Alstom’s Thermal Services course catalogue at a glance

PLEASE SELECT CATEGORY:
Training is investing in people and in the future of the energy industry. We know within Alstom Thermal Services that people are the key to success.

Being “dedicated to customers”, Alstom Thermal Services is putting customer’s feedback at the centre of our actions. When you told us about your growing training needs for your power plant personnel, we acted on those requirements. I am pleased to present to you our new global Thermal Services Training Course Catalogue.

Our training offering is based on decades of cumulative and proven experience that has made us world technology leaders.

We strive to provide the best training to support your teams to handle the operational or maintenance challenges they may encounter. Our specialist trainers prepare your teams to improve their competence levels on all major components. We provide tailored courses for plant operation, plant assessment, mechanical maintenance, electrical maintenance, instrumentation & controls as well as for health & safety.

Invest in your plant’s future by choosing from our training offering and benefiting from Thermal Services renowned expertise.

We are looking forward to welcoming you in one of our training centres or visiting you on any of your sites.

Michael Rechsteiner | Senior Vice President
Alstom Power Thermal Services
Skills for performance

All plant owners know the importance of ongoing training for their personnel. Particularly when seeking to avoid forced outages, minimise the risk of damage and extend component lifetime - all at the same time as increasing output in evolving markets. That is why Alstom offers a comprehensive training programme. Our courses equip your staff with general enabling skills as well as technology skills and product line expertise.

With the perfect balance of theory and hands-on practice, dedicated facilities and certified trainers, we prepare your staff to handle any operational or maintenance challenge and lay the foundations for immediate and long-term performance improvements.

A global training offer

With operations in more than 70 countries, Alstom Thermal Services has customers all over the world. Our network of training facilities includes designated training rooms and state-of-the-art training infrastructure. Furthermore, our training staff are all specialist coaches with practical service experience.

Key figures

Training centres in all our main markets
- > 150 Alstom certified training specialists
- > 1,100 training days per year
- > 3,000 customers trained per year

Every plant runs on two energy sources: Fuel and human ingenuity
Solutions

In a changing world, Alstom training solutions help to ensure that your plant reaches its full commercial, technical and clean power potential.

With a comprehensive set of courses and training programmes that are fully adapted to the needs of your operations and maintenance staff, we offer courses in our Alstom Training Centre or at your location.

Alstom offers the following training courses to fulfill your requirements:

Competence
Courses on safety and other fundamental skills that are essential basics for all types of on-site activities.

Technology
Courses for operational/maintenance skills that are platform or product independent.

Product
Courses which relate to specific Alstom or other OEM machines and/or equipment.

Skills and experience transfer
Effective training presents knowledge and imparts know-how. Practical hands-on and simulator training allows know-how to become the reflex responses that will determine the outcome in routine and critical situations.

Theory
We cover the theoretical aspects in the classroom with lectures, discussions, group work and course documentation. In addition, we expect participants to support these sessions with personal study. Guided personal studies using computer or web-based e-learning programmes are available for many courses.

Practice
We cover the practical aspects using hands-on exercises on real equipment or our plant simulator – in the training centre or at the customer’s plant.

With Alstom training, you are ready and able to reduce the cost of electricity, lower your environmental footprint and increase flexibility and reliability.
Our expertise
At Alstom, training builds on a unique OEM heritage and constant investment in service-focused R&D. Our technology also plays a key role in our courses, as we maximise know-how transfer with plenty of hands-on opportunities. This allows you to practice under real conditions and deepen your understanding.

We offer:
- state-of-the-art, web-based e-learning
- a portable plant control room simulator
- scale models and sample parts
- full-scale hardware for test and training purposes

Our unique offering: simulator-based training
Only Alstom is able to provide you with several solutions to best simulate power plant operating conditions. Some locations can offer training turbines, turbo-generators and many physical models or simulator-based training.

No risk learning with the power plant simulator
Alstom’s power plant simulator enables plant staff to train under very realistic operating conditions and thus minimise the risk of on-the-job errors.

This approach ensures a fast learning curve and helps establish unified procedures and teamwork skills. Having faced and mastered disturbances on the plant simulator, operators will respond to real challenges at their own plant with more confidence.

Training to go
Customer specific courses can be planned at your site or preferred location. Our portable training systems have been taken all over the world to train plant staff conveniently in their own premises. This also allows us to optimise the learning effect with respect to site specific conditions or customer parameters.
Your expectations met

More than 97% of Alstom training participants go home satisfied or very satisfied with the experience. During the period April 2013 to March 2014, not a single trainee answered a survey with the rating ‘not acceptable’. The overwhelming majority (73%) were ‘Very satisfied’ with both the competence of the trainers and the course design.

See you on the course!

This catalogue contains a full overview of our standard courses.

Booking an Alstom standard course is the easiest way to close specific knowledge and skill gaps or progressively develop the competence of your staff.

Convenience guaranteed

- To simplify your planning, Alstom now offers an increasing number of courses on a seat-by-seat basis with prices published in this catalogue.
- Please ask about the pricing and availability of other courses that require a full class booking.
- Courses are open to all Alstom customers.
- The class sizes are optimised for the course content.
- You have a choice of Alstom Training Centre locations.
- Customer specific courses can be planned at a location of your choice.

In case of any questions, please contact: thermal-service-training@alstom.com.

