your most qualified individuals. Delete or add any line items that are unique to your command but not already covered in these fundamentals. The package should be reviewed by the cognizant department head and required changes approved by the Commanding Officer or his designated representative. Retain the approved master copy on file for use in tailoring.

QUALIFIER

The PQS Qualifier is designated in writing by the Commanding Officer to sign off individual PQS line items. Qualifiers will normally be E-5 or above and, as a minimum, must have completed the PQS they are authorized to sign off. The names of designated Qualifiers should be made known to all members of the unit or department. The means of maintaining this listing is at the discretion of individual commands. For more information on the duties and responsibilities of PQS Qualifiers, see the PQS Management Guide.

CONTENTS

The Fundamentals contain the fundamental knowledge or book learning necessary for satisfactory understanding of the watchstation/workstation duties.

NOTE: The purpose of this Engineering Fundamentals PQS book is to eliminate redundancy of completing the same engineering fundamentals over and over. These fundamentals will be satisfactorily completed only once unless command direction or directives dictate otherwise.

INTRODUCTION (CONT'D)

REFERENCES

The references used during the writing of this PQS package were the latest available at the time. However, the most current references available should be used when qualifying with this Standard.

TRAINEE

Your supervisor will tell you which fundamentals you are to complete and in what order. If you have any questions or are unable to locate references, contact your supervisor or qualifier. Good Luck!

PQS FEEDBACK REPORTS

This PQS was developed using information currently available at the time of writing. When equipment and requirements change, the PQS needs to be revised. The only way the PQS Development Group knows of these changes is by you, the user, telling us either in a letter or via the Feedback Report contained in the back of this book. You can tell us of new requirements, or of errors you find.

100 INTRODUCTION TO FUNDAMENTALS

100.1 INTRODUCTION

This PQS covers the basic knowledge and principles needed to understand the equipment or duties to be studied. Normally, you would have acquired the knowledge required in these Fundamentals during the school phase of your training. If you have not been to school or if you need a refresher, the references listed at the beginning of each fundamental will aid you in a self-study program. All references cited for study are selected according to their credibility and availability.

100.2 SAFETY

Because safety is of paramount consideration, the Fundamentals describe the safety precautions which apply throughout a PQS.

100.3 HOW TO COMPLETE

The fundamentals you will have to complete are listed in the watchstation (300 section) of your PQS. You should complete all required fundamentals before starting any systems and watchstation portions of your PQS, since the knowledge gained from fundamentals will aid you in understanding the systems and your watchstation tasks. When you feel you have a complete understanding of one fundamental or more, contact your Qualifier. If you are attempting initial qualification, your Qualifier will expect you to satisfactorily answer all line items in the fundamentals before signing off completion of that fundamental. If you are requalifying or have completed the appropriate schools, your Qualifier may require you to answer representative line items to determine if you have retained the necessary knowledge for your watchstation. If your command requires an oral board or written examination for final qualification, you may be asked any questions from the fundamentals required for your watchstation.

101 AIR-CONDITIONING AND REFRIGERATION

NAME _____ RATE/RANK _____

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This section is to be kept in the individual's training jacket.



The trainee has satisfactory completed all PQS requirements for this fundamental. Completed AIR-CONDITIONING AND REFRIGERATION Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____



101 AIR-CONDITIONING AND REFRIGERATION FUNDAMENTALS

References:

[a] NSTM S9086-RW-STM-010/CH-516, Refrigeration Systems

[b] NAVEDTRA 12144, Machinist's Mate 3 & 2



101.1 Define the following terms as applied to air-conditioning/refrigeration:

- a. British thermal unit (Btu) [ref. a, sec. 1]
 - b. Charging [ref. a, sec. 1]
 - c. Compression [ref. b, ch. 11]
 - d. Condensation [ref. b, app. I]
 - e. Dew point [ref. b, ch. 12]
 - f. Dry bulb temperature [ref. b, ch. 12]
 - g. Evaporation [ref. b, app. I]
 - h. Heat [ref. b, app. I]
 - i. High side [ref. a, sec. 1]
 - j. Humidity [ref. b, app. I]
 - k. Latent heat of fusion [ref. a, sec. 1]
 - l. Latent heat of vaporization [ref. a, sec. 1]
 - m. Low side [ref. a, sec. 1]
 - n. Pumping down [ref. a, sec. 1]
 - o. Refrigerant [ref. a, sec. 1]
 - p. Refrigeration ton [ref. b, app. I]
 - q. Relative humidity [ref. b, app. I]
 - r. Sensible heat [ref. b, app. I]
 - s. Superheat [ref. a, sec. 1]
 - t. Specific heat [ref. b, app. I]
 - u. Wet bulb temperature [ref. b, ch. 12]
- .2 State the functions of the following main parts of a basic refrigeration cycle: [ref. b, ch. 11]
- a. Compressor
 - b. Condenser
 - c. Evaporator
 - d. Receiver
 - e. Thermostatic Expansion Valve (TXV)
- .3 State the functions of the following as used in or with air-conditioning/ refrigeration:
- a. Capacity control [ref. b, ch. 11]
 - b. Dehydrator [ref. b, ch. 11]
 - c. Evaporator Pressure Regulator (EPR) [ref. b, ch. 11]
 - d. Expansion tank [ref. a, sec. 4]
 - e. High pressure cutout switch [ref. b, ch. 11]
 - f. Low pressure cutout switch [ref. b, ch. 11]

101 AIR-CONDITIONING AND REFRIGERATION FUNDAMENTALS (CONT'D)

- 101.3 g. Lube oil failure switch [ref. b, ch. 11]
 - h. Moisture indicator [ref. b, ch. 11]
 - i. Solenoid valve [ref. b, ch. 11]
 - j. Thermostatic control switch [ref. b, ch. 11]
 - k. Water failure switch [ref. b, ch. 11]
 - l. Water Regulating Valve (WRV) [ref. b, ch. 11]
- .4 Discuss the following equipment used to circulate air aboard ships: [ref. b, ch. 12]
- a. Bracket fans
 - b. Centrifugal fans
 - c. Tube axial fans
 - d. Vane axial fans
- .5 Discuss the following types of environmental control systems used aboard ships:
- a. Chilled water circulating systems [ref. b, ch. 12]
 - b. Fan coil assemblies [ref. b, ch. 12]
 - c. Gravity cooling coils [ref. a, sec. 3]
 - d. Package unit air conditioners [ref. b, ch. 12]
 - e. Refrigerant circulating (vapor compression) systems [ref. b, ch. 12]
 - f. Electric heater [ref. b, ch. 12]
- .6 State the equipment for detecting refrigerant and how it detects. [ref. b, ch. 11]
- .7 What are the hazards associated with refrigerant gas in a poorly ventilated/enclosed space? [ref. b, ch. 11]

102 ASBESTOS CONTROL PROGRAM

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed ASBESTOS CONTROL PROGRAM Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____

102 ASBESTOS CONTROL PROGRAM FUNDAMENTALS

References:

[a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1, ch. B1



[b] NSTM S9086-VH-STM-010/CH-635, Thermal, Fire, and Acoustic Insulation

- 102.1 Discuss the hazards associated with asbestos insulation and material containing asbestos. [ref. a]
 - .2 Where is asbestos material commonly found aboard ship? [ref. a; ref. b, sec. 10]
 - .3 What are the requirements for removal of asbestos insulation? [ref. a]
 - .4 How is asbestos material identified? [ref. a]
 - .5 What personnel safety equipment is required while working on or entering an asbestos work area? [ref. a]
 - .6 What are the requirements for gasket cutting operations? [ref. b, sec. 10]
 - .7 Describe the proper asbestos disposal procedure. [ref. a]

103 AUXILIARY BOILER

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed AUXILIARY BOILER Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____
Supervisor

COMPLETED _____ DATE _____
Division Officer

COMPLETED _____ DATE _____
Department Head

SERVICE RECORD
ENTRY _____ DATE _____

103 AUXILIARY BOILER FUNDAMENTALS

References:

- [a] NSTM S9086-GY-STM-010/CH-221, Boilers
 - [b] NSTM S9086-GX-STM-020/CH-220 V2, Boiler Water/Feedwater-Test and Treatment
 - [c] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
 - [d] NAVEDTRA 12001, Fireman
 - [e] NAVEDTRA 12140, Boiler Technician 3 & 2
 - [f] Propulsion Plant Manual (PPM)
 - [g] Engineering Operational Sequencing System (EOSS)
-



103.1 Define the following terms as applied to auxiliary boilers:

- a. Operating pressure [ref. e, ch. 5]
- b. Design pressure [ref. e, ch. 5]
- c. psia and psig [ref. d, ch. 2]
- d. Combustion [ref. e, app. I]
- e. Natural circulation [ref. e, ch. 5]
- f. Atomization [ref. e, app. I]
- g. Sensible heat [ref. d, ch. 2]
- h. Latent heat [ref. d, ch. 2]
- i. Saturated steam [ref. d, ch. 2]
- j. Conduction [ref. e, app. I]
- k. Convection [ref. e, app. I]
- l. Radiation [ref. e, app. I]
- m. Feedwater [ref. b, sec. 21]
- n. Casings [ref. a, sec. 2]
- o. Smoke-pipes [ref. e, ch. 5]
- p. Handhole plate [ref. e, ch. 5]
- q. Flash point [ref. e, ch. 2]
- r. British thermal unit (Btu) [ref. e, app. I]
- s. Igniter assembly [ref. a, sec. 3]
- t. Gauge glass [ref. e, ch. 6]
- u. Uptakes [ref. e, ch. 5]
- v. Combustion air [ref. e, app. I]
- w. Combustion gases [ref. e, ch. 5]
- x. Forced draft blower [ref. e, ch. 10]
- y. Lay-up [ref. b, sec. 21]

.2 State the protective functions of the following:

- a. Safety valves [ref. e, ch. 6]
- b. Easing gear [ref. a, sec. 3]
- c. Quick-closing valves [ref. g]
- d. Refractory [ref. e, ch. 5]
- e. Expansion joints [ref. e, app. I]
- f. Photocells [ref. a, sec. 3]

103 AUXILIARY BOILER FUNDAMENTALS (CONT'D)

- 103.2 g. High/low water alarms [ref. a, sec. 3]
 - h. Burner root valves [ref. e, ch. 6]
 - i. Flange shields [ref. d, ch. 9]
 - j. Fuel oil filters/strainers [ref. d, ch. 9]
 - k. Visual smoke indicator [ref. a, sec. 3]
- .3 Discuss the following:
- a. Bottom blowdown [ref. e, ch. 9]
 - b. Surface blowdown [ref. e, ch. 9]
 - c. Blowing tubes [ref. e, app. I]
 - d. Light-off [ref. g]
 - e. Secure [ref. g]
 - f. Black smoke [ref. a, sec. 4]
 - g. White smoke [ref. a, sec. 4]
 - h. Boiler full power capacity [ref. a, sec. 1]
 - i. End point for combustion [ref. f]
 - j. End point for water circulation [ref. f]
 - k. End point for moisture carryover [ref. f]
 - l. Panting [ref. e, app. I]
 - m. Automatic [ref. a, sec. 4]
 - n. Manual [ref. e, ch. 7]
 - o. Steaming hours [ref. e, ch. 5]
- .4 Describe the relationship between pressure and temperature in a boiler when steam has begun to form. [ref. e, ch. 5]
- .5 Describe the safety precautions to be observed when lighting off an auxiliary boiler. [ref. c, ch. C13]
- .6 Explain the testing requirements for setting boiler safety valves. [ref. a, sec. 3]
- .7 Explain the purpose of chemically treating auxiliary/waste heat boilers. [ref. e, ch. 9]
- .8 State the purpose of auxiliary boiler lay-up. [ref. a, sec. 5]
- .9 Explain how pressure is maintained while operating in automatic. [ref. e, ch. 7]
- .10 Explain how steam leaving the boiler is recycled. [ref. g]
- .11 State the four phases of the basic steam cycle. [ref. d, ch. 3]
- .12 Explain the two methods of chemical treatment for waste heat boilers. [ref. b, sec. 30]

104 BOILER

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed BOILER Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____

104 BOILER FUNDAMENTALS

References:

- [a] NAVEDTRA 12001, Fireman
 - [b] NAVEDTRA 12140, Boiler Technician 3 & 2
 - [c] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
 - [d] NSTM S9086-GY-STM-010/CH-221, Boilers
 - [e] Engineering Operational Sequencing System (EOSS)
-



