# Diesel Generator Operation, Synchronising Panels and ATS Systems Training Course

4 – 29 April 2027
Manama



# Diesel Generator Operation, Synchronising Panels and ATS Systems Training Course

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## Introduction:

Diesel Generator Operation, Synchronising Panels and ATS Systems Training Course is a 4-week course for engineers, operators and technicians who run, connect and parallel standby and prime power, and its final deliverable is a site standby power operating and switching procedure. Sites that lose mains supply often find that gensets fail to start, synchronise poorly or that transfer switches do not transfer, leaving critical loads without power. Nominees already operate or maintain generators or low-voltage switchgear at work, and the course is taught through hands-on lab exercises. CoreConcept Training Center delivers this diesel generator operation course to international cohorts.

## Course Objectives:

- Operate diesel generator sets through start-up, loading, monitoring and shutdown using the generator control module
- Connect generators to site distribution with correct cabling, earthing, neutral arrangements and protection settings
- Commission a generator installation and verify its protection functions before handover to operations
- Synchronise and parallel generators with each other and with the mains while sharing active and reactive load
- Configure, test and fault-find automatic transfer switches across open, closed and delayed transition modes
- Assess standby power readiness with performance indicators and lead recovery from a total power failure

## Target Audience:

- Engineers responsible for standby and prime power generation on site
- Operators who start, load and monitor generator sets on shift
- Technicians who install, connect and commission generator and switchgear panels
- Facilities teams accountable for continuity of supply to critical loads
- Electrical supervisors who authorise switching between mains and generator supplies

## Course Outline:

### Day 1: Diesel Generator Set Fundamentals and Power System Context

- Diesel Genset Components From Engine to Alternator Terminals
- Prime, Standby and Continuous Ratings Under ISO 8528-1
- Standby Power Applications in Hospitals, Data Centres and Plants
- Single-Line Diagrams for Generator, Mains and Load Busbars
- Site Standby Power Current-State Assessment Checklist

### Day 2: Diesel Engine Systems for Generator Operators

- Fuel Supply, Day Tank and Transfer Pump Arrangements
- Lubrication and Cooling Circuits With Radiator and Jacket Water
- Air Intake, Turbocharging and Exhaust Back-Pressure Limits
- Electric Starting Systems, Batteries and Charger Monitoring
- Engine Governors and Speed Control for Frequency Stability

### Day 3: Alternator, Excitation and Voltage Regulation

- Brushless Alternator Construction and Winding Connection Options
- Automatic Voltage Regulator Settings and Voltage Droop
- Permanent Magnet Generator and Self-Excited Supply Comparison
- Alternator Capability Curve and Power Factor Limits
- ISO 8528-5 Performance Classes for Transient Voltage Response

### Day 4: Generator Control Modules and Operator Procedures

- Generator Control Module Screens, Modes and Alarm Lists
- Pre-Start Inspection Routine and Operator Logbook Entries
- Manual, Automatic and Remote Start Sequence Procedures
- Cool-Down, Normal Shutdown and Emergency Stop Procedures
- Engine and Alternator Protection Trips and Reset Rules

### Day 5: Generator Loading, Monitoring and Operating Performance

- Block Load Acceptance and Step Loading Practice
- Kilowatt, Kilovar and Power Factor Monitoring on Load
- Light Load Operation Risks and Wet Stacking Prevention
- Fuel Consumption Tracking and Running Hour Records
- Ambient Temperature and Altitude Derating of Generator Output

## Day 6: Generator Electrical Connection and Cable Installation

- Generator Output Cable Sizing and Voltage Drop Checks
- Cable Termination, Gland Selection and Busbar Connections
- Phase Rotation Verification Before First Energisation
- Control and Communication Wiring Between Genset and Panel
- Generator Room Layout, Ventilation and Access Clearances

## Day 7: Earthing, Neutral Arrangements and Generator Protection

- TN-S, TN-C-S and IT Earthing Arrangements for Generators
- Neutral Switching With Three-Pole and Four-Pole Switching Devices
- Earth Fault Protection and Restricted Earth Fault Schemes
- Generator Circuit Breaker Selection and Overcurrent Settings
- Discrimination Studies Between Generator and Downstream Breakers

## Day 8: Controlgear, Switchgear and Panel Interfaces

- ISO 8528-4 Requirements for Generator Controlgear and Switchgear
- Main Distribution Board Interfaces With Generator Incomers
- Battery Chargers, Auxiliary Supplies and Panel Heaters
- Remote Annunciation, BMS Interface and Modbus Signals
- Load Bank Connection Points for Commissioning Tests

## Day 9: Generator Commissioning and Pre-Energisation Checks

- Insulation Resistance Testing of Alternator and Cables
- Pre-Commissioning Checklist for Mechanical and Electrical Systems
- No-Load Run, Voltage and Frequency Verification
- Load Bank Commissioning Test Steps and Acceptance Records
- Protection Function Proving Before Handover to Operations

## Day 10: Guided Case Study on a Single Generator Standby Installation

- Case Study Single-Line Diagram Review and Fault Spotting
- Case Study Cable, Earthing and Breaker Selection Defence
- Case Study Start-Up Procedure Drafting for Night Shift
- Case Study Commissioning Record Review and Punch List
- Case Study Findings Briefing to Facilities Management Team

## Day 11: Synchronising Principles and Paralleling Conditions

- Voltage, Frequency, Phase Angle and Sequence Matching
- Synchroscope and Sync Lamp Methods for Manual Synchronising
- Check Synchronising Relay ANSI 25 Window Settings
- Dead Bus Closing and First-Up Generator Logic
- Consequences of Out-of-Phase Closing on Alternators and Couplings