(Period: April 2013 - March 2014)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number (Percentage)</th>
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<tbody>
<tr>
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<td>Satisfied</td>
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Time for questions/discussions
Motivation to participate in group work and exercises
Clarity of instructions for all activities
Trainers’ knowledge of the training topics
## Courses

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<thead>
<tr>
<th>Operation</th>
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<th>Health &amp; safety</th>
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<td>Handling parts of steam turbines</td>
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# ALSTOM THERMAL SERVICES - CUSTOMER TRAINING COURSE CATALOGUE

## GLOBAL CURRICULUMS

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<td>Boiler inspection seminar series - Session 1 (boiler inspection fundamentals)</td>
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<tr>
<td>Boiler inspection seminar series - Session 2 (boiler component failure causes &amp; corrective repair)</td>
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<td>Boiler inspection seminar series - Session 3 (pressure part failure analysis &amp; prevention)</td>
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<td>Boiler inspection seminar series - Session 4 (advanced pressure part condition &amp; remaining life assessment)</td>
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<td>Boiler performance optimisation - Tier 1 (unit design &amp; performance)</td>
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<tr>
<td>Boiler performance optimisation - Tier 2 (NOx/CO Emissions)</td>
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<tr>
<td>HP Coal pulveriser maintenance &amp; performance training seminar</td>
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<tr>
<td>RP/RPS/RS Coal pulveriser maintenance &amp; performance training seminar</td>
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<tr>
<td>Heat recovery steam generator (HRSG) operation and inspection seminar</td>
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For more information contact us at [thermal-service-training@alstom.com](mailto:thermal-service-training@alstom.com)
COMPETENCE

- Lifting facilities: Level 1 lifting & slinging (training)
- CCNSG Safety passport - National course
- CCNSG Safety passport - Renewal
- IOSH - Managing safely
- Instrumentation - ON / OFF and analogue sensors
- Instrumentation - Actuators & regulation
- Instrumentation - Basic principles
- Electrical engineering - Electrical protections (medium & low voltage distribution network)
- Electrical engineering – Transformer protections & high voltage substations
- Electrical engineering – Power lines electrical protection
- Centrifugal pumps - General description
TECHNOLOGY
- Practical bearing inspection
- Lube oil systems function & inspection
- Pipe fitting handling
- Practical levelling work
- Practical shaft alignment
- Practical turbine maintenance (hands-on rotating equipment training)
- Mechanical practical artisan training
- ADVANT with 05520
- ADVANT with IIT800xA
- AC800M with IIT800xA

PRODUCT
- GT26 Gas turbine systems
- GT13E2 Gas turbine systems
- GT13E2 Mechanical systems & components
- GT13E2 Inspection
- GT26 Mechanical systems & components (with retractable EV burner)
- GT26 Inspection (with retractable EV burner)
- Simulator based CCPP process training, GT related
- Simulator based CCPP process training, overall CCPP
STEAM

TECHNOLOGY
- Electrical engineering - Introduction to commissioning and measurement
- Turbines and generators joint bolting techniques
- Thermal processes - Basic principle & the thermal process simulator
- Thermal power stations - Water/steam cycles
- Shaft alignment of turbogenerator sets
- Handling parts of steam turbines
- Steam turbines - Overall description
- Steam turbines - Diaphragm alignment in a turbine casing - Basic & principles
- Steam turbines – Maintenance principles
- Steam turbines blading - Basic information
- Industrial steam turbines - General overview for risk assessment
- Steam turbines maintenance
- Steam turbines - General description
- TM2 Industrial steam turbines – Overall description
- Industrial steam turbines maintenance (practical exercises)

PRODUCT
- Simulator based CCPP process training, ST related
- Thermodynamics applied to steam turbines
TECHNOLOGY
- Thermal & combined cycle electrical power stations - Operation
- Electrical engineering – Generator electrical protections
- Excitation - Analogue voltage regulation for generators
- Excitation - Digital voltage regulation for generators
- Hydrogen cooled generator with stator water and auxiliary systems
- Air cooled generators for steam turbines
- Air cooled generators for gas turbines
- Generators in hydrogen and auxiliary systems - Description running & incidents
- Hydrogen cooled generators and auxiliary systems (basics, operating principles, running and incidents)
- Hydrogen cooled generators and auxiliary systems (operating principles, running and incidents on simulator)
- Hydrogen cooled generators and auxiliary systems (description, monitoring and incidents on simulator)
- Air and hydrogen cooled generators - Basic and operating principles
- Air cooled generators - Basic and operating principles

PRODUCT
- Protection system REG216 maintenance
- Protection system MiCOM maintenance
- Generator H2 cooling systems operation & maintenance
- Electrical operation & maintenance overview (air cooled generator & auxiliaries)
TECHNOLOGY

- Power plant steam generators - Design & operation
- Power plant steam generators - Combustion

PRODUCT

- Boiler inspection seminar series - Session 1 (boiler inspection fundamentals)
- Boiler inspection seminar series - Session 2 (boiler component failure causes & corrective repair)
- Boiler inspection seminar series - Session 3 (pressure part failure analysis & prevention)
- Boiler inspection seminar series - Session 4 (advanced pressure part condition & remaining life assessment)
- Boiler performance optimisation seminar - Tier 1 (unit design & performance)
- Boiler performance optimisation seminar - Tier 2 (NOx/CO Emissions)
- HP Coal pulverisers maintenance & performance training seminar
- RP/RPS/RS Coal pulverisers maintenance & performance training seminar
- Heat recovery steam generators (HRSG) operation and inspection seminar
Lifting facilities
Level 1 lifting & slinging (training)

COMPETENCE | FTC001

TARGET PROFILE
- Employees who need to monitor and review health and safety in the workplace

OBJECTIVES
On completion of the course, participants will have learned:
- Their statutory duties under the Health & Safety at Work Act 1974 and other statutory duties
- The correct procedure for using the pendant controller
- Safe methods of slinging
- The importance of weight and centre of gravity in relation to the safe working load of the lift tackle

Content

Statutory requirements:
- The Health & Safety at Work Act 1974
- Management of Health and Safety at Work Regulations 1999
- Powers of the inspectorate
- The Provision & Use of Work Equipment Regulations 1998 (an overview)
- The lifting operations & lifting equipment Regulations 1998 (an overview)
- Introduction to SAPI
- Manual handling, working at height including harness training