104.1 Define the following terms as applied to boilers:

- a. Combustion [ref. a, ch. 2]
 - b. Operating pressure [ref. b, ch. 5]
 - c. Superheated steam [ref. b, app. I]
 - d. Desuperheated steam [ref. b, app. I]
 - e. Saturated steam [ref. b, app. I]
 - f. psi [ref. a, ch. 2]
 - g. Design pressure [ref. b, ch. 5]
 - h. Conduction [ref. b, ch. 3]
 - i. Radiation [ref. b, ch. 3]
 - j. Convection [ref. b, ch. 3]
 - k. Shrink and swell [ref. d, sec. 4]
 - l. Boiler load [ref. b, app. I]
 - m. Atomization [ref. b, app. I]
 - n. Sensible heat [ref. b, ch. 3]
 - o. Latent heat [ref. b, ch. 3]
 - p. British thermal unit (Btu) [ref. b, ch. 3]
 - q. Feedwater [ref. b, app. I]
- .2 State the protective function of each of the following:
- a. Safety valves [ref. b, ch. 6]
 - b. Refractory [ref. d, sec. 2]
 - c. Expansion joints [ref. b, app. I]
 - d. Superheater protection steam [ref. d, sec. 4]
 - e. Steam Smothering System [ref. b, ch. 4]
 - f. Shutters [ref. d, sec. 4]
 - g. Fuel oil quick-closing valve [ref. d, sec. 4]
 - h. Safety shutoff device [ref. d, sec. 3]
 - i. Burner root valves [ref. b, ch. 6]
- .3 Discuss the following:
- a. Bottom blowdown [ref. b, ch. 9]
 - b. Surface blowdown [refs. b, ch. 9]
 - c. Blowing tubes [ref. d, sec. 4]
 - d. Light-off [ref. e]

104 BOILER FUNDAMENTALS (CONT'D)

- 104.3 e. Secure [ref. e]
 - f. Black smoke [ref. d, sec. 4]
 - g. White smoke [ref. d, sec. 4]
 - h. Steady steaming/steady-state operation [ref. d, sec. 4]
 - i. Panting [ref. b, app. A1-15]
 - j. Automatic [ref. d, sec. 5]
 - k. Remote manual [ref. b, ch. 7]
 - l. Local manual [ref. b, ch. 7]
 - m. Steaming hours [ref. d, sec. 1]
 - n. Warm-up [ref. b, ch. 8]
 - o. Purge [ref. d, sec. 4]

- .4 Discuss the terms as applied to boilers: [ref. b, ch. 5]
 - a. Boiler efficiency
 - b. Boiler capacity
 - c. End point of combustion
 - d. End point of circulation
 - e. End point of carryover

- .5 What are the pressure-temperature relationships involved in the generation of steam? [ref. a, ch. 3]

- .6 State the safety precautions to be observed when lighting off a boiler. [ref. c, ch. C13]

- .7 State the requirement for setting boiler safety valves. [ref. d, sec. 3]

- .8 Why are boilers chemically treated? [ref. b, ch. 9]

- .9 State the purpose and types of boiler lay-ups. [ref. d, sec. 5]

- .10 What are the four phases of the basic steam cycle? [ref. a, ch. 3]

105 DEGAUSSING

NAME _____ RATE/RANK _____

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COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____

105 DEGAUSSING FUNDAMENTALS

References:

[a] NAVEDTRA 10546-F, Electrician's Mate 3 & 2, ch. 8

[b] NSTM S9086-QN-STM-010/CH-475, Magnetic Silencing



105.1 What is degaussing? [ref. a]

- .2 Discuss the ship's permanent magnetization. [ref. a]
- .3 Explain the horizontal component of the earth's magnetic field. [ref. a]
- .4 Explain the vertical component of the earth's magnetic field. [ref. a]
- .5 Explain the longitudinal component of the ship's magnetic field. [ref. a]
- .6 Explain the athwartship component of the ship's magnetic field. [ref. a]
- .7 Explain the vertical component of the ship's magnetic field. [ref. a]
- .8 What is the unit of magnetic field strength? [ref. b, sec. 2]
- .9 Discuss the function of the degaussing coils. [ref. b, sec. 3]
- .10 Name the different degaussing coils and state their uses. [ref. a]
- .11 What is a degaussing folder? [ref. a]
- .12 Discuss the function of the compass compensating coil. [ref. b, sec. 8]

106 DIESEL ENGINE

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed DIESEL ENGINE Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____

106 DIESEL ENGINE FUNDAMENTALS

References:

- [a] NAVEDTRA 10539, Engineman 3
 - [b] NAVEDTRA 12001, Fireman
 - [c] NSTM S9086-HB-STM-000/CH-233, Diesel Engines
-



- 106.1 State the applications of diesel engines aboard your ship.
- .2 List all the authoritative manuals and instructions applicable to the operation of diesel engines aboard your ship.
 - .3 Define the following terms as applied to diesel engines:
 - a. Compression ignition [ref. a, ch. 2]
 - b. Compression ratio [ref. a, ch. 2]
 - c. Cycle [ref. a, app. I]
 - d. Displacement [ref. a, app. I]
 - e. Four-stroke cycle [ref. a, ch. 2]
 - f. Horsepower (hp) [ref. a, app. I]
 - g. IDC/ODC (opposed piston engine) [ref. a, ch. 2]
 - h. Internal combustion [ref. a, ch. 2]
 - i. Jacking [ref. a, app. I]
 - j. Prime mover [ref. a, app. I]
 - k. Reciprocating [ref. a, app. I]
 - l. Rotary [ref. b, ch. 7]
 - m. Rpm (engine speed) [ref. b, ch. 11]
 - n. Split plant [ref. a, app. I]
 - o. Stroke [ref. a, ch. 2]
 - p. TDC/BDC [ref. a, ch. 2]
 - q. Two-stroke cycle [ref. a, ch. 2]
 - r. Valve lash [ref. a, app. I]
 - .4 Define the following terms used with the Diesel Engine Air System:
 - a. Back pressure [ref. a, app. I]
 - b. Exhaust stroke [ref. b, ch. 7]
 - c. Intake stroke [ref. b, ch. 7]
 - d. Scavenging [ref. a, ch. 6]
 - e. Supercharging [ref. a, ch. 6]
 - f. Turbocharging [ref. a, ch. 6]

106 DIESEL ENGINE FUNDAMENTALS (CONT'D)

106.5 Define the following terms used with Diesel Engine Lubricating and Cooling Systems:
[ref. a]

- a. Cooler (heat exchanger) [app. I]
- b. Pressure [app. I]
- c. Pressure differential [app. I]
- d. Thermal expansion [app. I]
- e. Water jacket [app. I]
- f. Viscosity [app. I]
- g. Coolant treatment [ch. 7]

.6 Define the following terms used with Diesel Engine Fuel System: [ref. a]

- a. Atomization [app. I]
- b. Combustion [ch. 9]
- c. Detonation [app. I]
- d. Fuel knock [ch. 9]
- e. Fuel injection [ch. 9]
- f. Ignition lag (delay) [ch. 9]
- g. Precombustion [ch. 9]
- h. Priming [app. I]
- i. Turbulence [app. I]

.7 Define the following terms used with Diesel Engine Control and Monitoring Systems:
[ref. a]

- a. Critical speed [app. I]
- b. Hunting [ch. 9]
- c. Isochronous governing [ch. 9]
- d. Operating pressure [app. I]
- e. Operating temperature [app. I]
- f. Promptness [ch. 9]
- g. Sensing point [app. I]
- h. Sensitivity [ch. 9]
- i. Set point [app. I]
- j. Speed droop [ch. 9]
- k. Stability [ch. 9]
- l. Surging [app. I]
- m. Synchronize [app. I]

106 DIESEL ENGINE FUNDAMENTALS (CONT'D)

106.8 State the functions of each of the following primary parts/assemblies of a diesel engine:
[ref. a]

- a. Accessory drive assembly [ch. 5]
 - b. Block [ch. 3]
 - c. Camshaft [ch. 4]
 - d. Connecting rod [ch. 4]
 - e. Crankcase [ch. 3]
 - f. Crankshaft [ch. 4]
 - g. Cylinder head [ch. 3]
 - h. Cylinder liners [ch. 3]
 - i. Drive mechanism [ch. 5]
 - j. Manifold (intake/exhaust) [ch. 6]
 - k. Piston [ch. 4]
 - l. Sump/oil pan [ch. 3]
 - m. Valves (intake/exhaust) [app. I]
- .9 What are the mechanical cycle classifications of diesel engines? [ref. a, ch. 2]
- .10 What are the three types of cylinder liners used with diesel engines? [ref. a, ch. 3]
- .11 What are the two types of air intake silencer/cleaner commonly used with diesel engines? [ref. a, ch. 6]
- .12 Discuss the following starting systems commonly used with diesel engines: [ref. a, ch. 10]
- a. Electric starting
 - b. Hydraulic starting
 - c. Air starting
- .13 What are the three most common types of coolers (heat exchangers) used with diesel engines? [ref. a, ch. 7]
- .14 Discuss each of the following general types of governors used with diesel engines: [ref. a, ch. 9]
- a. Mechanical governor
 - b. Hydraulic governor
- .15 State the different types of mechanical fuel injection systems used with diesel engines. [ref. a, ch. 9]

106 DIESEL ENGINE FUNDAMENTALS (CONT'D)

106.16 Discuss the functions of the following as used with diesel engines:

- a. Pyrometer [ref. a, app. I]
- b. Thermocouple [ref. a, app. I]
- c. Thermostatic control valve [ref. a, ch. 7]
- d. Lube oil scavenging pump [ref. a, ch. 8]
- e. Fuel control rack [ref. a, ch. 9]
- f. Blower shutdown [ref. a, ch. 9]
- g. Remote fuel shutdown [ref. a, ch. 9]
- h. Manometer [ref. b, ch. 11]
- i. Crankcase ventilation [ref. a, ch. 8]
- j. Cylinder test valve [ref. a, ch. 6]
- k. Cylinder safety/relief valve [ref. a, ch. 6]
- l. Constant speed governor [ref. a, ch. 9]
- m. Load-limiting governor [ref. a, ch. 9]
- n. Overspeed governor [ref. a, ch. 9]
- o. Overspeed trip [ref. a, ch. 9]
- p. Speed-limiting governor [ref. a, ch. 9]
- q. Variable speed governor [ref. a, ch. 9]
- r. Tachometer [ref. a, app. I]

.17 Discuss the pressure, temperature, and volume relationship of the gas flow through a diesel engine cylinder for the following events: [ref. a, ch. 2]

- a. Scavenging
- b. Compression
- c. Combustion
- d. Expansion
- e. Exhaust

.18 Discuss the use of the following materials used with or in diesel engines:

- a. Disodium phosphate [ref. a, ch. 7]
- b. Distilled water [ref. a, app. I]
- c. Ethylene glycol [ref. a, ch. 7]
- d. F-76 [ref. c, sec. 7]
- e. JP-5 (F-44) [ref. c, sec. 7]
- f. Sodium chromate [ref. a, ch. 7]
- g. Zinc [ref. b, app. I]
- h. 2104 grade 10 [ref. c, sec. 8]
- i. 9250 [ref. c, sec. 8]
- j. Soluble oil [ref. a, ch. 7]

107 DISTILLING PLANT

NAME _____ RATE/RANK _____

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107 DISTILLING PLANT FUNDAMENTALS

References:

[a] NAVEDTRA 12144, Machinist's Mate 3 & 2

[b] NAVEDTRA 10539, Engineman 3



107.1 Discuss the use or function of the following components of the typical distilling plant:

- a. Evaporator [ref. a, app. I]
- b. Tube bundle [ref. b, ch. 15]
- c. Mesh-type demisters [ref. a, ch. 9]
- d. Brine circuit [ref. a, ch. 9]
- e. Spray pipes [ref. a, ch. 9]
- f. Air ejector circuit [ref. a, ch. 9]
- g. Zinc anodes [ref. b, app. I]
- h. Air ejector condenser [ref. a, ch. 9]
- i. Seawater heater [ref. a, ch. 9]
- j. Seawater heater drain circuit [ref. a, ch. 9]
- k. Feedwater temperature control valve [ref. a, ch. 9]
- l. Seawater heater vent line [ref. a, ch. 9]
- m. Orifice plate [ref. a, ch. 9]
- n. Desuperheater spray nozzle [ref. a, ch. 9]
- o. Distillate cooler [ref. a, ch. 9]
- p. Water meter [ref. b, ch. 15]
- q. Distillate three-way solenoid trip valve [ref. b, ch. 15]
- r. Distillate collection troughs [ref. a, ch. 9]
- s. Salinity cell [ref. b, ch. 15]

.2 Discuss the following terms as applied to the distilling process:

- a. Distillation [ref. b, ch. 15]
- b. Evaporation [ref. b, ch. 15]
- c. Condensation [ref. b, ch. 15]
- d. Feedwater [ref. b, ch. 15]
- e. Vapor [ref. b, ch. 15]
- f. Distillate [ref. b, ch. 15]
- g. Brine [ref. b, ch. 15]
- h. Salinity [ref. b, ch. 15]
- i. Effect [ref. b, ch. 15]
- j. Saturated steam [ref. b, app. I]
- k. Superheated steam [ref. b, ch. 15]
- l. Degree of superheat [ref. b, ch. 15]
- m. Ameroyal [ref. a, ch. 9]
- n. Chill shocking [ref. a, ch. 9]
- o. Mechanical cleaning [ref. a, ch. 9]
- p. Chemical cleaning [ref. a, ch. 9]
- q. Vacuum [ref. b, app. I]