## Day 12: Load Sharing and Parallel Control Modes

- Isochronous and Droop Speed Control for Parallel Sets
- Active Power Sharing Through Load Share Lines
- Reactive Power Sharing With Voltage Droop and VAR Control
- Base Load and Peak Lopping Operating Modes
- Circulating Current Causes and Correction Between Paralleled Sets

## Day 13: Synchronising Panel Architecture and Hardware

- Synchronising Panel Single-Line and Busbar Arrangements
- Generator Breakers, Motorised Operators and Interlocking Logic
- Paralleling Control Modules From DSE, ComAp and Woodward
- PLC-Based Synchronising Panels and HMI Operator Screens
- Panel Protection Relays for Reverse Power and Excitation Loss

## Day 14: Generator-to-Generator Paralleling Operations

- Multi-Set Start Sequence and Synchronising to Common Bus
- Load-Demand Start and Stop Scheduling Settings
- Load Add and Load Shed Priority Tables
- Duty Rotation and Running Hour Equalisation Between Sets
- Paralleled Set Fault Response and Selective Tripping

## Day 15: Generator-to-Mains Paralleling and Grid Interface

- Short-Term Mains Parallel for No-Break Return Transfer
- Long-Term Mains Parallel and Export Limitation Control
- Loss of Mains Protection With Vector Shift and ROCOF
- Utility Interface Protection and Interconnection Agreement Requirements
- Mains Parallel Import, Export and Power Factor Setpoints

## Day 16: Automatic Transfer Switch Principles and Transition Types

- IEC 60947-6-1 Transfer Switching Equipment Categories and Ratings
- Open Transition Transfer Sequence and Time Delays
- Closed Transition Transfer With Momentary Paralleling Limits
- Delayed Transition Transfer for Motor and Transformer Loads
- Bypass-Isolation and Service-Entrance ATS Configurations Compared

## Day 17: ATS Controllers, Settings and Coordination

- ATS Controller Voltage and Frequency Pickup and Dropout Settings
- Engine Start Delay, Transfer Delay and Retransfer Timers
- Mains Return Stabilisation and Generator Cool-Down Timing
- Multiple ATS Coordination With Load Priority Sequencing
- NFPA 110 Exercising Regimes for Emergency Standby Systems

## Day 18: ATS Testing, Fault Finding and Problem Cases

- Monthly Transfer Test Procedure Under Building Load
- ATS Fails to Transfer Fault-Finding Flowchart
- Contact Wear, Mechanism Inspection and Thermal Imaging Checks
- Neutral Current Problems in Three-Pole ATS Installations
- Root Cause Analysis of Failed Transfer Events

## Day 19: Standby Power Performance Measurement and Improvement

- Standby Power KPIs for Availability and Start Reliability
- Black Start and Total Power Failure Recovery Procedures
- Operator Shift Handover and Switching Authorisation Practice
- Event Log Trending and Alarm Rationalisation Reviews
- Continuous Improvement Plan for Standby Power Readiness

## Day 20: Lab Capstone and Standby Power Operating Procedure

- Lab Mains Failure Exercise From ATS Transfer to Retransfer
- Lab Two-Set Synchronising and Load Sharing Exercise
- Lab Generator-to-Mains Return Without Supply Interruption
- Lab Fault Injection and Operator Response Assessment
- Completing the Site Standby Power Operating and Switching Procedure

## Skills You Will Gain:

- Generator Control Module Operation
- Generator Room Installation Review
- Paralleling Switchgear Operation
- Load Sharing Adjustment
- Transfer Timer Coordination
- Protection Relay Setting Verification
- Standby Power Fault Diagnosis
- Switching Procedure Writing

## Why Attend This Course:

- Returns with a site standby power operating and switching procedure, ready for the facilities manager and electrical supervisor to approve and issue to shift operators
- Decides when to run sets in parallel, which set starts first and when to return the load to the mains
- Avoids out-of-phase closing, failed transfers and unplanned outages that damage equipment and interrupt critical loads
- Coaches shift operators and technicians on start sequences, synchronising checks and monthly transfer testing

## Conclusion:

Once the participant is back, the facilities manager and the electrical supervisor can approve the site standby power operating and switching procedure and issue it to shift operators as the reference for every start, synchronising and transfer action. It supports decisions on how many sets run, when to parallel with the mains and how to restore supply after a total power failure. After its first use in a monthly transfer test or a real mains failure, the organisation should review start times, transfer delays, load sharing balance and alarm records, then update the procedure.

## Frequently Asked Questions FAQ:

### Which roles should an organisation nominate for diesel generator operation, synchronising panels and ATS systems training?

Nominate the people who run and switch standby power: site power engineers, generator shift operators, technicians who install and commission generator and switchgear panels, facilities staff responsible for critical loads, and electrical supervisors who authorise switching between mains and generator supplies.

## What should nominees already do at work before a diesel generator operation, synchronising panels and ATS course?

Nominees should already operate, maintain or supervise generators or low-voltage switchgear and be able to read a single-line diagram and work under a permit to work. Prior experience of synchronising is not required; the course builds it from first principles to multi-set paralleling.

## What does an organisation receive after diesel generator operation, synchronising panels and ATS systems training?

The organisation receives a site standby power operating and switching procedure covering start-up, loading, synchronising, load sharing, mains paralleling, ATS transfer and retransfer, fault response and recovery from total power failure, ready for approval by the facilities manager and electrical supervisor.

## Which standards does diesel generator operation, synchronising panels and ATS systems training follow?

The course follows the ISO 8528 series for generating sets, including ISO 8528-1 ratings, ISO 8528-4 controlgear and switchgear and ISO 8528-5 performance classes, IEC 60947-6-1 for transfer switching equipment, and NFPA 110 as a widely used reference for exercising emergency standby systems.