Introduction to slinging:
- Types of slings available
- Correct use of slings
- Use of chain blocks

Methods of slinging:
- Choice of equipment to suit SWL
- Angles of lifts
- Configuration of slings
- Weight assessment/centre of gravity
- Load packing

Method of slinging (Equipment):
- Slings - nylon, wire rope
- Chain blocks, Tirfors, pull-lifts, shackles, eye-bolts, jacks, skates, pinch bars

Practical lifting:
- Planning the lift and inspection of the load to be lifted
- Establish the weight and centre of gravity
- Selection of method and equipment
- Safe route planning, load lifting and movement
- Job completion procedure
- Practical assessment and theory test

Please Note: Other levels of rigging and lifting courses are available covering various competencies at ‘training’ and ‘assess and test’ level to take a novice to a lifting supervisor

Course Information

Location:
- Rugby

Course Price:
- This course is sold per seat at £400

Email:
rp-training-facility@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE
- Employees without a valid safety passport

OBJECTIVES
On completion of the course, participants will be able to:
✓ Demonstrate their understanding of safe working practices with tests during the course which will lead to the award of their passport

Content

**Course outline and topics:**
- Safe behaviour at work
- Safe place of work
- Confined space entry
- Excavations
- Permit to Work systems
- Safe use of access equipment & working at heights
- Site transport
- Protecting the environment
- Safe lifting and manual handling
- Safe systems of work
- Asbestos
- Hazardous substances
- LOLER
- PUWER
- Electricity
- Isolation
- Hand-arm vibration
- Noise

Course Information

**Location:**
- Stafford & Rugby
- Customer premises

**Course Price:**
- This course is sold per seat at £150
TARGET PROFILE

- Employees with a valid safety passport that is no more than three months after its expiry date

OBJECTIVES

On completion of the course, participants will be able to:
- Demonstrate their understanding of leadership and health and safety with a test at the end of the course

Content

Course outline and topics:
- Safe behaviour at work
- Safe place of work
- Confined space entry
- Excavations
- Permit to Work systems
- Safe use of access equipment & working at heights
- Site transport
- Protecting the environment
- Safe lifting and manual handling
- Safe systems of work
- Asbestos
- Hazardous substances
- LOLER
- PUWER
- Electricity
- Isolation
- Hand-arm vibration
- Noise

Course Information

Location:
- Stafford & Rugby
- Customer premises

Course Price:
- This course is sold per seat at £100

Email: rp-training-facility@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Operative staff who are required to lift and move loads in their workplace using lifting and slinging techniques and equipment

OBJECTIVES

On completion of the course, participants will be able to:

✓ Demonstrate their understanding of health and safety with tests during the course which will lead to the award of the certificate

Content

Course outline and topics:

- Managing safely
- Assessing risks
- Controlling risks
- Understanding your responsibilities
- Identifying hazards
- Investigating accidents and incidents
- Measuring performance
- Protecting our environment

Course Information

Location:

- Stafford & Rugby
- Customer premises

Course Price:

- This course is sold per seat at £400

Prerequisites

- Candidates will be required to take a short Knowledge Test before progressing to the practical demonstration. They will then be assessed during the practical demonstration
Instrumentation
ON/OFF and analogue sensors

TARGET PROFILE
- Technicians working in an energy production power plant

OBJECTIVES
On completion of the course, participants will be able to:
- List the various symbols employed in the measurement of temperature, analogue output values, pressure and level
- List the various signals
- List physical units
- Set the scale of an analogue detector
- Convert signals delivered by the sensor into measured physical heights
- Define the necessary equipment for an intervention
- Use the testing procedures

Content

Measures of temperature:
- Safety rules - Responsibility
- Management obligations
- Crane driver, specific lifting devices
- Anomaly

Measures of analogue output values

Measures of flow:
- The membranes
- The other measures of current (knowledge of the different types of measures)
- Setting of a delta-P force-balance converter
- Setting of a delta-P analogue transformer
- Setting of a delta-P digital transformer

Measures of level:
- Measure of level by delta-P
- The other measures of level
- Setting of a level converter by torque tube

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mathematical bases : units conversion and scale changes

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
COMPETENCE | IPA-IS-03

TARGET PROFILE
- Technicians working in an energy production power plant

OBJECTIVES
On completion of the course, participants will be able to:
- List the different signals
- List the physical units
- Verify the actuators and in particular the control valves
- Regulate and set PID regulators
- Verify and set the control valve actuators
- Make simple settings of PID regulators
- Define the material necessary for an intervention
- Use testing procedures

Content

**Physical properties:**
- Signals used in instrumentation
- Electropneumatic converters

**Actuators:**
- Actuators
- Valves body
- Servomotors
- Valves positioners

**Regulation:**
- Knowledge of centrifugal pumps
- Regulation main principles
- Knowledge of PID regulators

Course Information

**Location:**
- La Courneuve

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mathematical basics: units conversion and scale change
- Basic instrumentation knowledge (participation to the Instrumentation – ON/OFF and analogue sensors » IPA-IS-02 training course is preferable)

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- People who want a basic knowledge of simple instrumentation work

OBJECTIVES

On completion of the course, participants will be able to:

- Know the principles used for the measurement of temperature, flow, current and level
- List the different signals
- List the physical units

Content

The instrumentation loop
- Measurement units
- Presentation of the different measures
- Instrumentation channel principle

Current measurement
- Detector basic principles
- Assembling principle

Flow measurement
- Detector basic principles
- Assembling principle

Level measurement
- Detector basic principles
- Assembling principle

The temperature loop
- Detector basic principles
- Assembling principle

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mathematical basics: units conversion and scale change