107 DISTILLING PLANT FUNDAMENTALS (CONT'D)

107.3 Discuss the following types of distilling plants: [ref. a, ch. 9]

- a. Vapor compression
- b. Low pressure steam

108 ELECTRICAL

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108 ELECTRICAL FUNDAMENTALS

References:

- [a] NAVEDTRA 10546-F, Electrician's Mate 3 & 2
- [b] NAVEDTRA B72-01-00-92, NEETS Module 1 - Introduction to Matter, Energy, and Direct Current
- [c] NAVEDTRA 172-02-00-91, NEETS Module 2 - Introduction to alternating Current and Transformers
- [d] NAVEDTRA B72-03-00-93, NEETS Module 3 - Introduction to Circuit Protection, Control, and Measurement
- [e] NAVEDTRA B72-05-00-94, NEETS Module 5 - Introduction to Generators and Motors
- [f] NSTM S9086-KY-STM-000/CH-320, Electric Power Distribution Systems
- [g] NSTM S9086-PA-STM-000/CH-430, Interior Communication Installations
- [h] NAVEDTRA 12001, Fireman
- [i] NAVEDTRA 10539, Engineman 3
- [j] NAVEDTRA 12160, Interior Communication Electrician, Volume 1
- [k] NAVEDTRA 10564, Gas Turbine Systems Technician (Electrical) 3/Gas Turbine Systems Technician (Mechanical) 3, vol. 2
- [l] Propulsion Operating Guide (POG)
- [m] Ship's Information Book (SIB)
- [n] NSTM S9086-KN-STM-010/CH-310, Electric Power Generators and Conversion Equipment



108.1 State the basic units of measure, symbols or abbreviations for the following electrical terms:

- a. Capacitance [ref. c, app. I]
- b. Conductance [ref. b, app. I]
- c. Current [ref. b, app. I]
- d. Frequency [ref. a, app. I]
- e. Impedance [ref. c, app. I]
- f. Inductance [ref. c, app. I]
- g. Potential [ref. a, app. I]
- h. Power [ref. a, app. I]
- i. Resistance [ref. b, app. I]

.2 Discuss the applications and functions of the following switchboards:

- a. Action Cutout (ACO) [ref. g, sec. 2]
- b. Control benchboard [ref. a, ch. 4]
- c. Main switchboard [ref. f, sec. 1]
- d. Interior Communications (IC) switchboard [ref. g, sec. 2]
- e. Local IC switchboard [ref. g, sec. 2]

108 ELECTRICAL FUNDAMENTALS (CONT'D)

108.3 State the function of the following indicators:

- a. Ammeter [ref. d, ch. 1]
- b. Annunciator [ref. j, app. I]
- c. Auto start indicator [ref. f, sec. 2]
- d. Blown fuse indicator [ref. d, ch. 2]
- e. Frequency meter [ref. d, ch. 1]
- f. Ground indicator [ref. a, ch. 4]
- g. Wattmeter [ref. a, ch. 4]
- h. Megohmmeter [ref. d, ch. 1]
- i. Phase–sequence indicator [ref. a, ch. 3]
- j. Salinity indicator [ref. j, ch. 10]
- k. Stroboscope [ref. h, ch. 11]
- l. Synchronizing monitor [ref. a, ch. 4]
- m. Synchroscope [ref. a, ch. 4]
- n. Tachometer [ref. k, app. I]
- o. Voltmeter [ref. d, ch. 1]

.4 Define the following:

- a. ACO [ref. g]
- b. ac [ref. c, ch. 1]
- c. APD [ref. k, app. I]
- d. ABT [ref. a, ch. 7]
- e. Bus [ref. f, sec. 1]
- f. Bus tie [ref. f, sec. 1]
- g. Casualty power [ref. a, ch. 3]
- h. Conductor [ref. b, app. I]
- i. Distribution panel [ref. f, sec. 1]
- j. dc [ref. b, ch. 3]
- k. Droop [ref. i, ch. 9]
- l. Isochronous governor [ref. i, ch. 9]
- m. Kilowatt [ref. b, ch. 3]
- n. Load center [ref. a, ch. 4]
- o. MBT [ref. a, ch. 4]
- p. Mimic bus [ref. f, sec. 1]
- q. Parallel circuit [ref. b, app. I]
- r. Polarity [ref. b, app. I]
- s. Prime mover [ref. e, ch. 3]
- t. Power factor [ref. c, ch. 4]
- u. Reverse power relay [ref. a, ch. 3]
- v. Rheostat [ref. b, app. I]
- w. Selective tripping [ref. a, ch. 3]
- x. SSDG [ref. h, ch. 12]
- y. SSTG [ref. h, ch. 12]

108 ELECTRICAL FUNDAMENTALS (CONT'D)

- 108.4 z. Shore power [ref. a, ch. 3]
- aa. Solenoid [ref. d, ch. 3]
 - ab. Split plant [ref. a, ch. 4]
 - ac. Switchboard [ref. a, ch. 4]
 - ad. Thermocouple [ref. b, app. I]
 - ae. Ungrounded system [ref. f, sec. 1]
 - af. Voltage regulator [ref. a, ch. 4]
 - ag. 1S & 2S [ref. a, ch. 4]
- .5 Describe the applications of the following switches:
- a. Knife [ref. d, ch. 3]
 - b. Toggle (SPST, SPDT, DPST, DPDT) [ref. d, ch. 3]
 - c. Push button [ref. d, ch. 3]
 - d. Rotary snap [ref. d, ch. 3]
 - e. Rotary selector [ref. d, ch. 3]
 - f. Microswitch (precision snap-acting switch) [ref. d, ch. 3]
 - g. Magnetically operated (relay, solenoid) [ref. d, ch. 3]
 - h. Limit switch (mechanical, magnetic) [ref. a, ch. 3]
 - i. Darken ship [ref. a, ch. 7]
- .6 State the applications of the following circuit breakers: [ref. a, ch. 3]
- a. ACB
 - b. AQB
 - c. NQB
 - d. ALB
 - e. NLB
- .7 Explain the following electromagnetic terms:
- a. Right/left-hand rule [ref. e, chs. 1, 2]
 - b. Rotating magnetic field [ref. e, ch. 1]
 - c. Magnetic flux [ref. b, ch. 1]
 - d. Self-induction [ref. c, app. I]
 - e. Mutual inductance [ref. c, app. I]
 - f. Residual magnetism [ref. b, app. I]
- .8 Discuss the relationship between voltage and current in the primary and secondary windings of a transformer. [ref. c, ch. 5]
- .9 Explain Ohm's Law as it pertains to ac circuits. [ref. c, ch. 4]

108 ELECTRICAL FUNDAMENTALS (CONT'D)

- 108.10 Describe the operation of the following types of ac generators: [ref. e, ch. 3]
- a. Rotating armature
 - b. Rotating field
- .11 Discuss the applications of the following ac motors: [ref. e, ch. 4]
- a. Induction
 - b. Synchronous
 - c. Series
- .12 State the difference between capacitive-start and repulsion-start ac motors. [ref. e, ch. 4]
- .13 Describe the operation of the following types of dc generators: [ref. e, ch. 1]
- a. Separately excited
 - b. Self-excited
 - c. Series
 - d. Shunt
- .14 Discuss the following types of dc motors and state applications for each: [ref. e, ch. 2]
- a. Shunt
 - b. Series
 - c. Compound
- .15 What are the procedures for rigging and unrigging: [ref. a, ch. 4]
- a. Casualty power
 - b. Shore power
- .16 Explain the meaning of the following terms associated with shipboard electrical motor controllers: [ref. a, ch. 5]
- a. Normally Open/Normally Closed (NO/NC)
 - b. Contractor (main/auxiliary)
 - c. Latching relay
 - d. Overload (OL) protection
 - e. Low Voltage Protection (LVP)
 - f. Low Voltage Release/Low Voltage Release Effect (LVR/LVRE)
 - g. Timing relay

108 ELECTRICAL FUNDAMENTALS (CONT'D)

- 108.17 Define electrochemical action. [ref. b, ch. 2]
- .18 Define Ohm's law as it pertains to dc circuits. [ref. b, ch. 3]
- .19 Explain the basic principle of electrical power generation. [ref. c, ch. 1]
- .20 What conditions must be met prior to paralleling ac generators? [ref. a, ch. 4]
- .21 State the applications of the following: [ref. g, sec. 7]
- a. Audible signal devices
 - b. Visual indicators
- .22 Identify the following color codes associated with visual alarms and indicators: [ref. f, sec. 2]
- a. Red
 - b. White
 - c. Blue
 - d. Green
 - e. Yellow
 - f. Clear
- .23 State the function of the following devices:
- a. Circuit breakers [ref. a, ch. 3]
 - b. Fuse [ref. d, ch. 2]
 - c. Generator [ref. e, app. I]
 - d. Ground detector lamps [ref. a, ch. 4]
 - e. Motor [ref. e, app. I]
 - f. Motor controller [ref. a, ch. 5]
 - g. Pressure switch [ref. a, ch. 3]
 - h. Reverse power relay [ref. a, ch. 3]
 - i. Switchboard [ref. a, ch. 4]
 - j. Temperature switch [ref. a, ch. 3]
 - k. Transformer [ref. a, ch. 4]
- .24 What are the amperage and kilowatt capacities of the: [ref. I]
- a. Ship's service turbogenerator
 - b. Ship's service diesel generator

108 ELECTRICAL FUNDAMENTALS (CONT'D)

- 108.25 Which in-space components are: [ref. m]
- a. LVR
 - b. LVP
 - c. LVRE
- .26 Explain the difference between selective and selected tripping. [ref. d, chs. 2, 3]
- .27 Describe the effects of a zero ground in more than one phase of a three-phase power supply. [ref. n]
- .28 What interior communication circuits/devices are used in your ship's engineering spaces? [ref. m]
- .29 Which in-space components are supplied with power from a(n): [ref. m]
- a. ABT
 - b. MBT
- .30 Describe the effect in the remaining engineering spaces when each of the following engineering spaces has been electrically isolated: [ref. m]
- a. Auxiliary machinery room
 - b. Firerooms
 - c. Enginerooms

109 ENGINEERING ADMINISTRATION

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109 ENGINEERING ADMINISTRATION FUNDAMENTALS

References:

- [a] NAVEDTRA 12147, Engineering Administration
- [b] OPNAVINST 3120.32C, Standard Organization and Regulations Manual of the U.S. Navy (SORM)
- [c] NAVEDTRA 10543-E1, Engineman 1 & C
- [d] NSTM S9086-CH-STM-030/CH-074 V3, Gas Free Engineering
- [e] Engineering Department Organization and Regulations Manual (EDORM)
- [f] NAVEDTRA 12144, Machinist's Mate 3 & 2
- [g] OPNAVINST 4100.11B, Navy Energy Usage Reporting System (NEURS)
- [h] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
- [i] Class Advisory Notebook
- [j] Local Instructions
- [k] OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual
- [l] NAVEDTRA 10193-D, Instrumentman 3 & 2, ch. 2
- [m] NWP 62-1 (Rev. D), Surface Ship Survivability



109.1 State the location of the following manuals aboard your ship: [ref. j]

- a. OPNAVINST 3120.32C, Standard Organization and Regulations Manual of the U.S. Navy (SORM)
 - b. Engineering Department Organization and Regulations Manual (EDORM)
 - c. Ship's Information Book (SIB)
 - d. Engineering Operational Sequencing System (EOSS)
 - e. Propulsion Plant Manual (PPM)
 - f. Guide for User's Maintenance of NAVSEA Technical Manuals
 - g. Class Advisory Notebook
 - h. Main Space Fire Doctrine
- .2 Describe your duties as defined in references b and e.
- .3 What are the duties of the following as defined in your ship's EDORM: [ref. e, ch. 1]
- a. Engineering Officer
 - b. Main Propulsion Assistant
 - c. Damage Control Assistant
 - d. Electrical Officer
 - e. Engineering Administrative Assistant
 - f. Oil King
 - g. Engineering Duty Officer (EDO)
 - h. Engineering Officer of the Watch (EOOW)
- .4 State the in-port watchstations as defined in your ship's EDORM, and describe the duties and responsibilities of each watchstander. [ref. e, ch. 1]

