Operation and Maintenance Customer Training
Gas-insulated switchgear (GIS): 10-day factory training

For anyone managing GIS assets, it is essential to understand the components, the operation and the maintenance criteria. Our training concept combines classrooms training and practical lessons in the best possible way.

The course location is ABB’s Training Center in Zurich, Switzerland.

ABB is a leader in high-voltage GIS technology with a global installed base of more than 30,000 bays.

The following program is used for reference. The program can be adjusted according to special customer needs.

Main components of the GIS:
- Circuit breaker and breaker operating mechanism
- Disconnect, earthing switch, fast acting earthing switch
- Local control modules for apparatus
- Current transformer and voltage transformer
- Static components like connecting elements & busbars
- Interface like SF₆-to-air bushing and connections to HV cables and transformers
- Metal-oxide GIS surge arresters

SF₆-Gas, SF₆-Gas handling and SF₆-Gas measuring instruments:
- SF₆-Gas properties and environmental aspects when working with SF₆-Gas
- SF₆-Gas handling equipment and application of Reclaimer (evacuating, filling, reclaiming)
- SF₆-Gas measuring instruments

Operation and Maintenance:
- Guide through the switchgear manual about instructions for operation and maintenance
- Planning and checkpoints of a maintenance tour
- Time-based and condition-based maintenance and corresponding maintenance intervals
- Rules and procedures for working with pressurized compartments and insulators
- Troubleshooting on apparatus and drives

Within this special course we offer an exclusive visit to one of our sub suppliers in Wettingen, Switzerland.
<table>
<thead>
<tr>
<th>Day 1</th>
<th>Welcome and organisation</th>
<th>Information about health and safety regulations</th>
</tr>
</thead>
</table>
|       | Circuit Breaker Model    | • Bay overview, circuit breaker mechanical design, switching principle  
|       |                          | • Demonstration of breaker movement (slow, manual speed movement, close-open operation)  |
| Day 2 | Hands-on Circuit Breaker and Operating Mechanism HMB | • Drive assembly, functions, mechanical interlocking device, hydraulic system, solenoid valves  
|       |                          | • Electrical charging, manual discharging of springs  
|       |                          | • Contacts and functions for charging status indication  
|       |                          | • Activate and deactivate alarms, blocking signals and safety lock  
|       |                          | • Check motor brushes, oil level, troubleshooting according to O&M manual  
|       |                          | • HMB modules such as motor, pump and coil, detect sources of defect and initiate remedial actions (troubleshooting) according to HMB operation and maintenance manual  |
| Day 3 | Disconnectors / (Fast Acting) Earthing Switches | Design and function  
|       | Hands on - Disconnector, Earthing Switch, Fast-acting Earthing Switch | • 3-pole assembly of switches and drive as well as gearbox assembly  
|       |                          | • Operate switch electrically with the aid of a simulator  
|       |                          | • Main contacts & gear functions, adjustments to synchronize drive mechanism with main contacts and adjustments at drive gear incl. drive rods  
|       |                          | • Practice manual operation of switch  
|       |                          | • Electrical and mechanical safety locking mechanism with simulator  
|       |                          | • Check all functions and LED status display inside drive  |
| Day 4 | Static elements | • Current and voltage transformers  
|       |                          | • Connecting bus and elbows  
|       |                          | • Lateral dismantling devices and compensators  
|       |                          | • Gas partition insulators and drying filters  
|       |                          | • Bushings, cable and transformer connections and surge arresters  |
| Day 5 | Factory Tour | • Tour around GIS assembly hall from goods reception through component assembly and components testing including test field for routine high voltage/partial discharge testing  
|       |                          | • Introduction to functional details of components, view on specific design details and quality control  |
|       | Review with Q&A | • Review the lessons of the first week  
|       |                          | • Answering open questions  |
| Day 6 | SF₆-Gas monitoring system | • Working principle of gas monitoring and tools  
|       | SF₆-Gas properties, handling and measuring | • Correlation of pressure, temperature and density (Mollier diagram)  
|       |                          | • Testing steps of density monitors with test device  
|       |                          | • Properties of SF₆ and environmental aspects of SF₆  
|       |                          | • Regulations and instructions  
|       |                          | • SF₆-measurements, instruments and values according to standards  
|       |                          | • Rated density and pressure for filling of compartment  
|       |                          | • Instructions and values for gas reclaiming and DILO reclamer functions  
|       |                          | • Limits for decomposition products  
|       |                          | • SF₆-analyzer for purity measurements (according to IEC and ABB specific)  |
| Day 7 | Operation and maintenance | • Guide through the switchgear manual, highlighting the most important subjects  
|       |                          | • Time-based maintenance, condition-based maintenance and corresponding maintenance intervals  
|       |                          | • Troubleshooting on apparatus  
|       |                          | • Visualization of maintenance and repair procedures (guided by the manual) for circuit breakers disconnector / earthing switches and SF₆-monitoring system  |
| Day 8          | Hands-on Circuit Breaker  | • Reclaim and storage of SF6-gas, flood compartment with air  
|               |                           | • Prepare tools for removing drive/arcing unit  
|               |                           | • Remove drive HMB8  
|               |                           | • Attach dismantling cart for arcing unit  
|               |                           | • Remove arcing unit  
|               |                           | • Re-insert arcing unit into enclosure  
|               |                           | • Re-connect drive HMB8  
|               |                           | • Evacuate air from CB housing  
|               |                           | • Refill SF6-gas  

| Day 9          | Visit the subsupplier  | • Visit the Surge Arrester manufacturer located in Wettingen  
|               |                           | • Visit the Density Monitor manufacturer “Trafaq” located in Bubikon  
|               |                           | • Visit the CT and VT manufacturer “Pfiffner” in Hirschthal  

The subsupplier to be visited will be selected if the manufactured parts are used within the project and the corresponding subsupplier is available to receive us.

| Day 10         | Conclusions, final discussion and hand-over of confirmation of attendance  | • Final discussion, questions and answers  
|               |                           | • Review and conclusion of all the course topics  
|               |                           | • Hand-over of certificate  

---

GIS Factory  
Zurich, Switzerland
**Important notes**

- The course language is English. If trainees do not feel comfortable to follow in English, an interpreter can be organized by the Oerlikon Training Center.
- Course documentation is in English. Documents may be translated to local language. However, English original version prevails all other.
- After training, confirmation of attendance will be issued to the course attendees.