Method of Training

- Presentation including group work and exercises

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Sales or design engineers in charge of the electrical operation of electrical power installations

OBJECTIVES

On completion of the course, participants will be able to:

✓ Be familiar with the electrical board’s electrical protections overall
✓ Identify the different types of faults that could happen on an electrical board
✓ List the distribution board electrical protections and describe their functions
✓ Set and test the distribution board electrical protection relays
✓ Validate the protections calculation note drawn up by the design office
✓ Verify the secondary loops of current and voltage transformers

Content

**Repetition:**
- Basic knowledge of alternative current
- Circuit breaker failure
- Single line diagram
- Short-circuit currents
- Current and voltage transformers
- Principle of symmetrical components

**Theoretical functioning:**
- Electrical boards
- Selectivity basics
- Motors’ operation
- Chargers/uninterruptible power supply
- Sources transfers

**Motors’ and boards’ protection:**
- The various types of protections (ANSI standard)
- Description of the protections
- Injection and adjustment of protection relay’s parameters

Course Information

**Location:**
- La Courneuve

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

**Prerequisites**
- Mathematical knowledge: complex numbers, vectors, trigonometry
Electrical engineering
Transformer protections & high voltage substations

TARGET PROFILE
- Sales or design engineers in charge of the electrical operation and maintenance of electrical power installations

OBJECTIVES
On completion of the course, participants will be able to:
✓ Be familiar with transformer and high voltage station electrical protection
✓ Identify the different type of faults that could happen on a transformer
✓ List the electrical protections and describe their functions
✓ Set and test the electrical protection relays
✓ Validate the protection calculation note drawn up by the design office
✓ Verify the secondary loops of current and voltage transformers

Content

Reminders:
- Basic knowledge of alternative current
- Circuit breaker failure
- Single line diagram
- Short-circuit currents
- Current and voltage transformers
- Principle of symmetrical components

Theoretical functioning:
- Transformers functioning
- Digital indications
- Type of station/architecture
- Different diagrams of station

The transformer’s protection:
- The different types of protections (ANSI standard)
- Description of the Buchholz type protections
- Description of the protections by relays
- Voltage & current injection and adjustment of protection relay’s parameters

The high voltage station protection:
- Busbar protections: busbar differential and directional protections
- Protections and circuit breaker failure (poles discrepancy)

Course Information
Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mathematical knowledge: complex numbers, vectors, trigonometry

INFORMATION & REGISTRATION
Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- People in charge of the electrical operation and maintenance of electrical power installations

OBJECTIVES

On completion of the course, participants will be able to:

✓ Master the high voltage line electrical protection as a whole
✓ Identify the different type of faults that could happen on a high voltage line
✓ List the line electrical protection protections and describe their functions
✓ Set and test the line electrical protection relays
✓ Validate the protection calculation note drawn up by the design office
✓ Verify the secondary loops of current and voltage transformers

Content

Reminders:
- Basic knowledge of alternative currents
- Principle of symmetrical components

Electrical power network:
- The structure of electrical power network
- Type of faults (short-circuit, insulation failure, overload, power swing)
- Fault current calculation
- Definition and calculation of equivalent impedance

Power Lines Protections:
- Longitudinal differential protection
- Protections against resistance phase-ground defaults (directional comparison & ground over power)
- Protections against overloads
- Protections against circuit breaker fault

Distance protection:
- R X Diagram of functioning
- Measure of the default distance
- Detection of power fluctuations
- Diagrams of teleaction
- Re-trip
- Localisation of the fault

Electrical Protections:
- Longitudinal differential protection
- Protections against resistant phase-ground defaults (directional comparison & ground over power)
- Protections against overloads
- Protections against circuit breaker fault

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mathematical knowledge: complex numbers, vectors, trigonometry

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Centrifugal pumps

General description

TARGET PROFILE
- Engineers and technicians

OBJECTIVES

On completion of the course, participants will be able to:
- Understand the characteristic curves
- Distinguish the various materials and how to choose the heat treatments
- Choose and interpret the NDT (Non destructive testing)
- Recognise the various types of centrifugal pump and their components
- Understand the principle of the pumps’ operation
- Analyse the causes of degradation and the solutions considered

Content

Pump general design:
- General data of dimensioning, general dimensioning on the hydraulic level, definition of the fluid flow
- Mechanical design: Forces occurring generated in a pump (hydrostatic pressure, axial and radial thrusts), various types of bearing pedestal and thrust bearing, various types of shaft end sealing, materials used according to the fluid
- Monitoring of the pumps (temperatures, vibrations), principal centrifugal pumps used in the nuclear power plants
- Various types of flow, basic laws governing the fluids moving
- The triangle of speeds applied to the pumps and their characteristic curves
- Various types of centrifugal pumps, cavitation

Materials:
- Materials’ manufacturing process
- Standardised designation of steels
- Heat treatments
- Erosion and corrosion
- Mechanical tests, creep, relieving

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Advanced mechanical knowledge

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ Perform a bearing inspection
✓ Use the bearing technical documentation correctly
✓ Plan and prepare a bearing inspection
✓ Fill in the quality documents

Content

**Bearing casing:**
- Function and design of bearing casings
- Quality documents

**Pocket bearings, insulated pocket bearings:**
- Function and design of pocket bearings
- Installation and removal of a pocket bearing
- Checks and measurements performed during installation and removal
- Quality documents used during installation and removal

**Combined axial and radial bearings:**
- Function and design of combined bearings
- Installation and removal of a combined bearing
- Checks and measurements performed during installation and removal
- Quality documents used during installation and removal

Course Information

**Location:**
- Birr

**Course Price:**
- This course is sold per seat at €3200
- Fleet training

**Prerequisites**
- Have an elementary background of power plants
- Have a mechanical background
- Be familiar with the erection of power plants

