

# EMERGENCY GENERATORS & STANDBY POWER SYSTEMS



December 10-11 , 2018 | Mississauga, ON

December 12-13 , 2018 | Winnipeg, MB

January 14-15, 2019 | Edmonton, AB

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## DESIGN, INSTALLATION, TESTING AND MAINTENANCE

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# EMERGENCY GENERATORS & UPS SYSTEM TRAINING

THIS 2-DAY EMERGENCY GENERATORS & STANDBY POWER SYSTEMS TRAINING COURSE IS DESIGNED TO ASSIST ORGANIZATIONS TO IDENTIFY THE MANY SAVINGS TO BE GAINED FROM PROPER GENERATOR DESIGN, INSTALLATION, TESTING AND MAINTENANCE.

Much of today's infrastructure such as hospitals, data centres, industrial facilities and commercial buildings cannot withstand a loss of electrical power. As a result, generators are installed to provide electrical redundancy and in some instances, may help to reduce power costs. This course examines the operation of generators and their application within an overall electrical system and focuses on emergency standby generators.

Generators are an essential part of today's electrical system for providing power when needed. Generators can be used for many different applications some of which include: emergency standby generation, prime power, grid connected and micro-grid applications. The purpose of this course is to learn how generators operate and how they may be applied to suit various types of custom applications.

The focus of this course is on emergency standby generators and how they may be applied in a variety of settings and industrial sectors. Standby generation are used primarily to provide backup power in the event that utility power from the utility electrical distribution system is lost. In this scenario, a standby generator may be

## WHAT WILL YOU LEARN

- Specific requirements and recommendations for the installation, operation and maintenance of backup power generation equipment Where to find critical information from professional sources such as the EGSA, IEEE, NFPA, NECA and NETA.
- How To Read And Understand Vendor Drawings And Technical Information For Generators.
- How Generators Operate
- Supporting Electrical Equipment Such As Transfer Switches, Switchgear, Emergency Power Distribution
- Auxiliary Generator Equipment Such power system.
- As Fuel Tanks, Silencers, Ventilation, Control Equipment, Gas Detection Etc.
- How To Work With Parallel Energy Sources Synchronizing Procedures And Load Sharing.
- How To Troubleshoot Using A Logical, Systematic Approach To Isolate And Repair Generator Problems
- Generator Energy Management And Heat Recovery Applications

## AGENDA - DAY 1

### 1. Introduction To Generators

- Introduction To Generators
- Purpose Of Electric Generators
- Application Of Electric Generators I.E. Power Plants, Microgrids, Prime Power, Off Grid, Standby And Backup Power
- Standby Vs Prime Power Vs Continuous Rated Generators
- Generator Drivers (Gas Reciprocating Engine, Gas Turbine, Steam Generation, Hydro)
- Renewable Generation

### 2. Generator Basic Electrical Fundamentals

- Electrical Fundamentals
- How Electricity Is Produced And Controlled In Generators And Batteries
- Understanding Single-Phase And Three Phase Generator Wiring Configurations
- Understanding Generator Nameplate Data

### 3. Generator Types and Construction

- Stator
- Mechanical Components
- Wye Configuration
- Delta Configuration
- Types Of Rotors
- Salient Pole
- Cylindrical Pole
- Types Of Bearings And Lubrication Systems
- Sinusoidal Voltage Output
- Motor Vs Generator Comparison
- Three-Phase Generators
- Components
- Operation

### 4. Generator and Engine Controls

- Paralleling And Non Paralleling Governor Control
- Purposes Of Generator Excitation
- Power To The Rotating Electromagnetic Field
- Locking Rotor To Stator
- Means Of Regulating Voltage
- Types Of Generator Excitation

- DC Exciters
- Static Excitation
- Brushless Excitation
- Concept Of Response Time Vs Voltage Levels
- Voltage Regulator Function
- Voltage Regulator Components
- Voltage Regulator Operation
- Reactive Power Control For Parallel Operations
- Auxiliary Regulator Functions
- Voltage Regulator Troubleshooting
- Onsite Generator Controls Including PLCs And SCADA Systems

