Diesel Electric Generating Plants

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the appropriate Naval Facilities Guide Specification (NFGS) based on plant duty type and generating capacity.
- **Select** the correct definitive design number for stationary diesel-electric generating plants ranging from 10 kW to over 3000 kW.
- **Evaluate** the applicability of specific NAVFAC definitive drawings for mechanical and electrical system design.

Executive Summary: This section establishes the design criteria for stationary diesel-electric generating plants at naval shore activities, covering Prime and Standby/Emergency duty types. It provides a standardized framework using definitive designs and Naval Facilities Guide Specifications (NFGS) to ensure consistency in procurement and construction for capacities ranging from small 10 kW units to large-scale plants exceeding 3000 kW.

Scope of Design Criteria

Apply the data and criteria provided in this handbook to the design of stationary diesel-electric generating plants at **naval shore activities**. The scope encompasses both **Prime Duty** and **Standby/Emergency Duty** applications. Designers must incorporate considerations for:

- **Cogeneration systems** for steam and/or hot water to satisfy export heat loads.
- **Supplemental power generation** using recovered thermal energy.

Diesel-Electric Generating Plant Types

Stationary diesel-electric generating plants are classified into two primary duty types based on the electrical loads they serve:

- **Prime Duty:** Continuous power generation for primary facility loads.
- **Standby/Emergency Duty:** Intermittent power for critical or mobilization requirements.

💡 **Design Tip:** For comprehensive planning guidance, refer to **NAVFAC DM-4.01**, *Electrical Engineering, Preliminary Design Considerations*, and ensure all designs adhere to **NFPA No. 70, National Electrical Code (NEC)**.

Definitive Designs and Guide Specifications

The Navy utilizes a standardized system of **definitive designs** and **guide specifications** summarized by capacity and duty type in the table below.

Table 1: Summary Diesel-Electric Generating Plant NAVFAC Definitive Designs and Guide Specifications for Duty Types and Generating Capacity Ranges

Duty Type	Generating Capacity	Definitive Design Number	Guide Specification
Prime	10 kW to 500 kW	None Available	NFGS-16208
	501 kW to 2500 kW	Design 1	NFGS-16202
	2501 kW and larger	Design 2	NFGS-16203
Standby/ Emergency	10 kW to 300 kW	None Available	NFGS-16208
	301 kW to 1000 kW	Design 3	NFGS-16204
	1001 kW to 3000 kW	Design 4	NFGS-16205

System Usage and Procurement

Tailor the definitive designs and guide specifications using the guidance within this handbook.

- **Commercial Units:** Use **NFGS-16208** for standard commercial units procured for single unit replacements or as part of a building construction project.
- **Capacity Limits:** Note that **Design Number 4** and **NFGS-16205** are strictly limited to units with a maximum capacity of **3,000 kW**.

⚠️ **Safety Constraint:** Design 4 (NFGS-16205) must not be utilized for standby/emergency duty generating units that exceed 3,000 kW in capacity.

NAVFAC Definitive Drawings

Unless specifically noted, the following drawings apply to **all designs (1, 2, 3, and 4)**.

NAVFAC Definitive Drawing List

- **1403463** - Symbol Legend
- **1403464** - Operating Floor Plan, Design 1
- **1403465** - Basement Floor Plan, Design 1
- **1403466** - Building Isometrics and Section, Design 1
- **1403467** - Operating Floor Plan, Design 2
- **1403468** - Basement Floor Plan, Design 2
- **1403469** - Building Isometrics and Section, Design 2
- **1403470** - Operating Floor Plan, Design 3
- **1403471** - Building Isometrics and Section, Design 3