109 ENGINEERING ADMINISTRATION FUNDAMENTALS (CONT'D)

- 109.5 Explain the procedures required to permit underwater work by divers. [ref. h, ch. C8]
- .6 Explain the procedures required aboard your ship to gain permission to go aloft. [ref. h, app. C8-A]
 - .7 Describe the steps required to obtain permission to turn over the main shafting. [ref. f, ch. 7]
 - .8 Who gives permission to start/test major machinery in port? [ref. f, ch. 7]
 - .9 State the legal records of the Engineering Department. [ref. a, ch. 2]
 - .10 State the purpose of the Main Space Fire Doctrine. [ref. j]
 - .11 What are the following logs/reports:
 - a. Engineering Log [ref. a, ch. 2]
 - b. Bell Book [ref. a, ch. 2]
 - c. Bell Log/Data Log [ref. a, ch. 2]
 - d. Distilling Plant Operating Log [ref. a, ch. 2]
 - e. Refrigeration/Air-Conditioning Equipment Operating Record [ref. a, ch. 2]
 - f. Fuel and Water Report [ref. a, ch. 2]
 - g. Fueling Memorandum [ref. a, ch. 2]
 - h. Navy Energy Usage Reporting System (NEURS) [ref. g]
 - i. Engineering Officer Night Order Book [ref. a, ch. 2]
 - j. Damage Control (DC) Closure Log [ref. m, ch. 3]
 - k. Boiler Water Chemistry/Feedwater Chemistry Log [ref. a, ch. 2]
 - l. Engineering Standing Orders [ref. f, ch. 8]
 - m. Propulsion Steam Turbine Operating Record [ref. a, ch. 2]
 - n. Boiler Room Operating Record [ref. a, ch. 2]
 - o. Bearing Record [ref. j]
 - p. Trouble Call Record [ref. j]
 - q. Steaming Orders [ref. a, ch. 2]
 - r. Boiler Tube Casualty Report [ref. a, ch. 2]
 - s. NAVSEA Technical Manual Deficiency Evaluation Report (TMDER) NAVSEA Form 9086/10 [ref. i]
 - .12 State the information available in the following publications:
 - a. Engineering Operational Sequencing System (EOSS) [ref. a, ch. 4]
 - b. Engineering Operational Casualty Control (EOCC) Procedures [ref. a, ch. 4]

109 ENGINEERING ADMINISTRATION FUNDAMENTALS (CONT'D)

- 109.12
- c. Engineering Operational Procedures (EOP) [ref. a, ch. 4]
 - d. Engineering Department Organization and Regulations Manual (EDORM) [ref. e, ch. 1]
 - e. Class Advisory Notebook [ref. i]
- .13 State the purpose of the following:
- a. Electrical Safety Program [ref. h, ch. B7]
 - b. Tag-Out Program [ref. h, ch. B11]
 - c. Out-of-Commission Log [ref. f, ch. 8]
 - d. Environmental and Natural Resources Program [ref. k]
 - e. Fuel Quality Management Program [ref. e, ch. 4]
 - f. Lube Oil Quality Management Program [ref. e, ch. 4]
 - g. Damage Control Training Team (DCTT) [ref. m, ch. 3]
 - h. Engineering Casualty Control Training Team (ECCTT, formerly ECCET) [ref. c, ch. 9]
 - i. Gas-Free Engineer [ref. d, sec. 18; ref. h, ch. B8]
 - j. Gage Calibration Program [ref. l]
 - k. Hearing Conservation Program [ref. h, ch. B4]
 - l. Heat Stress Program [ref. h, ch. B2]
 - m. Physical Security Program [ref. e, ch. 3]
 - n. Hazardous Material/Hazardous Waste Program [ref. h, ch. B3]
 - o. Sight Conservation Program [ref. h, ch. B5]
 - p. Asbestos Control Program [ref. h, ch. B1]
 - q. Personnel protective clothing and equipment [ref. h, ch. B12]
- .14 Explain the following as applied to the equipment Safety Tag-Out Program:
- a. Tag-Out Log [ref. b, ch. 6]
 - b. Duties of authorizing officer, person attaching tag, person checking tag and repair activity [ref. b, ch. 6]
 - c. Use of caution tag [ref. b, ch. 6]
 - d. Use of danger tag [ref. b, ch. 6]
 - e. Out-of-calibration label [ref. b, ch. 6]
 - f. Out-of-commission label [ref. b, ch. 6]
 - g. Location and custody of Tag-Out Log and software on your ship [ref. j]
 - h. Function and use of Instrument Log [ref. b, ch. 6]
 - i. Function of Tag-Out Log audit [ref. b, ch. 6]
 - j. Equipment/conditions requiring Commanding Officer's permission [ref. j]
- .15 Explain your ship's Restricted Maneuvering Doctrine. [ref. j]

110 ENGINEERING SAFETY PRECAUTIONS

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110 ENGINEERING SAFETY PRECAUTIONS FUNDAMENTALS

References:

- [a] NAVEDTRA 12001, Fireman
- [b] NSTM S9086-RK-STM-010/CH-505, Piping Systems
- [c] NAVEDTRA 10546-F, Electrician's Mate 3 & 2
- [d] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
- [e] NAVEDTRA 12144, Machinist's Mate 3 & 2
- [f] NSTM S9086-SY-STM-010/CH-551, Compressed Air Plants and Systems, Rev. 1
- [g] NSTM S9086-S3-STM-010/CH-555, Shipboard Firefighting
- [h] NSTM S9086-VG-STM-010/CH-634, Deck Coverings
- [i] NSTM S9086-K9-STM-000/CH-330, Lighting
- [j] NSTM S9086-SX-STM-010/CH-550, Industrial Gases; Generating, Handling and Storage
- [k] NSTM S9086-CH-STM-030/CH-074 V3, Gas Free Engineering
- [l] NSTM S9086-WK-STM-010/CH-670, Stowage, Handling, and Disposal of Hazardous General Use Consumables
- [m] NSTM S9086-SN-STM-010/CH-541, Ship Fuel and Fuel Systems
- [n] NSTM S9086-S4-STM-010/CH-556, Hydraulic Equipment Power Transmission and Control
- [o] NSTM S9086-CL-STM-010/CH-077, Protection Equipment
- [p] OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual
- [q] NSTM S9086-RW-STM-010/CH-516, Refrigeration Systems
- [r] OPNAVINST 3120.32C, Standard Organization and Regulations Manual of the U.S. Navy (SORM)
- [s] NSTM S9086-KC-STM-010/CH-300, Electric Plant General



110.1 Explain the use of each of the following:

- a. Lagging [ref. a, app. I]
 - b. Flange spray shields [ref. b, sec. 7]
 - c. Incandescent light steam-tight cover (explosion proof) [ref. i, sec. 2]
- .2 State the safety precautions to be followed when working with rotating machinery. [ref. d, ch. C13]
 - .3 What are the safety precautions to be followed when operating a compressed air system? [ref. f, sec. 1]
 - .4 State good housekeeping practices of engineering spaces. [ref. d, ch. C1; ref. e, ch. 7]
 - .5 State the importance of bolted deck plates, gratings and handrails. [ref. d, chs. C1, C13]
 - .6 State the dangers of skylarking in machinery spaces. [ref. d, ch. C1]

110 ENGINEERING SAFETY PRECAUTIONS FUNDAMENTALS (CONT'D)

- 110.7 Explain the hazard of oil in the bilges. [ref. g, sec. 6; ref. m, sec. 2]
- .8 State the safety precautions applicable for the use, handling and storage of hydraulic fluids and synthetic lubricants aboard your ship. [ref. n, sec. 1]
 - .9 Explain the oily waste discharge limitations as they apply to shipboard personnel. [ref. p, ch. 19]
 - .10 State the procedures required in the event of an oil spill. [ref. p, ch. 19]
 - .11 State the causes of oil fires. [ref. d, ch. C10; ref. g, sec. 6; ref. m, sec. 2]
 - .12 State the protection provided by the following safety equipment; include examples of ship evolutions that require their use:
 - a. Long-sleeved shirt [ref. d, ch. C13]
 - b. Hard hat [ref. d, ch. B12]
 - c. Goggles/safety glasses/face shield [ref. d, ch. B5]
 - d. Gloves [ref. d, ch. B12]
 - e. Safety shoes [ref. d, ch. B12]
 - f. Respirator [ref. d, ch. B6]
 - g. Hearing protection [ref. d, ch. B4]
 - h. Safety harness/DYNA-Brake [ref. d, ch. B12]
 - i. Life jacket [ref. o, sec. 2]
 - .13 What are the safety precautions to be followed prior to and when entering a void or poorly ventilated space? [ref. k, sec. 18]
 - .14 What are the safety precautions to be followed when using the following:
 - a. Calcium hypochlorite [ref. d, ch. C23]
 - b. Solvents [ref. d, ch. C23]
 - c. Caustic soda [ref. l, sec. 1]
 - d. Mercuric nitrate [ref. l, sec. 1]
 - e. Refrigerants [ref. e, sec. 11; ref. l, sec. 3; ref. q, sec. 1]
 - f. Stock reagents [ref. l, sec. 1]
 - .15 State the safety precautions to be observed and/or personnel safety equipment/devices required in the following situations:
 - a. During replenishment-at-sea operations [ref. d, ch. C3]
 - b. When working aloft [ref. d, ch. C8]
 - c. During heavy weather [ref. d, ch. C16]
 - d. While working with paint [ref. d, ch. C18]

110 ENGINEERING SAFETY PRECAUTIONS FUNDAMENTALS (CONT'D)

- 110.15
 - e. While working with electrical/electronic equipment [ref. d, ch. C9; ref. s, sec. 5]
 - f. While operating portable electric tools [ref. d, chs. C9, C13]
 - g. While welding, cutting and brazing [ref. d, ch. C11]
 - h. While working with workshop equipment [ref. d, ch. C13]
 - i. While handling hazardous material [ref. d, ch. C23]
 - j. While working with synthetic lube oil (MIL-L-23699) [ref. l, sec. 4]
 - k. While working with pneumatic tools [ref. d, ch. C13]
- .16 State the first aid procedures for electrical shock. [ref. d, ch. C9; ref. s, sec. 2]
- .17 State the purpose of the following as safety equipment when performing hazardous tasks:
 - a. Rubber mats [ref. h, sec. 3]
 - b. Rubber aprons [ref. d, ch. C23]
- .18 State the importance of tag-out procedures and clearing of tags. [ref. c, ch. 2; ref. d, ch. C9; ref. r, sec. 6]
- .19 State the safety precautions to follow when working on or close to electrical circuits. [ref. d, ch. C9]
- .20 State the procedures for removing a victim from an energized circuit. [ref. d, ch. C9, ref. s, sec. 2]
- .21 Describe how changes in the body caused by the environment (sweat, moisture, etc.) change the way electrical shock affects the body. [ref. c, ch. 2; ref. s, sec. 2]
- .22 State the safety precautions associated with each firefighting agent. [ref. g, sec. 1]
- .23 Explain the possible damage caused by missile hazards and flammable materials as applied to safety. [ref. d, ch. C1]
- .24 State the first aid procedures for treatment of acid on skin and/or in eyes. [ref. l, sec. 6]
- .25 Explain the procedures to follow when working on a pressure system component. [ref. b, sec. 8]
- .26 State the procedures for working on a system that opens to the sea. [ref. b, sec. 1]

110 ENGINEERING SAFETY PRECAUTIONS FUNDAMENTALS (CONT'D)

- 110.27 Draw a simple diagram of machinery locations, indicating access and escape routes in the main space. [refer to ship's diagram]
- .28 State the hazardous material labeling requirements. [ref. d, ch. B3]
- .29 Explain the effect of petroleum products in relation to oxygen producing and storage devices. [ref. j, sec. 1]

111 FUEL OIL QUALITY MANAGEMENT PROGRAM

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed FUEL OIL QUALITY MANAGEMENT PROGRAM Fundamental (NAVEDTRA 43103).