**Method of Training**
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical exercises in turbine training
Lube oil systems functions & inspection

TARGET PROFILE

- Mechanical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:

✓ Explain the function of the lube oil system
✓ List the components of the lube oil system
✓ Explain the start of the lube oil system
✓ Find and use the operating instructions for the lube oil components
✓ Read and apply the specification for lube oil

Content

Lube oil system:
- Overall purpose and function of the lube oil system
- Main components of the lube oil system
- Normal starting and operation of the lube oil system
- Typical operating parameters like lube oil pressure and lube oil temperature
- Operation and maintenance manual:
  - Finding the main components in the manual
  - Finding the operation procedures in the manual

Jacking oil system:
- Overall purpose and function of the jacking oil system
- Main components of the jacking oil system
- Normal starting and operation of the jacking oil system
- Operation and maintenance manual:
  - Finding the main components in the manual
  - Finding the operation procedures in the manual

Inspection and overhaul:
- Temporary modification required to operate the systems safe during inspection and overhaul

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €1600
- Fleet training

Prerequisites

- Have an elementary background of power plants
- Have a mechanical background
- Be familiar with the erection of power plants

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ List the different types of fittings
✓ List the requirements for fittings
✓ Assemble Ermeto, Swagelok and Bosch fittings correctly
✓ Use tools and equipment correctly
✓ Explain the assembly of Parker, Dilo and Serto fittings

Content
- Function and design characteristic of following pipe fitting types:
  - Ermeto fittings
  - Swagelock fittings
  - Bosch fittings
  - Parker fittings
  - Dilo fittings
  - Serto fittings

- Theory of assembly and reassembly of these fittings

- Practical exercise on Swagelok, Ermeto and Bosch fittings:
  - Preparing the pipe for the fitting
  - First assembly of the fitting
  - Procedure for loosening and re-tightening pipe fittings

- Qualifying test to assemble and handle Swagelok fittings

- Correct handling and storage of pipes after removal

- Safety precautions for assembling and handling pipe fittings

Course Information
Location:
- Birr

Course Price:
- This course is sold per seat at €1600
- Fleet training

Prerequisites
- Have an elementary background of power plants
- Have a mechanical background
- Be familiar with the erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical work on training equipment
Practical levelling work

TECHNOLOGY | 10305

TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- List the operations for which the levelling instrument is required
- Explain the function of the levelling instrument
- Test the levelling instrument
- Take measurements with the levelling instrument

Content
Purpose and applications of leveling in power plants:
- Typical measurements and checks using the levelling instrument
- Transferring of heights
- Measuring of level differences
- Use of the levelling tool for new erections and revisions

The levelling instrument:
- Functional check of the levelling instrument
- Use of a levelling instrument
- Safety precautions while using a levelling instrument

Practical exercise:
- Levelling of a turbine foundation
- Transferring heights
- Measuring level differences

Course Information
Location:
- Birr

Course Price:
- This course is sold per seat at €2400
- Fleet training

Prerequisites
- Have an elementary background of power plants
- Have a mechanical background
- Be familiar with the erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical work in the training centre

Email:
training.center.birr@power.alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Mechanical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:
- List the types of couplings and their use
- Perform preparation work prior to uncouple and couple rotors
- Tighten the couplings (cold, warm, hydraulic)
- Measure the axial and radial position of the shaft
- Use the measuring tools for shaft alignment correctly
- Find the tolerance of various couplings by using the technical documentation

Content

**Rotor couplings:**
- The various types of couplings used in power plants:
  - Toothed couplings
  - Self friction clutch coupling
  - Shear bush coupling
  - Expansion sleeve coupling
- Preparation work prior to uncouple and couple rotors:
  - Use of the technical documentation for coupling and uncoupling
  - Finding the coupling tolerances in the technical documentation
  - Safety precautions for coupling and uncoupling rotors
- Condition assessment and testing of:
  - Coupling bolts
  - Coupling nuts
  - Friction parts
  - Expansion sleeve
  - Coupling flanges
- Tighten the coupling bolts:
  - Cold tightening
  - Warm tightening
  - Hydraulic tightening
  - Safety precautions while tightening coupling bolts
- Installation and tightening of an expansion sleeve coupling

**Shaft Alignment:**
- Preparation work prior to measure rotor position:
  - Use of the technical documentation for shaft alignment
  - Finding the alignment tolerances in the technical documentation
  - Safety precautions for measuring shaft alignment
- Measuring of shaft alignment:
  - Measuring the axial position
  - Measuring the radial position
  - Using the measuring tools correctly
  - Common mistakes while measuring rotor position
  - Calculation of the rotor position
  - Determining if the rotor is positioned correctly

Course Information

**Location:**
- Birr

**Course Price:**
- This course is sold per seat at €4000
- Fleet training

**Prerequisites**
- Have an elementary background of power plants
- Have an elementary technical background
- Be familiar with the erection of power plants

**Method of Training**
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical exercises on the shaft alignment model

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**INFORMATION & REGISTRATION**

**Email:** training.center.birr@power.alstom.com
  thermal-service-training@alstom.com
TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ Work with heavy turbine parts
✓ Perform the adjustment of the turbine parts including the rotor, inner and outer casings by using shims
✓ Perform the measurements to be taken before, during & after an A, B or C inspection
✓ Apply the procedure to tighten elongation bolts cold, warm or with the hydraulic tensioning device
✓ Assess various turbine parts such as labyrinth seals, blade carriers, rotor blading, adjusting keys, casings, flanges and piping

Course Information
Location:
- Birr

Course Price:
- This course is sold per seat at €12000
- Fleet training

Prerequisites
- Have a mechanical background
- Be familiar with the service or erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Hands-on training on the training turbine

Technical Training Centre: BIRR
15 Days | 8 Trainees (max)