### 5. Generator Auxiliary Power Requirements

- Pre/Post Lube Pumps
- Starter Motors
- Battery Chargers
- Cooling Fans

### 6. Generator Emissions

- Government Requirements
- Specifying Generators
- Emission Controls

### 7. Auxiliary Systems

- Fuel Systems
- Cooling Systems
- Exhaust Systems
- Vibration Attenuation
- Sound Attenuation
- Engine Starting Systems
- Load Banks
- Emissions Control
- Silencers
- Ventilation
- Fuel Tanks

### 8. Generator Protection

- Short Circuit Protection

- Ground Fault Protection
- Overload Protection
- Thermal Protection
- Overspeed Protection
- Low Field Excitation Or Loss Of Field Excitation Protection
- Generator Motoring Protection
- Protection Against Unbalanced Faults
- Overexcitation Protection
- Reverse Power Protection
- Volts Per Hertz Protection
- Synch-Check
- Over/Under Voltage Protection
- Over/Under Frequency Protection
- Differential Protection

- Rate Of Change Of Frequency Protection

### 9. Generator Grounding

- Why Do Generators Require Grounding?
- Neutral Grounding Resistors
- Standby Generator Grounding Vs Parallel Generator Grounding
- Considerations For Parallel Generator Grounding

### 10. Generator Applications

- Emergency Power Systems
- Legally Required Standby Systems

## AGENDA - DAY 2

### 11. Generator Loading And Control

- Effects Of Various Type Loads On Generator Control: Lighting, Motors, UPS Systems
- Parallel Operation
- Protection And Transfer Of Power

### 12. The Gas, Natural Gas And Diesel Engines As Prime Movers

- Prime Mover Types And Fuel Considerations
- Mechanical Systems Operation: Fuel, Intake Air, Lube Oil, Cooling, Governors
- Typical Manufacturers, Ratings And Operation Of Diesel Generator Sets.
- Diesel Vs Gas Generators

### 13. Transfer Switch Equipment

- Types And Applications Of Transfer Switch Equipment
- The Automatic Transfer Switch (ATS)
- Loss Of Utility Power Scenarios
- Load Shedding Operations
- Bypass Operation
- Protection Considerations
- Transfer Switch Equipment Maintenance Safer

- Utility Re-Transfer Scenarios
- Open Vs Closed Transition Switches

### 14. Emergency and Standby Generator Architecture

- Manual Transfer Switch
- Auto Transfer Switch
- Main-Tie-Main Architecture
- Micro-Grid
- Generator Paralleling Switchgear Application
- Parallel Operation Of Generators

### 15. Generator Transients and Operation

- Starting A Generator
- Transferring Load
- Motor Starting
- Load Pickup
- Load Rejection
- Harmonics And Generators
- Generator Sizing

### 16. Emergency Busses

- What Is An Emergency Bus?
- What Loads Are Typically Placed On An Emergency Bus?
- Power Transfer To An Emergency Bus
- Re-Transferring To The Utility

### 17. Troubleshooting And Maintenance Of Standby Generators

- Recommended Maintenance Practices From: IEEE, NFPA, NETA, EGSA
- Recommended Generator Maintenance Practices
- Developing A Logical Systematic Approach To Troubleshooting
- Common Generator Problems
- Electrical Testing Of Generators
- Starting Battery Maintenance
- Troubleshooting Frequency Control Problems
- Troubleshooting Voltage Control Problems
- Troubleshooting Grounding Problems

### 18. Basic Generator Installation Requirements

- Marking Requirements
- Overcurrent Protection
- Selecting And Sizing Cables And Conductors For Generator Output
- Protecting Live Parts
- Loads Supplied – Practical Applications

AND MORE.....

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