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Supervisor

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111 FUEL OIL QUALITY MANAGEMENT PROGRAM FUNDAMENTALS

References:

- [a] CINCLANTFLTINST/CINCPACFLTINST 4026.1, Fuel Management Afloat Manual
 - [b] NSTM S9086-SN-STM-010/CH-541, Ship Fuel and Fuel Systems
 - [c] Engineering Department Management Manual (EDMM)
 - [d] NSTM S9086-SP-STM-010/CH-542, Gasoline and JP-5 Fuel Systems
 - [e] NAVEDTRA 10536-F, Boiler Technician 1 & C
 - [f] NAVEDTRA 12147, Engineering Administration
-



111.1 State the purpose of the Fuel Oil Quality Management Program. [ref. a, ch. 1]

.2 Explain how the following samples are obtained:

- a. All levels sample [ref. a, ch. 4]
- b. Bottom sample [ref. a, ch. 4]
- c. Line sample [ref. b, sec. 10]
- d. Sounding sample [ref. b, sec. 10]
- e. Thief sample [ref. a, ch. 4]

.3 Define or explain the following:

- a. Flash point [ref. a, glossary]
- b. American Petroleum Institute (API) gravity [ref. a, glossary]
- c. Bottom Sediment and Water (BS&W) [ref. a, glossary]
- d. Free water [ref. a, glossary]
- e. Sediment [ref. a, glossary]
- f. Cetane number [ref. b, sec. 10]
- g. Clear and bright [ref. a, glossary]
- h. Cloud point [ref. a, ch. 4]
- i. Dissolved water [ref. a, glossary]
- j. Emulsion [ref. a, glossary]
- k. Entrained water [ref. a, glossary]
- l. Fire point [ref. a, glossary]
- m. Calorific or heating value [ref. b, sec. 10]
- n. JP-5 (F-44 fuel) [ref. a, ch. 4]
- o. MOGAS [ref. d, sec. 1]
- p. NATO F-76 fuel [ref. a, ch. 4]
- q. NATO F-75 fuel [ref. b, sec. 10]
- r. POL [ref. a, glossary]
- s. Specific gravity [ref. a, glossary]
- t. Viscosity (kinematic) [ref. b, sec. 10]
- u. Visual test [ref. b, sec. 10]

.4 State the procedures used, communications established, and reports required prior to transfer or receipt of fuel. [ref. e, ch. 7]

111 FUEL OIL QUALITY MANAGEMENT PROGRAM FUNDAMENTALS (CONT'D)

111.5 What are the minimum requirements for sampling fuel during replenishment? [ref. a, ch. 4]

- .6 Explain the use of the following logs and reports:
 - a. Fuel Oil and Water Report [ref. f, ch. 2]
 - b. Fuel Oil Quality Test Log [ref. c]
 - c. Fuel Oil Analysis Report [ref. c]
 - d. Daily Fuel Report [ref. f, ch. 2]
- .7 State the minimum requirements for testing fuel oil on board naval ships. [ref. b, sec. 10]
- .8 What is the maximum BS&W and minimum flash point for fuel oil? [ref. b, sec. 10]

112 GAS TURBINE

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112 GAS TURBINE FUNDAMENTALS

References:

- [a] NAVEDTRA 10563, Gas Turbine Systems Technician (Electrical) 3/Gas Turbine Systems Technician (Mechanical) 3, Volume 1
 - [b] NAVEDTRA 10564, Gas Turbine Systems Technician (Electrical) 3/Gas Turbine Systems Technician (Mechanical) 3, Volume 2
-



112.1 State the following laws and principles: [ref. a, ch. 4]

- a. Charles's law
 - b. Boyle's law
 - c. Newton's First Law of Motion
 - d. Newton's Second Law of Motion
 - e. Newton's Third Law of Motion
 - f. Pascal's law
 - g. Bernoulli's principle
- .2 Discuss the Brayton cycle in regards to: [ref. b, ch. 1]
- a. Intake
 - b. Compression
 - c. Combustion
 - d. Expansion
 - e. Exhaust
- .3 Define the following terms:
- a. Ambient [ref. a, app. I]
 - b. Ambient pressure [ref. a, app. I]
 - c. Ambient temperature [ref. a, app. I]
 - d. Annular [ref. a, app. I]
 - e. Atmosphere [ref. a, app. I]
 - f. Atmospheric pressure [ref. a, app. I]
 - g. Axial flow [ref. b, app. I]
 - h. Centrifugal [ref. a, app. I]
 - i. Coalesce [ref. a, app. I]
 - j. Cohesion [ref. a, app. I]
 - k. Combustion cycle [ref. b, app. I]
 - l. Concentric [ref. b, app. I]
 - m. Conduction [ref. b, app. I]
 - n. Density [ref. b, app. I]
 - o. Differential pressure [ref. b, app. I]
 - p. Expansion [ref. b, app. I]
 - q. Fail [ref. a, app. I]
 - r. Fail position [ref. a, app. I]
 - s. Fatigue [ref. a, app. I]
 - t. Ferrous [ref. a, app. I]

112 GAS TURBINE FUNDAMENTALS (CONT'D)

- 112.3
- u. Foot pound [ref. a, app. I]
 - v. Hydrostatic [ref. a, app. I]
 - w. Inert gas [ref. a, app. I]
 - x. Joules [ref. b, app. I]
 - y. Mass [ref. a, app. I]
 - z. Micron [ref. b, app. I]
 - aa. Navy standard day [ref. b, app. I]
 - ab. Parameter [ref. a, app. I]
 - ac. Pitch [ref. a, app. I]
 - ad. Pressure [ref. a, app. I]
 - ae. Relative humidity [ref. a, app. I]
 - af. Sensing point [ref. a, app. I]
 - ag. Sensitivity [ref. a, app. I]
 - ah. Specific heat [ref. a, app. I]
 - ai. Stall [ref. b, app. I]
 - aj. Strain [ref. a, app. I]
 - ak. Volume [ref. a, app. I]
 - al. Vortex [ref. b, app. I]
- .4 Discuss the following gas turbine measurements and where they are sensed on the gas turbine: [ref. a, app. I]
- a. Compressor Inlet Temperature (CIT or T_2)
 - b. Compressor inlet total pressure (P_{t2})
 - c. Gas generator speed (N_{gg})
 - d. Power turbine inlet temperature ($T_{5.4}$)
 - e. Power turbine inlet pressure ($P_{t5.4}$)
 - f. Power turbine speed (N_{pt})
 - g. Compressor Discharge Pressure (CDP)
- .5 Explain the cause of a dirty compressor and its affect on gas turbine performance. [ref. b, ch. 1]
- .6 State the use and construction of the following combustors: [ref. b, ch. 1]
- a. Can
 - b. Annular
 - c. Can-annular
- .7 Discuss the centrifugal flow compressor. [ref. b, ch. 1]
- .8 State the types of axial flow compressors and describe their construction [ref. b, ch. 1]

112 GAS TURBINE FUNDAMENTALS (CONT'D)

112.9 What are the two major components of the gas generator section? [ref. b, ch. 1]

.10 What is the purpose of the power turbine? [ref. b, ch. 1]

.11 Describe the energy conversion in gas turbine engines. [ref. b, ch. 1]

113 HAZARDOUS MATERIAL CONTROL AND MANAGEMENT (HMC&M) PROGRAM

NAME _____ RATE/RANK _____

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Supervisor

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113 HAZARDOUS MATERIAL CONTROL AND MANAGEMENT (HMC&M) PROGRAM FUNDAMENTALS

References:

[a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1

[b] Local Instructions



113.1 Define the following: [ref. a, ch. B3]

- a. Hazardous Material (HM)
- b. Used or excess HM
- c. HM labeling requirements
- d. Used HM labeling requirements
- e. Material Safety Data Sheet (MSDS)
- f. Hazardous Material Information System (HMIS)

.2 Explain where the documents are located: [ref. b]

- a. HMIS MSDSs
- b. Ship's Hazardous Material List (SHML)
- c. List of authorized HM storage locations
- d. Ship's HM Inventory
- e. Hazardous Material User's Guide (HMUG)

.3 Discuss the duties and responsibilities of the following: [ref. a, ch. B3]

- a. Safety Officer
- b. HM Coordinator
- c. Division Officer
- d. Work Center Supervisor
- e. All hands

.4 Discuss the procedures for disposal of excess HM. [ref. a, ch. B3]

.5 What are the restrictions on the stowage of flammable liquids in machinery spaces? [ref. a, ch. C23]

.6 What is the rule on the stowage of excess HM in the work area? [ref. a, ch. C23]

.7 What are the requirements for the collection of used HM? [ref. a, ch. B3]

.8 What are the restrictions on the open purchase of HM? [ref. a, ch. B3]

.9 What are the HMC&M Program training requirements for all hands? [ref. a, ch. B3]

114 HEARING CONSERVATION PROGRAM

NAME _____ RATE/RANK _____

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114 HEARING CONSERVATION PROGRAM FUNDAMENTALS

Reference:

- [a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
 - [b] Ship's Instructions
-



- 114.1 State the goal of the Hearing Conservation Program. [ref. a, ch. B4]
 - .2 Who is covered under the Hearing Conservation Program? [ref. a, ch. B4]
 - .3 When are hearing tests required? [ref. a, ch. B4]
 - .4 When is the wearing of hearing protective devices (insert plugs or circumaural muffs) mandatory? [ref. a, ch. B4]
 - .5 When is double hearing protection required? [ref. a, ch. B4]
 - .6 Where are hazardous noise warning labels and decals placed? [ref. a, ch. B4]
 - .7 How often are identified noise-hazardous areas and operations resurveyed, and by whom? [ref. a, chs. B4, A3]
 - .8 What is the purpose of monitoring hearing tests? [ref. a, ch. B4]
 - .9 What action is taken if a Significant Threshold Shift (STS) is identified? [ref. a, ch. B4]
 - .10 Identify the noise-hazardous areas aboard your ship. [ref. b]
 - .11 What are the Command training requirements for Hearing Conservation Program education? [ref. a, ch. B4]

115 HYDRAULIC/PNEUMATIC

NAME _____ RATE/RANK _____

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115 HYDRAULIC/PNEUMATIC FUNDAMENTALS

References:

- [a] NAVEDTRA 12964, Fluid Power
 - [b] NAVEDTRA 12144, Machinist's Mate 3 & 2
 - [c] NSTM S9086-SY-STM-010/CH-551, Compressed Air Plants and Systems, Rev. 1
 - [d] Ship's Information Book (SIB)
 - [e] NAVEDTRA 10539, Engineman 3
-



115.1 Define the following terms as applied to hydraulics/pneumatics:

- a. Accumulator [ref. a, app. I]
- b. Actuator [ref. a, app. I]
- c. Air bank [ref. b, ch. 13]
- d. Air filter [ref. a, ch. 9]
- e. Cfm [ref. b, ch. 13]
- f. Control air supply [ref. b, app. I]
- g. Density [ref. a, app. I]
- h. Dew point [ref. c, sec. 1]
- i. Displacement [ref. a, app. I]
- j. Force [ref. a, app. I]
- k. High pressure [ref. b, ch. 13]
- l. Humidity [ref. b, app. I]
- m. Hydraulics [ref. a, app. I]
- n. Low pressure [ref. b, ch. 13]
- o. Medium pressure [ref. b, ch. 13]
- p. Pressure [ref. a, app. I]
- q. Pneumatic [ref. b, app. I]
- r. Reducing station [ref. b, app. I]
- s. Regulator [ref. a, ch. 6]
- t. Sequencing [ref. a, ch. 6]
- u. Supply air [ref. b, app. I]
- v. Velocity [ref. a, app. I]
- w. Volume of flow [ref. a, app. I]

.2 State the function of each of the following as applied to hydraulics/pneumatics:

- a. Air flask [ref. b, ch. 13]
- b. Cylinder actuator [ref. a, ch. 10]
- c. Dehydrator [ref. b, ch. 13]
- d. Directional control valves [ref. a, app. I]
- e. Filters [ref. a, app. I]
- f. Manifold [ref. b, app. I]
- g. Orifice [ref. b, app. I]
- h. Pressure control valves [ref. a, ch. 6]
- i. Pressure switch [ref. a, app. I]
- j. Priority valve [ref. e, ch. 14]
- k. Ram-type cylinder actuator [ref. a, ch. 10]

115 HYDRAULIC/PNEUMATIC FUNDAMENTALS (CONT'D)

- 115.2 l. Receiver [ref. a, app. l]
 - m. Reservoir [ref. a, app. l]
 - n. Rotary actuator [ref. a, ch. 10]
 - o. Sequencing valves [ref. a, ch. 6]
 - p. Solenoid [ref. e, app. l]
 - q. Strainers [ref. a, ch. 9]
 - r. Unloader [ref. b, ch. 13]
 - s. Volume control valves [ref. a, ch. 6]
- .3 What type of air compressors are aboard your ship? [ref. d]
- .4 Identify the types of hydraulic fluids aboard your ship and their uses. [ref. d]

116 INTERIOR COMMUNICATIONS (IC)

NAME _____ RATE/RANK _____

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116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS

References:

- [a] NSTM S9086-PA-STM-000/CH-430, Interior Communication Installations
 - [b] NAVEDTRA B72-15-00-93, NEETS Module 15 - Principles of Synchros, Servos, and Gyros
 - [c] NAVEDTRA 12160, Interior Communications (IC) Electrician, Vol. 1
 - [d] NAVEDTRA B72-15-00-92, NEETS Module 6 - Introduction to Electronic Emission, Tubes, and Power Supplies
 - [e] NAVEDTRA B72-15-00-92, NEETS Module 7 - Introduction to Solid-State Devices and Power Supplies
 - [f] NAVEDTRA B72-01-00-92, NEETS Module 1 - Introduction to Matter, Energy, and Direct Current
 - [g] NAVEDTRA 10546-F, Electrician's Mate 3 & 2
 - [h] NSTM S9086-NZ-STM-010/CH-420, Navigation Systems, Equipment, and Aids
-