Content
Course outline and topics:
- Design & function of the main parts of a turbine
- Hands-on training in handling of heavy turbine parts
- Hands-on training on adjusting of turbine parts
- Hands-on training on taking various measurements before, during and after an overhaul
- Condition of turbine parts, what needs to be checked during an overhaul
- Hands-on training on tightening the various bolts correctly
TARGET PROFILE

- Mechanical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:

✓ Execute the basic mechanical manufacturing techniques like manual work and lathing, milling and assembly work
✓ Reach confidence in the fields of safety at work, reading of drawings, manufacturing and machine production, tools, measuring equipments and auxiliaries, through practice oriented work
✓ Understand and gain experience on the work with conventional mechanical manufacturing
✓ Apply the learned techniques in technical environment and workshops

Content

Course outline and topics:

- Ability of self controlled and confident independent working
- How to use the personal protective equipment
- Safe working with workshop machines and mechanical equipment, EHS aspects
- Interpreting and implementation of workshop drawings: design, dimensions, tolerances (in general, also for IT-systems), surfaces
- Learning measuring methods, measuring devices like sliding gauge, depth gauge, micrometer, limit gauge, surface standard
- Distinguishing and machining different materials
- Filing and de burring
- Overview on welding techniques, practicing welding
- Applying assembly tools, bolts, locking elements, assembly of pins
- Naming and utilising of tools and machinery
- Calculation of: cutting speed, rotational speed, feed etc
- Application of drilling, lathing and milling techniques

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat
- Course price to be issued on request

Prerequisites

- Be able to read technical documents, have a mechanical background,
- Have a good command of the English language in speaking and writing

Method of Training

- Practical work in the workshop

Email:
training.center.birr@power.alstom.com
thermal-service-training@alstom.com
ADVANT with OS520

TECHNOLOGY | 79530

TARGET PROFILE
- I&C maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- Understand the control system architecture and functional description of components
- Understand the communication protocols and hardware configuration
- Trace signals, programme modifications and generate codes
- Understand the UNIX commands for OS520 and graphic display design
- Perform maintenance and troubleshooting

Content
Course outline and topics
- Control system architecture and functional description of components
- Configuration of ADVANT controllers using the engineering tool
- Application Builder, Function Chart Builder, Online Builder Commands
- Communication protocols used within the ADVANT System
- DB elements used in ADVANT System, signal tracing exercises
- UNIX commands for OS520, X-workplace server, startup via XDM login process
- Designing a graphic display in OS520
- Maintenance and troubleshooting with the ADVANT system

Course Information
Location:
- Birr
- Customer premises

Course Price:
- This course is sold per seat at €4000
- Fleet training

Prerequisites
- Have fundamental skills regarding combined cycle power plants and considerable I&C experience with ADVANT systems

Method of Training
- Theoretical and practical work with ADVANT Controllers (AC160, AC450, OS520 and ADVA Build engineering station)
- Practical exercises on real life experiences
- Group works and interactive workshops

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
ADVANT with IIT800xA

TARGET PROFILE
- I&C maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- Understand the control system architecture and functional description of components
- Understand the communication protocols and hardware configuration
- Trace signals, programme modifications and generate codes
- Understand the Aspect Server and Connectivity Server of IIT800xA
- Perform maintenance and troubleshooting

Content

Course outline and topics
- Control system architecture and functional description of components
- Configuration of ADVANT controllers using the engineering tool
- Application Builder, Function Chart Builder, Online Builder Commands
- Communication protocols used within the ADVANT System
- DB elements used in the ADVANT system
- Structures of IIT800xA engineering workplace
- Overview of the configuration of the IIT800xA system
- Uploading of objects from the MB300 uploader
- Designing a graphic display using VB 6.0
- Maintenance and troubleshooting with ADVANT and IIT800xA system

Course Information

Location:
- Birr
- Customer premises

Course Price:
- This course is sold per seat at €4000
- Fleet training

Prerequisites
- Have fundamental skills regarding combined cycle power plants and considerable I&C experience with ADVANT and IIT800xA systems

Method of Training
- Theoretical and practical work with ADVANT Controllers (AC160, AC450 and ADVABuilt engineering station and Combined Aspect Connectivity Server)
- Practical exercises on real life experiences
- Group works and interactive workshops

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
     thermal-service-training@alstom.com
TARGET PROFILE
- I&C maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- Understand the control system architecture and functional description of components
- Understand the communication protocols and hardware configuration
- Trace signals, programme modifications and generate codes
- Understand the Aspect Server and Connectivity Server of IIT800xA
- Work with Control Builder M and Function designer
- Perform maintenance and troubleshooting

Content
Course outline and topics
- Control system architecture and functional description of components
- Structures of the IIT800xA engineering workplace
- Overview of the configuration of the IIT800xA system
- AC800M hardware configuration using the Control Builder M Professional
- Working with Function Designer
- Designing a graphic display using VB 6.0
- Maintenance and troubleshooting with IIT800M and IIT800xA system

Course Information
Location:
- Birr
- Customer premises

Course Price:
- This course is sold per seat at €4000
- Fleet training

Prerequisites
- Have fundamental skills regarding combined cycle power plants and considerable I&C experience with AC800M and IIT800xA systems

Method of Training
- Theoretical and practical work with the AC800M controllers training station and the combined aspect connectivity server
- Practical exercises on real life experiences
- Group works and interactive workshops

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
GT26 Gas turbine systems

REVIEWED BY

TECHNICAL TRAINING CENTRE: BIRR

| PRODUCT | 20204 |

TARGET PROFILE
- Operation personnel

OBJECTIVES
On completion of the course, participants will be able to:

