



Training Program:

**Operation & Troubleshooting Of Emergency Power
Generation**

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Introduction:

This course describes the principles of engines and generators starting with the fundamentals, discusses the options available and the constructional details of engines, the electrical alternators and auxiliary equipment in an easy to understand manner. The testing and commissioning of Diesel engine generators and their operation and maintenance aspects are also discussed

Who Should Attend?

Plant electrical and mechanical engineers, design engineers, project engineers, testing and commissioning engineers and technicians, maintenance technicians

Course Objectives:

By the end of this course delegates will be able to:

- Select and apply Diesel engines for emergency power requirements in your work place
- Choose appropriate ratings and fuel options
- Select and apply alternators, their excitation and protection systems
- Plan for auxiliary systems of the engine as a part of the package
- Formulate procedures for testing and commissioning of Diesel engine generators
- Guide your team to operate and maintain Diesel engine generators

Accreditation:

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

Course Outline

The Basic Electrical Theory

- A brief history of electricity, The static and dynamic forms of electricity-the difference
- Electrical circuits, Voltage, current, resistance and Ohm's law
- DC and AC circuits-how they differ, AC amplitude-time curve
- Reactance and impedance and Ohm's law for AC circuits: Calculation examples
- Concept of power factor (displacement power factor)
- Circuit theory and applicable laws for solving problems of power flow in AC and DC circuits

Forms of Energy & Conversion

- Potential and kinetic energy as the main classification of energy forms
- Energy types based on the source such as fuel, chemical, nuclear and mechanical
- Why is electricity the most preferred energy carrier? Points of comparison
- Law of energy conservation and laws of thermodynamics, Applications to power generation

Engines for Power Generation-Liquid & Gaseous Fuels

- brief historical perspective, External combustion cycles
- External combustion engines-Spark and compression ignition types
- Industrial generating sets based on compression ignition cycle

Diesel Technology & Classifications

- Basic Engine processes, Dual Fuel Engines
- Speed Classifications, Service Classifications

Basic Engine Design & Ratings

- Design characteristics and formulas, Turbo charger, Ambient conditions, ISO ratings
- Performance and Efficiency, Efficiency enhancements, Engine speed, Fuel combustion methods

Fuel Oils Used & Fuel Handling System

- Crude oil, HSD, LDO and Heavy fuels, Economics of fuel selection
- Pressure and temperature characteristics, Viscosity characteristics
- Specific heat and temperature, Viscosity conversion, Specific fuel consumption
- Fuel filters and heaters, Fuel nozzles and igniters, Emission control
- Storage requirements, Typical fuel system layouts and components

Lube Oil System

- Lube oil specification & consumption, Typical Lube oil system layouts
- Viscosity and temperature, Lube oil filters and heaters

Basics of AC Synchronous Generators & Essential Components

- The basic electrical generator, Components of the alternator, Stator winding in alternators
- Rotor (field) windings, Damper windings, Slip rings
- Sources for supplying field current to rotor, Rotary exciters, Static exciters
 - Brushless excitation, Cooling components and methods of cooling

Protection of AC Synchronous Generators

- Failure modes of ac generator, Stator winding protection-short circuits
- Stator winding protection-earth faults, Differential protection for windings
- Rotor winding protection-Single and double earth fault
- Negative sequence current protection, Excitation failure and pole slip/out-of-step protection
- Over voltage protection of generators

Diesel Generating Sets

- Coupling Requirements, Skid mounting, Layout requirements
- Standard Control panels, Interconnections

Other Components

- Starting methods, Starting characteristics, Battery sizing, Step load requirements
- Standby requirements, Auto start and auto transfer schemes, Auto Transfer switches

Testing & Commissioning

- Factory tests, Pre-commissioning checks & tests, Performance monitoring
- Fuel and lube oil consumption checks, Electrical system tests

Operation & Maintenance of Diesel Generating Plants

- Safety requirements, Operation monitoring based on applications
- Philosophy of maintenance , Maintenance techniques
- Maintenance planning and scheduling , Spares and inventory management
- Maintenance tools , Inspection, Engine overhaul and repair
- Health monitoring, Troubleshooting