116.1 In what situations are the following audible signal devices used: [ref. c]

- a. Bells [ch. 9]
 - b. Buzzers [ch. 9]
 - c. Sirens [ch. 9]
 - d. Horns [ch. 9]
 - e. Bus failure alarms (E1D1) [ch. 3]
 - f. Electronic signal unit (E3D2) [ch. 9]
- .2 Describe the construction of the following types of microphones: [ref. c, ch. 7]
- a. Dynamic
 - b. Magnetic
 - c. Crystal
 - d. Carbon
- .3 State the applications of the following visual indicators: [ref. c]
- a. Lamp-type [ch. 9]
 - b. Annunciator [ch. 5]
- .4 State the five 1MC alarms in their order of priority. [ref. c, ch. 7]
- .5 Define the following terms as they apply to gyros:
- a. Damping [ref. b, app. AI]
 - b. Azimuth phantom [ref. h, sec. 5]

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

116.6 Define the two properties a gyroscope develops when spinning that it does not have when at rest: [ref. c, ch. 4]

- a. Rigidity of plane
- b. Precession

.7 Discuss the three degrees of freedom of a gyro: [ref. c, ch. 4]

- a. Tilt
- b. Turn
- c. Spin

.8 State the applications of synchro and servo systems. [ref. b, chs. 1, 2]

.9 Describe the applications of the following types of switchboards: [ref. c]

- a. Main IC switchboard distribution section [ch. 3]
- b. Main IC switchboard Action Cutout (ACO) section [ch. 3]
- c. Local IC switchboard [ch. 3]
- d. IC test switchboard [ch. 3]
- e. Alarm switchboard [ch. 9]

.10 State and explain the different levels of classification of IC Systems. [ref. a, sec. 1]

.11 Discuss the application of the following MC Systems: [ref. c, ch. 7]

- | | | |
|------------|----------|----------|
| a. 1MC | s. 24MC | ak. 42MC |
| b. 2MC | t. 25MC | al. 43MC |
| c. 3MC | u. 26MC | am. 44MC |
| d. 4MC | v. 27MC | an. 45MC |
| e. 5MC | w. 28MC | ao. 46MC |
| f. 6MC | x. 29MC | ap. 47MC |
| g. 7MC | y. 30MC | aq. 48MC |
| h. 8MC | z. 31MC | ar. 49MC |
| i. 9MC | aa. 32MC | as. 50MC |
| j. 10MC | ab. 33MC | at. 51MC |
| k. 11-16MC | ac. 34MC | au. 52MC |
| l. 17MC | ad. 35MC | av. 53MC |
| m. 18MC | ae. 36MC | aw. 54MC |
| n. 19MC | af. 37MC | ax. 55MC |
| o. 20MC | ag. 38MC | ay. 56MC |
| p. 21MC | ah. 39MC | az. 57MC |
| q. 22MC | ai. 40MC | ba. 58MC |
| r. 23MC | aj. 41MC | bb. 59MC |

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

116.12 State the uses of the following equipment:

- a. Dead Reckoning Tracer (DRT) [ref. h, sec. 5]
- b. Salinity indicators (CKT SB) [ref. c, ch. 12]
- c. Navigational Computer (NC-2) Plotting System [ref. h, sec. 5]
- d. Dead Reckoning Analyzer Indicator (DRAI) [ref. h, sec. 5]
- e. Underwater Log (CKT Y) [ref. c, ch. 12]
- f. Dummy Log (CKT 4Y) [ref. c, ch. 12]
- g. Wind Direction and Speed Indicating System (CKT HD & HE) [ref. c, ch. 12]
- h. Pneumatic tubes [ref. a, sec. 6]
- i. Sound-powered amplifiers [ref. c, ch. 5]
- j. Power signal relay [ref. c, ch. 6]
- k. Synchro signal amplifiers [ref. c, ch. 10]
- l. Gyrocompass (CKT LC) [ref. c, ch. 10]
- m. Engine order (CKT MB) [ref. c, ch. 12]
- n. Propeller revolution order (CKT K) [ref. c, ch. 12]
- o. Rudder angle indicator (CKT N) [ref. c, ch. 12]
- p. Rudder angle order circuit (CKT L) [ref. c, ch. 12]
- q. Steering emergency alarm signal (CKT LB) [ref. c, ch. 12]
- r. Helm angle (CKT LH) [ref. c, ch. 12]
- s. Steering remote control console [ref. c, ch. 12]
- t. Propeller revolution indicator (CKT K) [ref. c, ch. 12]
- u. Ship's telephone (CKT J) [ref. c, ch. 6]
- v. Impressed current cathodic protection [ref. g, ch. 11]

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

116.13 Describe the use of the following alarm, safety, and warning circuits: [ref. c, ch. 9]

a.	BZ	z.	EZ	ay.	SP
b.	BW	aa.	F	az.	TD
c.	CX	ab.	4F	ba.	1TD
d.	DL	ac.	9F	bb.	2TD
e.	DW	ad.	11F	bc.	5TD
f.	EA	ae.	12F	bd.	6TD
g.	1EC	af.	FD	be.	7TD
h.	2EC	ag.	FH	bf.	8TD
i.	1ED	ah.	FR	bg.	9TD
j.	2ED	ai.	FS	bh.	11T
k.	EF	aj.	FZ	bi.	12TD
l.	EG	ak.	4FZ	bj.	14TD
m.	EH	al.	HF	bk.	16TD
n.	EJ	am.	LB	bl.	17TD
o.	1EK	an.	LS	bm.	18TD
p.	3EK	ao.	MG	bn.	19TD
q.	EL	ap.	NE	bo.	20TD
r.	EP	aq.	NH	bp.	21TD
s.	1EQ	ar.	QA	bq.	24TD
t.	2EQ	as.	QD	br.	25TD
u.	3ES	at.	QX	bs.	29TD
v.	ET	au.	RA	bt.	30TD
w.	EV	av.	RD	bu.	TW
x.	1EW	aw.	RW	bv.	W
y.	2EW	ax.	4SN		

.14 Explain the operation of the following types of switches: [ref. c]

- a. Lever-operated switch [ch. 2]
- b. Mechanical switch [ch. 2]
- c. Pressure switch (IC/L) [ch. 2]
- d. Thermostatic switch (IC/N) [ch. 2]
- e. Mercury thermostat (IC/J) [ch. 9]
- f. Liquid level float switch [ch. 2]
- g. Flow switch [ch. 9]
- h. Water switch [ch. 2]
- i. Pressure-operated switch [ch. 2]

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

- 116.15 What is the function of the following types of detectors:
- a. Combustion gas, smoke detector, and ionization detectors [ref. c, ch. 9]
 - b. Infrared detector [ref. a, sec. 7]
 - c. Rate-of-rise detector [ref. a, sec. 7]
- .16 Define the following types of sound-powered circuits and components: [ref. c, ch. 5]
- a. Switchboard
 - b. Switchbox
 - c. String
 - d. Bus
 - e. Circuit
 - f. Jackbox
 - g. Jackplug
 - h. Line
 - i. Paralleling
 - j. Station
 - k. Tie line
 - l. Tie switch
 - m. Tie plus switch

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

116.17 Discuss the following sound-powered circuits and their uses: [ref. c, ch. 5]

a.	JA	ar.	20JS2	ci.	X2JZ
b.	JC	as.	20JS3	cj.	X1J
c.	10JC	at.	20JS4	ck.	X2J
d.	JD	au.	21JS	cl.	X3J
e.	JF	av.	22JS	cm.	X4J
f.	1JG	aw.	23JS	cn.	X5J
g.	2JG	ax.	24JS	co.	X6J1
h.	2JG1	ay.	25JS	cp.	X6J7
i.	2JG2	az.	26JS	cq.	X6J11-14
j.	2JG3	ba.	31JS	cr.	X7J
k.	3JG	bb.	32JS	cs.	X8J
l.	4JG1	bc.	33JS	ct.	X9J
m.	4JG2	bd.	34JS	cu.	X10J
n.	4JG3	be.	35JS	cv.	X10J1
o.	5JG1	bf.	36JS	cw.	X10J10
p.	5JG2	bg.	61JS	cx.	X11J
q.	6JG	bh.	80JS	cy.	X12J
r.	9JG	bi.	81JS	cz.	X13J
s.	10JG	bj.	82JS	da.	X14J
t.	11JG	bk.	JT	db.	X15J
u.	JH	bl.	1JV	dc.	X16J
v.	JL	bm.	2JV	dd.	X17J
w.	JK	bn.	3JV	de.	X18J
x.	JM	bo.	4JV	df.	X19J
y.	JN	bp.	5JV	dg.	X20J
z.	JO	bq.	6JV	dh.	X21J
aa.	2JP	br.	11JV	di.	X22J
ab.	4JP	bs.	JW	dj.	X23J
ac.	5JP	bt.	JX	dk.	X24J
ad.	6JP	bu.	2JZ	dl.	X25J
ae.	8JP	bv.	3JZ	dm.	X26J
af.	9JP	bw.	4JZ	dn.	X28J
ag.	10JP	bx.	5JZ	do.	X29J
ah.	10JP1	by.	6JZ	dp.	X34J
ai.	10JP2	bz.	7JZ	dq.	X40J
aj.	11JP	ca.	8JZ	dr.	X41J
ak.	JQ	cb.	9JZ	ds.	X42J
al.	JR	cc.	10JZ	dt.	X43J
am.	JS	cd.	11JZ	du.	X44J
an.	1JS	ce.	XJA	dv.	X45J
ao.	2JS	cf.	X1JG	dw.	X50J
ap.	3JS	cg.	X1JV	dx.	X61J
aq.	20JS1	ch.	XJX		

116 INTERIOR COMMUNICATIONS (IC) FUNDAMENTALS (CONT'D)

- 116.18 Explain Kirchhoff's voltage law [ref. c, app. I]
- .19 Explain Kirchhoff's current law. [ref. c, app. I]
- .20 Explain the power transfer theorem. [ref. f, ch. 3]
- .21 Discuss the following components of tubes: [ref. d, ch. 2]
- a. Cathode
 - b. Focusing anode
 - c. Control grid
 - d. Screen
- .22 Discuss the differences of the following tubes: [ref. d, ch. 1]
- a. Diode
 - b. Triode
 - c. Tetrode
 - d. Pentode
- .23 Discuss the following in relation to amplifiers: [ref. d, app. I]
- a. Amplification
 - b. Quiescence
 - c. Distortion
 - d. Saturation
- .24 Discuss the following relation to solid state components: [ref. e, app. I]
- a. Solid state device
 - b. Anode
 - c. Cathode
 - d. Diode
 - e. Transistor
 - f. NPN
 - g. Light emitting diode
 - h. Varactor
 - i. Zenor diode
 - j. UJT
 - k. Common base
 - l. Common collector
 - m. Common emitter
 - n. Integrated circuit

117 LUBRICATING AND HYDRAULIC OIL

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed AIR-CONDITIONING AND REFRIGERATION Fundamental (NAVEDTRA 43103).