✓ Describe the purpose, design and function of the GT’s sub-systems as lube oil, jacking oil, power oil, fuel and NOx water systems, air intake, variable guide vanes, blow-off valves etc.
✓ Explain the monitoring and protection concept of the GT
✓ Describe the concept, design and functions performed by the electro-hydraulic safety system
✓ Explain the routine operational maintenance procedure
✓ Explain the cooling of the components exposed to high temperatures
✓ List walk down checks during the different operation modes of the GT

Content

GT26 thermal block:
- Main components
- Parts dimensions, weight and function

Gas turbine systems:
- Purpose, design and function of the following systems:
  - Lube oil system
  - Jacking oil system
  - Power oil system
  - Fuel gas system
  - Fuel oil system
  - NOx water system
  - Air intake system
  - Variable inlet guide vanes
  - Blow off valves

Gas turbine operation:
- Using the operation and maintenance manuals
- Using the P&I diagrams and single line diagrams
- Using the operating instructions including typical process set points and process values
- Purpose, design and function of the gas turbine monitoring and protection system
- Concept of the electro-hydraulic safety system
- Testing of the gas turbine protection system:
  - Trip block testing
  - Over speed simulation
  - Load rejection
  - Cooling of the gas turbine hot gas parts

Gas turbine maintenance:
- Daily maintenance
- Weekly maintenance
- Walk down check of the gas turbine:
  - During standstill
  - Prior to the start
  - During operation of the gas turbine

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €2400
  - Fleet training

Prerequisites
- Have fundamental skills regarding combined cycle power plants and considerable field experience

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Site and equipment visits
- Open discussions

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
GT13E2 Gas turbine systems

TARGET PROFILE

- Operation personnel

OBJECTIVES

On completion of the course, participants will be able to:
- Yes: Describe the purpose, design and function of the GT’s sub-systems as lube oil, jacking oil, power oil, fuel and NOx water systems, air intake, variable guide vanes, blow-off valves etc.
- Yes: Explain the monitoring and protection concept of the GT
- Yes: Describe the concept, design and functions performed by the electro-hydraulic safety system
- Yes: Explain the routine operational maintenance procedure
- Yes: Explain the cooling of the components exposed to high temperatures
- Yes: List walk down checks during the different operation modes of the GT

Content

GT13E2 thermal block:
- Main components
- Parts dimensions, weight and function

Gas turbine systems:
- Purpose, design and function of the following systems:
  - Lube oil system
  - Jacking oil system
  - Power oil system
  - Fuel gas system
  - Fuel oil system
  - NOx water system
  - Air intake system
  - Variable inlet guide vanes
  - Blow off valves

Gas turbine operation:
- Using the operation and maintenance manuals
- Using the P&I diagrams and single line diagrams
- Using the operating instructions including typical process set points and process values
- Purpose, design and function of the gas turbine monitoring and protection system
- Concept of the electro-hydraulic safety system
- Testing of the gas turbine protection system:
  - Trip block testing
  - Over speed simulation
  - Load rejection
  - Cooling of the gas turbine hot gas parts

Gas turbine maintenance:
- Daily maintenance
- Weekly maintenance
- Walk down check of the gas turbine:
  - During standstill
  - Prior to the start
  - During operation of the gas turbine

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €2400
- Fleet training

Prerequisites

- Have fundamental skills regarding combined cycle power plants and considerable field experience

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Site and equipment visits
- Open discussions

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
GT13E2 Mechanical systems & components

TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- Describe the design and function of a GT13E2
- Describe the systems of the GT13E2 and explain their functions
- List the components of the GT13E2 and explain their functions

Content

GT13E2 thermal block:
- Main components
- Parts dimensions, weight and function

Gas turbine systems:
- Purpose, design and function of the following systems:
  - Lube oil system
  - Jacking oil system
  - Power oil system
  - Fuel gas system
  - Fuel oil system
  - NOx water system
  - Air intake system
  - Variable inlet guide vanes
  - Blow off valves

Gas turbine technical documentation:
- Working with the operation manual
- Using the maintenance manuals:
  - Assembly and disassembly procedures
  - Working with quality documentation and test certificates
- Exercises finding the required documents in the maintenance manual

Gas turbine components:
- Purpose, design and function of the gas turbine main components:
  - Compressor
  - Combustion chamber
  - Turbine
  - Rotor
  - Blades and vanes
  - Bearings
  - Instrumentation to the thermal block
  - Sealing and cooling air

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €5600
- Fleet training

Prerequisites
- Be able to interpret technical documents such as the Piping & Instrumentation Diagram (P&ID) and drawings
- Have a mechanical background
- Be familiar with the service or erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Mechanical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:

- State the purpose and the duration of the three types of inspection on the gas turbine (A, B, C)
- Explain the tasks to be carried out during a C-inspection
- Describe step by step the procedures for disassembling and reassembling the machine
- Use the relevant documentation

Course outline and topics:

- Preparation for a C-inspection
- Manpower planning
- Setting up the site for the inspection
- Documentation:
  - O&M manuals and test certificates
  - Disassembly and reassembly of the turbine instrumentation
  - Step by step sequences for disassembly, inspections, and reassembly of all turbine components
- Special tools for disassembly and reassembly
- Alignment of the outer and inner casing to the rotor (Radial rotor position)
- Coupling alignment
- Preparatory work for start-up of the gas turbine and cleaning of systems
- Preparatory work up to “motor roll”
- Preparatory work for first ignition after the inspection

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €8000
- Fleet training

Prerequisites

- Have a mechanical background
- Be familiar with the service or erection of power plants

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises
GT26 Mechanical systems & components
With retractable EV burner

PRODUCT | 20305

TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ Describe the design and function of a GT26
✓ Describe the systems of the GT26 and explain their functions
✓ List the components of the GT26 and explain their functions