- **1403472** - Operating Floor Plan, Design 4
- **1403473** - Building Isometrics and Section, Design 4
- **1403474** - Typical Wall Sections
- **1403475** - Miscellaneous Details
- **1403476** - Lubricating Oil System Flow Diagram, Designs 1 and 2
- **1403477** - Lubricating Oil System Flow Diagram, Designs 3 and 4
- **1403478** - Fuel Oil System Flow Diagram, Designs 1, 2, and 4
- **1403479** - Fuel Oil System Flow Diagram, Design 3
- **1403480** - Radiator Cooling System Flow Diagram
- **1403481** - Tower or Natural Cooling System Flow Diagram
- **1403482** - Compressed Air and Space Heating Flow Diagram
- **1403483** - Miscellaneous Mechanical Details
- **1403484** - Primary Electrical One-Line Diagram, Designs 1 and 2
- **1403485** - Primary Electrical One-Line Diagram, Designs 3 and 4
- **1403486** - Station Service System One-Line Diagram, Designs 1 and 2
- **1403487** - Station Service System One-Line Diagram, Designs 3 and 4

Checkpoint Quiz

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1. **A project requires a 2,000 kW Prime Duty stationary diesel-electric plant. Which NAVFAC Definitive Design Number should be referenced?**
   a) Design 1
   b) Design 2
   c) Design 3
   d) Design 4

Answer: (a). According to Table 1, Prime Duty plants in the 501 kW to 2500 kW range utilize **Design 1** and **NFGS-16202**.

2. **Which guide specification is specifically intended for the procurement of small, standard commercial units (e.g., a 100 kW Standby generator) without a dedicated definitive design?**
   a) NFGS-16202
   b) NFGS-16204
   c) NFGS-16208
   d) NFGS-16205

Answer: (c). NFGS-16208 is available without a definitive design for units 10 kW to 500 kW (Prime) and 10 kW to 300 kW (Standby/Emergency).

3. **A designer is developing a 4,000 kW Standby/Emergency Duty plant. Can Design Number 4 and NFGS-16205 be used for this application?**
   a) Yes, as long as it is for emergency service.
   b) No, Design 4 is not intended for units above 3,000 kW.
   c) Yes, provided building construction is included.
   d) No, because no standby designs exist above 1,000 kW.

Answer: (b). The handbook explicitly notes that **Design 4** and **NFGS-16205** are not intended for generating units above **3,000 kW** in capacity.

Module 2: Policy

Learning Objectives

By the end of this section, you will be able to:

- **Distinguish** between Prime Duty and Standby/Emergency Duty plants based on annual operating hours and mission requirements.
- **Evaluate** the justification for government ownership versus commercial procurement of electric power based on economic and mission-critical factors.
- **Select** appropriate life-cycle cost analysis methodologies for varying levels of economic studies and procurement bidding.

Executive Summary: Diesel-electric generating plants must be designed to satisfy specific duty requirements—Prime or Standby/Emergency—at the lowest life-cycle cost to support naval missions. Policy mandates the use of commercial power sources unless government ownership is proven more economical or necessary for security, command control, or mobilization. All designs must maximize reliability and maintainability through adequate spacing, redundant units, and rigorous economic analysis.

Design Fundamentals for Diesel-Electric Plants

Design plants to fulfill the temporary or permanent mission of a naval activity while achieving the **lowest life-cycle cost**. This criteria applies strictly to stationary facilities; this handbook does not cover portable generating units.

Sources of Electric Power

Naval activities typically utilize multiple power sources, including both **commercial and government-owned** plants. The configuration of these sources depends on:

- The specific mission of the facility.
- On-site activities and existing equipment.
- Specific design criteria found in individual facility design manuals.

For detailed load calculations and sizing, **incorporate** guidance from **NAVFAC DM-4.01**, *Electrical Engineering, Preliminary Design Considerations*.

Classification of Duty Types and Loads

Stationary plants are categorized by their intended service profile:

Prime Duty Electric Generating Plants

Sizing for prime duty plants is based on peak electrical demand during normal peacetime operations for continuous service. Define a plant as **Prime Duty** if it meets any of the following:

Purchase this course to see the remainder of the technical materials.