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Supervisor

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117 LUBRICATING AND HYDRAULIC OIL FUNDAMENTALS

References:

- [a] NAVEDTRA 12144, Machinist's Mate 3 & 2
 - [b] NAVEDTRA 10539, Engineman 3
 - [c] NAVEDTRA 12964, Fluid Power
 - [d] NSTM S9086-H7-STM-010/CH-262, Lubricating Oils, Greases, Hydraulic Fluids, and Lubrication Systems
-



117.1 Define the following terms:

- a. Acidity [ref. a, ch. 3]
- b. Adhesion [ref. a, ch. 4]
- c. Autogenous ignition point [ref. a, ch. 4]
- d. BS&W [ref. d, sec. 5]
- e. Carbon residue [ref. b, ch. 8]
- f. Clear and bright [ref. d, sec. 5]
- g. Cohesion [ref. a, ch. 4]
- h. Demulsification [ref. a, ch. 4]
- i. Emulsion [ref. a, app. I]
- j. Fire point [ref. a, ch. 4]
- k. Flash point [ref. a, ch. 4]
- l. Free water [ref. d, sec. 5]
- m. Neutralization number [ref. b, ch. 8]
- n. Oxidation [ref. b, app. I]
- o. Pour point [ref. b, ch. 8]
- p. Precipitation number [ref. b, ch. 8]
- q. Sediment [ref. b, app. I]
- r. Sludge [ref. b, ch. 8]
- s. Suspended solids [ref. d, sec. 5]
- t. Transparency test [ref. d, sec. 5]
- u. Viscosity (SSU) [ref. b, ch. 8]
- v. Visual test [ref. d, sec. 5]

.2 Define the following types of friction: [ref. b, app. I]

- a. Fluid
- b. Kinetic
- c. Rolling
- d. Sliding
- e. Static

.3 Explain how each of the following affects lube oil quality:

- a. Temperature [ref. a, ch. 4]
- b. Pressure [ref. c, ch. 3]
- c. Water [ref. a, ch. 4]

117 LUBRICATING AND HYDRAULIC OIL FUNDAMENTALS (CONT'D)

- 117.3 d. Carbon residue [ref. b, ch. 8]
- e. Sludge [ref. b, ch. 8]

- .4 State the purpose and required frequency of conducting tests of lubricating oil aboard your ship. [ref. d, sec. 5]

- .5 Discuss the following processes of oil purification: [ref. a, ch. 4]
 - a. Batch
 - b. Continuous

- .6 How is the classification of lubricating oil determined? [ref. a, ch. 4]

- .7 State the two most commonly used oil purifiers in naval applications. [ref. a, ch. 4]

- .8 State the four major areas of contamination in Hydraulic Systems. [ref. c, ch. 3]

- .9 How are hydraulic fluids classified, and what are the three general classifications of hydraulic fluids currently used in shipboard applications? [ref. c, ch. 3]

- .10 State which checks are made during a shipboard analysis of hydraulic liquids. [ref. c, ch. 3]

118 LUBRICATING OIL QUALITY MANAGEMENT PROGRAM

NAME _____ RATE/RANK _____

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118 LUBRICATING OIL QUALITY MANAGEMENT PROGRAM FUNDAMENTALS

References:

- [a] NSTM S9086-H7-STM-010/CH-262, Lubricating Oils, Greases, Hydraulic Fluids, and Lubrication Systems
 - [b] PMS Maintenance Requirement Card (MRC) 2000/R-1 Lube Oil Sampling
 - [c] Engineering Department Organization and Regulations Manual (EDORM)
 - [d] SECNAVINST 5212.5C, Disposition of Navy and Marine Corps Records
 - [e] NSTM S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals
 - [f] NSTM S9086-HB-STM-000/CH-233, Diesel Engines
-



- 118.1 What is the purpose of the Lubricating and Hydraulic Oil Quality Management Program? [ref. c]
 - .2 State the objectives of the Lubricating and Hydraulic Oil Quality Management Program. [ref. c]
 - .3 Using the logic flow chart, explain the types of tests, limits, and sample flow path for 2000 series lube oil contained in the following equipment: [ref. a, sec. 5]
 - a. Equipment without on-line purification capability
 - b. Equipment with on-line purification capability
 - .4 Describe sampling connections requirements. [ref. c; ref. e, sec. 2]
 - .5 State the frequency and equipment required in each space for sampling lube oil. [ref. a, sec. 5; refs. b, c]
 - .6 Explain the types of tests and limits for 9000 series lube oil. [ref. a, sec. 5; ref. f, sec. 4]
 - .7 What is contained in the Daily Lube Oil Quality Management Log? [ref. c]
 - .8 What are the sampling requirements of the Navy Oil Analysis Program (NOAP)? [ref. a, sec. 4]
 - .9 To whom are feedback reports (for the NOAP required action) submitted; what is contained in the report, and why? [ref. a, sec. 4]
 - .10 Explain the procedures for submission of lube oil samplings under NOAP. [ref. a, sec. 4]

118 LUBRICATING OIL QUALITY MANAGEMENT PROGRAM FUNDAMENTALS (CONT'D)

- 118.11 What are the procedures for disposal of contaminated and uncontaminated oil samples on board ship? [ref. a, sec. 3; ref. b]

- .12 How long are NOAP reports, required actions, and feedback reports retained aboard ship? [ref. d, ch. 3]

119 MECHANICAL

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119 MECHANICAL FUNDAMENTALS

References:

- [a] NAVEDTRA 12140, Boiler Technician 3 & 2
 - [b] NAVEDTRA 12144, Machinist's Mate 3 & 2
 - [c] NAVEDTRA 12001, Fireman
 - [d] NAVEDTRA 10539, Engineman 3
 - [e] NSTM S9086-RK-STM-010/CH-505, Piping Systems
-



119.1 Explain the use of each of the following valves:

- a. Ball [ref. b, ch. 10]
- b. Butterfly [ref. b, ch. 10]
- c. Check [ref. b, ch. 10]
- d. Combined exhaust and relief [ref. a, ch. 11]
- e. Gate [ref. b, ch. 10]
- f. Globe [ref. b, ch. 10]
- g. Remote-operated [ref. b, ch. 10]
- h. Needle [ref. b, app. I]
- i. Pilot-operated [ref. b, ch. 10]
- j. Plug (plug cocks) [ref. b, app. I]
- k. Pressure reducer [ref. b, ch. 10]
- l. Relief [ref. a, ch. 11]
- m. Safety [ref. a, ch. 6]
- n. Sentinel [ref. b, ch. 10]
- o. Stop-check [ref. c, ch. 9]
- p. Thermostatic control [ref. b, ch. 10]
- q. Unloading [ref. a, ch. 11]

.2 State the purpose or function of the following items/terms associated with tanks:

- a. Storage [ref. a, ch. 4]
- b. Service [ref. a, ch. 4]
- c. Settling [ref. a, ch. 4]
- d. Collecting [ref. a, ch. 4]
- e. Overflow [ref. a, ch. 4]
- f. Stripping [ref. a, ch. 4]
- g. Swash plates/baffles [ref. a, app. I]
- h. Vent [ref. a, app. I]
- i. Sounding tube [ref. d, app. I]

.3 Explain the function and draw the symbol for the following indicating devices:

- a. Bimetallic thermometer [ref. c, ch. 11]
- b. Differential pressure gage [ref. c, ch. 11]

119 MECHANICAL FUNDAMENTALS (CONT'D)

- 119.3 c. Duplex pressure gage [ref. c, ch. 11]
d. Fluid meter [ref. d, ch. 7]
e. Liquid-level indicator [ref. c, ch. 11]
f. Liquid-in-glass thermometer [ref. c, ch. 11]
g. Revolution counter [ref. c, ch. 11]
h. Salinity indicator [ref. c, ch. 11]
i. Simplex pressure gage [ref. c, ch. 11]
j. Compound gage [ref. c, ch. 11]

.4 Explain the function of each of the following heat exchangers:

- a. Air ejector condenser [ref. b, ch. 6]
- b. Boiler [ref. a, app. I]
- c. Cooler [ref. a, app. I]
- d. Condenser [ref. a, app. I]
- e. Deaerating Feed Tank (DFT) [ref. a, app. I]
- f. Heat exchanger [ref. c, app. I]

.5 Explain the basic principles of operation and the use of each of the following pumps:
[ref. b, ch. 5]

- a. Centrifugal
- b. Jet
- c. Propeller
- d. Reciprocating
- e. Rotary

.6 Explain the function of the following:

- a. Constant pressure regulator [ref. b, ch. 5]
- b. Constant speed governor [ref. b, ch. 2]
- c. Flange shields [ref. b, ch. 10]
- d. Pipe hangers and supports [ref. e, sec. 7]
- e. Sounding tape [ref. c, ch. 1]
- f. Speed-limiting governor [ref. b, app. I]
- g. Reachrod [ref. b, app. I]
- h. Steam traps [ref. a, ch. 11]

.7 State the color code for the following systems: [ref. e, sec. 7]

- a. Condensate
- b. Feedwater/condensate
- c. Firemain
- d. Aqueous Film Forming Foam (AFFF) solution
- e. Fuel oil

119 MECHANICAL FUNDAMENTALS (CONT'D)

- 119.7 f. High Pressure (HP) air
- g. Hydraulic
- h. JP-5
- i. Low Pressure (LP) air
- j. Lube oil
- k. Potable water
- l. Seawater
- m. Sewage
- n. Steam
- o. Refrigerants
- p. Chilled water

.8 Define the following terms as applied to the operation and testing of machinery equipment:

- a. Align (line-up) [ref. c, app. I]
- b. Bypass [ref. c, app. I]
- c. Circulating [ref. b, app. I]
- d. Cold iron [ref. c, app. I]
- e. Crack (open)/unseat [ref. e, sec. 1]
- f. Cross-connect [ref. a, app. I]
- g. Cutout [ref. a, app. I]
- h. Drain/vent [ref. a, ch. 6]
- i. Disengage [ref. b, ch. 3]
- j. Engage [ref. b, ch. 3]
- k. Guarding [ref. a, ch. 6]
- l. Hydrostatic test [ref. a, app. I]
- m. Inlet/suction [ref. b, ch. 5]
- n. Leakage rate (leakoff) [ref. b, ch. 5]
- o. Light-off [ref. a, app. I]
- p. Local manual [ref. a, app. I]
- q. Purge [ref. d, app. I]
- r. Recirculating [ref. b, app. I]
- s. Remote manual [ref. a, app. I]
- t. Root valve [ref. a, app. I]
- u. Sounding [ref. c, ch. 1]
- v. Standby [ref. a, app. I]
- w. Throttle [ref. a, app. I]
- x. Top-off [ref. a, app. I]
- y. Vent [ref. c, app. I]
- z. Warm-up [ref. e, sec. 1]

120 MERCURY CONTROL PROGRAM

NAME _____ RATE/RANK _____

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120 MERCURY CONTROL PROGRAM FUNDAMENTALS

Reference:

[a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1



- 120.1 What are the hazards associated with mercury or mercury containing compounds/components? [ch. B13]
 - .2 What are the guidelines for the storage of mercury/mercury components? [ch. B13]
 - .3 What equipment/qualification is required for the cleanup of mercury spill? [app. B13-B]
 - .4 Describe the procedures for a mercury spill cleanup. [app. B13-B]
 - .5 What are the proper mercury disposal procedures? [app. B13-B]

121 PHYSICAL SECURITY

NAME _____ RATE/RANK _____

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121 PHYSICAL SECURITY FUNDAMENTALS

References:

- [a] OPNAVINST 3120.32C, Standard Organization and Regulations Manual of the U.S. Navy (SORM)
 - [b] Engineering Department Organization and Regulations Manual (EDORM)
 - [c] NAVEDTRA 12043, Military Requirements, Basic (MRB)
 - [d] NSTM 0901-LP-420-0002/CH-9420, Propulsion Reduction Gears, Couplings and Associated Components
 - [e] NSTM S9086-GY-STM-010/CH-221, Boilers
 - [f] NSTM S9086-SE-STM-010/CH-533, Potable Water Systems
 - [g] Local Instructions
-



- 121.1 What is the purpose of the Physical Security Program? [ref. a, ch. 6]
- .2 How often are engineering spaces aboard your ship inspected? [ref. b]
- .3 What engineering spaces aboard your ship are locked during cold iron conditions? [ref. g]
- .4 To whom do you report violations of physical security? [ref. a, ch. 6]
- .5 What are the requirements aboard your ship for locking devices and seals on the following:
- a. Aqueous Film Forming Foam (AFFF) System valves [ref. g]
 - b. Ballast and deballast valves [ref. g]
 - c. Boiler safety valves [ref. e, sec. 3]
 - d. Desuperheater outlet valves [ref. g]
 - e. Feedwater sounding tubes [ref. g]
 - f. Fuel oil transfer valves [ref. g]
 - g. Lube oil rundown valves [ref. g]
 - h. Lube oil sampling valves [ref. g]
 - i. Lube oil sight flow indicators (Bull's-eyes) [ref. g]
 - j. Lube oil transfer valves [ref. g]
 - k. Main lube oil pump suction and discharge valves [ref. g]
 - l. Potable water sounding tubes [ref. f, sec. 2]
 - m. Propulsion reduction gears [ref. d, sec. IV]
 - n. Spring bearing/line shaft bearing inspection covers [ref. g]
- .6 Explain the procedures for reporting the following:
- a. Bomb threat [ref. g]
 - b. Fire/Flooding [ref. c, ch. 15]
 - c. Intruder [ref. g]
 - d. Sabotage [ref. a, ch. 5]
 - e. Main reduction gear covers [ref. g]

122 POWER TRANSMISSION

NAME _____ RATE/RANK _____

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122 POWER TRANSMISSION FUNDAMENTALS

References:

- [a] NAVEDTRA 10539, Engineman 3, ch. 12
 - [b] NSTM S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals
 - [c] NSTM 0901-LP-430-0012/CH-9430, Shaftings, Bearings and Seals
 - [d] NAVEDTRA 10563, Gas Turbine Systems Technician 3, Vol. 1
-



122.1 Define power transmission. [ref. a]

.2 Define the following terms as applied to power transmission:

- a. Drive mechanism [ref. a]
- b. Feet of pitch [ref. d, app. I]
- c. Frozen clutch [ref. a]
- d. Lock shaft [ref. d, ch. 8]
- e. Stop shaft [ref. d, ch. 8]
- f. Torque [ref. a]

.3 State the function(s) of the following:

- a. Bearing pedestal [ref. c, sec. 2]
- b. Clutch [ref. a]
- c. Controlled pitch propeller [ref. a]
- d. Flexible coupling [ref. a]
- e. Pitch control unit [ref. a]
- f. Pivoted shoe thrust bearing [ref. b, sec. 3]
- g. Prime mover [ref. a, app. I]
- h. Propulsion shaft [ref. c, sec. 1]
- i. Reduction gears [ref. a]
- j. Friction brake [ref. a]
- k. Solid coupling [ref. a]
- l. Spring bearing [ref. a]

.4 Discuss the following as applied to power transmission: [ref. a]

- a. Direct drive
- b. Indirect drive

.5 What are the different types of clutches used on some types of drive mechanisms. [ref. a]

.6 Explain the basic principle of propeller pitch. [ref. a, app. I]

.7 Describe the basic differences between fixed pitch and controllable pitch propellers [ref. a]

123 RESPIRATORY PROTECTION PROGRAM

NAME _____ RATE/RANK _____

This page is to be used as a record of satisfactory completion of designated sections of the Personnel Qualification Standard (PQS). Only specified supervisors may signify completion of applicable sections either by written or oral examination, or by observation of performance. The examination or checkout need not cover every item; however, a sufficient number should be covered to demonstrate the examinee's knowledge. Should supervisors *give away* their signatures, unnecessary difficulties can be expected in future routine operations.

This section is to be kept in the individual's training jacket.



The trainee has satisfactory completed all PQS requirements for this fundamental. Completed RESPIRATORY PROTECTION PROGRAM Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____

Supervisor

COMPLETED _____ DATE _____

Division Officer

COMPLETED _____ DATE _____

Department Head

SERVICE RECORD
ENTRY _____ DATE _____

123 RESPIRATORY PROTECTION PROGRAM FUNDAMENTALS

Reference:

[a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1



123.1 Describe the following: [ch. B6]

- a. Particulate air-purifying respirators
 - b. Gas and vapor air-purifying respirators
 - c. Prefilters
 - d. Military gas-masks
 - e. Continuous flow air line respirators
 - f. Self-Contained Breathing Apparatus (SCBA)
- .2 Describe the positive and negative pressure checks performed when the respirator is initially donned. [ch. B6]
- .3 What are the requirements for using ship's Low Pressure (LP) air for breathing air? [ch. B6]
- .4 What are the requirements that must be met before using a respirator? [ch. B6]
- .5 What respirators are required for the following operations? [app. B6-E]
- a. Degreasing
 - b. Interior spray painting
 - c. Welding or brazing nontoxic metals
 - d. Surface preparation, sanding leaded paint

124 SHIPBOARD HEAT STRESS CONTROL PROGRAM

NAME _____ RATE/RANK _____

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COMPLETED _____ DATE _____
Supervisor

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Division Officer

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ENTRY _____ DATE _____

124 SHIPBOARD HEAT STRESS CONTROL PROGRAM FUNDAMENTALS

References

- [a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1, ch. B2
- [b] NAVEDTRA 12081, Standard First Aid, ch. 7
-



- 124.1 State the purpose of the Heat Stress Program. [ref. a]
- .2 Define heat stress. [ref. a]
- .3 What are the symptoms of heat stress? [ref. a]
- .4 What are the symptoms of heat exhaustion? [ref. b]
- .5 What are the first aid steps for treatment of heat exhaustion? [ref. b]
- .6 What are the symptoms of heat stroke? [ref. b]
- .7 What are the first aid steps for treatment of heat stroke? [ref. b]
- .8 What precautions must be taken for fighting heat stress? [ref. a]
- .9 Who is responsible for taking required heat stress surveys? [ref. a]
- .10 What is the frequency for conducting heat stress monitoring? [ref. a]
- .11 Define the following terms: [ref. a]
- a. Personnel recovery period
 - b. PHEL chart
 - c. WBGT
- .12 What is a WBGT meter (heat stress monitor) used for? [ref. a]
- .13 What are the requirements for the positioning of dry bulb thermometers? [ref. a]
- .14 Who can authorize the extension of safe stay times? [ref. a]

125 SIGHT CONSERVATION PROGRAM

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed SIGHT CONSERVATION PROGRAM Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____
Supervisor

COMPLETED _____ DATE _____
Division Officer

COMPLETED _____ DATE _____
Department Head

SERVICE RECORD
ENTRY _____ DATE _____

125 SIGHT CONSERVATION PROGRAM FUNDAMENTALS

Reference:

[a] OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1, ch. B5



125.1 When must eye protection be worn?

.2 State the responsibilities of the following personnel in the Sight Conservation Program:

- a. Commanding Officer
- b. Safety Officer
- c. Department Heads and Division Officers
- d. Medical Officer or Senior Medical Department Representative
- e. All hands

.3 Describe the elements of the Sight Conservation Program.

.4 What is considered during an eye hazard survey?

.5 How are eye hazard areas posted and marked?

.6 What are the requirements for sight screening evaluations?

.7 What are the procedures governing the use of corrective lenses in sight protection equipment?

.8 What are the procedures governing the use of temporary protective eyewear?

.9 Where shall emergency eyewash facilities be located?

.10 What specifications must emergency eyewash facilities meet?

.11 What are the marking requirements for an emergency eyewash station?

.12 Describe the training requirements for the Sight Conservation Program.

126 STEAM TURBINE

NAME _____ RATE/RANK _____

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The trainee has satisfactory completed all PQS requirements for this fundamental. Completed STEAM TURBINE Fundamental (NAVEDTRA 43103).

COMPLETED _____ DATE _____
Supervisor

COMPLETED _____ DATE _____
Division Officer

COMPLETED _____ DATE _____
Department Head

SERVICE RECORD
ENTRY _____ DATE _____

126 STEAM TURBINE FUNDAMENTALS

Reference:

[a] NAVEDTRA 12144, Machinist's Mate 3 & 2

[b] NAVEDTRA 12001, Fireman



126.1 Explain the function of steam turbines. [ref. a, ch. 2]

.2 Explain how the following components are used:

- a. Nozzle poppet valves [ref. a, ch. 2]
- b. Labyrinth seals [ref. a, ch. 2]
- c. Carbon ring packing [ref. b, ch. 5]
- d. Constant pressure governor [ref. b, app. I]
- e. Nozzle diaphragms [ref. a, ch. 2]
- f. Constant speed governor [ref. a, ch. 2]
- g. Thrust bearings [ref. b, ch. 5]
- h. Radial bearings [ref. b, ch. 5]
- i. Stationary turbine blading [ref. a, ch. 2]
- j. Moving turbine blading [ref. a, ch. 2]
- k. Reversing chambers [ref. a, ch. 2]

.3 Explain the protective functions of the following: [ref. a, ch. 2]

- a. Speed limiting governors
- b. Overspeed trips
- c. Low lube oil pressure trips
- d. Back pressure trips

.4 Explain the following terms associated with turbines: [ref. a]

- a. Rateau stage [ch. 2]
- b. Curtis stage [app. I]
- c. Impulse [app. I]
- d. Reaction [app. I]
- e. Pressure/velocity compounded [ch. 2]
- f. Pressure compounded [ch. 2]
- g. Velocity compounded [ch. 2]
- h. Axial flow [ch. 2]
- i. Radial flow [ch. 2]
- j. Helical flow [ch. 2]
- k. Double axial flow [ch. 2]
- l. Kinetic energy [ch. 2]

.5 State the four ways to classify steam turbines. [ref. a, ch. 2]



LIST OF REFERENCES USED IN THIS PQS

CINCLANTFLTINST/CINCPACFLTINST 4026.1, Fuel Management Afloat Manual
Class Advisory Notebook
Engineering Department Organization and Regulations Manual (EDORM)
Engineering Operational Sequencing System (EOSS)
Local Instructions
NAVEDTRA 10539, Engineman 3
NAVEDTRA 12001, Fireman
NAVEDTRA 10543-E1, Engineman 1 & C
NAVEDTRA 12144, Machinist's Mate 3 & 2
NAVEDTRA 10546-F, Electrician's Mate 3 & 2
NAVEDTRA 10536-F, Boiler Technician 1 & C
NAVEDTRA 12140, Boiler Technician 3 & 2
NAVEDTRA 10193-D, Instrumentman 3 & 2, ch. 2
NAVEDTRA 12147, Engineering Administration
NAVEDTRA B72-01-00-92, NEETS Module 1 - Introduction to Matter, Energy, and Direct Current
NAVEDTRA 172-02-00-91, NEETS Module 2 - Introduction to alternating Current and Transformers
NAVEDTRA B72-03-00-93, NEETS Module 3 - Introduction to Circuit Protection, Control, and
Measurement
NAVEDTRA B72-05-00-94, NEETS Module 5 - Introduction to Generators and Motors
NAVEDTRA B72-15-00-92, NEETS Module 6 - Introduction to Electronic Emission, Tubes, and Power
Supplies
NAVEDTRA B72-15-00-92, NEETS Module 7 - Introduction to Solid-State Devices and Power Supplies
NAVEDTRA B72-15-00-93, NEETS Module 15 - Principles of Synchros, Servos, and Gyros
NAVEDTRA 12160, Interior Communication Electrician, Volume 1
NAVEDTRA 10563, Gas Turbine Systems Technician (Electrical) 3/Gas Turbine Systems Technician
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NAVEDTRA 12964, Fluid Power
NAVEDTRA 10539, Engineman 3
NAVEDTRA 12043, Military Requirements, Basic (MRB)
NAVEDTRA 12081, Standard First Aid, ch. 7
NSTM S9086-RK-STM-010/CH-505, Piping Systems
NSTM S9086-SY-STM-010/CH-551, Compressed Air Plants and Systems, Rev. 1
NSTM S9086-S3-STM-010/CH-555, Shipboard Firefighting
NSTM S9086-VG-STM-010/CH-634, Deck Coverings
NSTM S9086-K9-STM-000/CH-330, Lighting

LIST OF REFERENCES USED IN THIS PQS (CONT'D)

NSTM S9086-SX-STM-010/CH-550, Industrial Gases; Generating, Handling and Storage
NSTM S9086-CH-STM-030/CH-074 V3, Gas Free Engineering
NSTM S9086-WK-STM-010/CH-670, Stowage, Handling, and Disposal of Hazardous General Use Consumables
NSTM S9086-SN-STM-010/CH-541, Ship Fuel and Fuel Systems
NSTM S9086-S4-STM-010/CH-556, Hydraulic Equipment Power Transmission and Control
NSTM S9086-CL-STM-010/CH-077, Protection Equipment
NSTM S9086-RW-STM-010/CH-516, Refrigeration Systems
NSTM S9086-PA-STM-000/CH-430, Interior Communication Installations
NSTM S9086-H7-STM-010/CH-262, Lubricating Oils, Greases, Hydraulic Fluids, and Lubrication Systems
NSTM S9086-KC-STM-010/CH-300, Electric Plant General
NSTM S9086-SP-STM-010/CH-542, Gasoline and JP-5 Fuel Systems
NSTM S9086-NZ-STM-010/CH-420, Navigation Systems, Equipment, and Aids
NSTM S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals
NSTM S9086-HB-STM-000/CH-233, Diesel Engines
NSTM 0901-LP-420-0002/CH-9420, Propulsion Reduction Gears, Couplings and Associated Components
NSTM S9086-GY-STM-010/CH-221, Boilers
NSTM S9086-SE-STM-010/CH-533, Potable Water Systems
NSTM 0901-LP-430-0012/CH-9430, Shaftings, Bearings and Seals
NSTM S9086-VH-STM-010/CH-635, Thermal, Fire, and Acoustic Insulation
NSTM S9086-GY-STM-010/CH-221, Boilers
NSTM S9086-GX-STM-020/CH-220 V2, Boiler Water/Feedwater-Test and Treatment
NSTM S9086-QN-STM-010/CH-475, Magnetic Silencing
NSTM S9086-KY-STM-000/CH-320, Electric Power Distribution Systems
NSTM S9086-PA-STM-000/CH-430, Interior Communication Installations
NSTM S9086-KN-STM-010/CH-310, Electric Power Generators and Conversion Equipment
NSTM S9086-CH-STM-030/CH-074 V3, Gas Free Engineering
NWP 62-1 (Rev. D), Surface Ship Survivability
OPNAVINST 5100.19C, Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat, Change Transmittal 1
OPNAVINST 4100.11B, Navy Energy Usage Reporting System (NEURS)
OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual
OPNAVINST 3120.32C, Standard Organization and Regulations Manual of the U.S. Navy (SORM)
PMS Maintenance Requirement Card (MRC) 2000/R-1 Lube Oil Sampling
Propulsion Operating Guide (POG)
Propulsion Plant Manual (PPM)
SECNAVINST 5212.5C, Disposition of Navy and Marine Corps Records
Ship's Information Book (SIB)

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