Content

GT26 thermal block:
- Main components
- Parts dimensions, weight and function

Gas turbine systems:
- Purpose, design and function of the following systems:
  - Lube oil system
  - Jacking oil system
  - Power oil system
  - Fuel gas system
  - Fuel oil system
  - NOx water system
  - Air intake system
  - Variable inlet guide vanes
  - Blow off valves

Gas turbine technical documentation:
- Working with the operation manual
- Using the maintenance manuals:
  - Assembly and disassembly procedures
  - Working with quality documentation and test certificates
- Exercises finding the required documents in the maintenance manual

Gas turbine components:
- Purpose, design and function of the gas turbine main components:
  - Compressor
  - Combustion chamber
  - Turbine
  - Rotor
  - Blades and vanes
  - Bearings
  - Instrumentation to the thermal block
  - Sealing and cooling air

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €8000
- Fleet training

Prerequisites
- Be able to interpret technical documents such as the Piping & Instrumentation Diagram (P&ID) and drawings
- Have a mechanical background
- Be familiar with the service or erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises

Email:
- training.center.birr@power.alstom.com
- thermal-service-training@alstom.com
GT26 Inspection
With retractable EV burner

PRODUCT | 20306

TARGET PROFILE
- Mechanical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
- State the purpose and the duration of the three types of inspection on the gas turbine (A, B, C)
- Explain the tasks to be carried out during a C-inspection
- Describe step by step the procedures for disassembling and reassembling the machine
- Use the relevant documentation

Content
Course outline and topics:
- Preparation for a C-inspection
- Manpower planning
- Setting up the site for the inspection
- Documentation:
  - O&M manuals and test certificates
  - Disassembly and reassembly of the turbine instrumentation
  - Step by step sequences for disassembly, inspections, and reassembly of all turbine components
  - Special tools for disassembly and reassembly
  - Alignment of the outer and inner casing to the rotor (Radial rotor position)
  - Coupling alignment
  - Preparatory work for start-up of the Gas Turbine and cleaning of systems
  - Preparatory work up to “motor roll”
  - Preparatory work for first ignition after the inspection

Course Information
Location:
- Birr

Course Price:
- This course is sold per seat at €8000
- Fleet training

Prerequisites
- Have a mechanical background
- Be familiar with the service or erection of power plants

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
Simulator based CCPP process training

GT Related

PRODUCT   | 81212

TARGET PROFILE

- Operation personnel
- Electrical maintenance personnel
- I&C maintenance personnel
- Mechanical maintenance personnel
- General staff

OBJECTIVES

On completion of the course, participants will be able to:

✓ Have a strong conceptual understanding of the CCPP and the process dynamics
✓ Understand the operation concept of the Gas Turbine on fuel gas and fuel oil operation
✓ Understand the startup prerequisites and startup procedure of the whole CCPP using unit master/manual startup
✓ Understand the process behaviour during plant transient conditions and equipment malfunctions
✓ Analyse the plant transients and trips

Content

Course outline and topics:
- Introduction to the simulator equipment and working environment, basics about the HMI
- Refresher about the Gas Turbine systems
- GT operation concept on fuel gas and fuel oil, GT protection concept, Handling GT PLS(T), TRIP
- GT startup prerequisites from HRSG/WSC GT startup sequencer steps GT load operation and release criteria at GT min load, GT hold points
- GT fuel switch-over from fuel gas to fuel oil and fuel oil to fuel gas
- GT online and offline compressor wash
- GT forced cooling
- CCPP startup and shutdown procedures

Course Information

Location:
- Birr
- Customer premises

Course Price:
- This course is sold per seat at €4000
- Fleet training

Prerequisites

- Have an elementary background of power plants

Method of Training

- Theoretical and practical work with a full scope simulator
- Practical exercises on real life experiences
- An evaluation test based on real life experiences
- Group works and interactive workshops

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
Simulator based CCPP process training

Overall CCPP

PRODUCT | 81302

TECHNICAL TRAINING CENTRE: BIRR

| | 📅 5 Days | ⛔ 6 Trainees (max)

TARGET PROFILE

- Operation personnel
- Electrical maintenance personnel
- I&C maintenance personnel
- Mechanical maintenance personnel
- General staff

OBJECTIVES

On completion of the course, participants will be able to:

✓ Have a strong conceptual understanding of the CCPP and the process dynamics
✓ Understand the process behaviour during plant transient conditions and equipment malfunctions
✓ Analyse the plant transients and trips

Content

Course outline and topics:
- Introduction to the simulator equipment and working environment, basics about the HMI
- Refresher about the GT/ST/HRSG/WSC systems
- Closed Loop Control of the HRSG/WSC
- Operation and control concept of the CCPP
- CCPP start-up given the plant’s different conditions
- CC Load Controller and AGC controller
- Handling various plant transient conditions like loss of feedwater, loss of condensate system, operation with one main cooling water
- CCPP efficiency and Key Performance Indicators
- CCPP shutdown options and the shutdown procedure

Course Information

Location:
• Birr
• Customer premises

Course Price:
• This course is sold per seat at €4000
• Fleet training

Prerequisites

• Have fundamental skills regarding combined cycle power plants and considerable field experience

Method of Training

• Theoretical and practical work with a full scope simulator
• Practical exercises on real life experiences
• An evaluation test based on real life experiences
• Group works and interactive workshops

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
TARGET PROFILE
- New technicians or engineers in charge of the electrical operation and maintenance of electrical power units

OBJECTIVES
On completion of the course, participants will be able to:
✓ Be familiar with the electrical fundamental quantities, the significant units and the electrical circuit laws
✓ Identify the plant electrical equipment and understand their functions
✓ List the types of main measuring instruments and principles of measurement
✓ Know how to carry out the usual electrical measurements

Content

**Direct current general basics:**
- The electric current
- Current strength
- The electric voltage
- Resistance
- Ohm and Kirchhoff laws

**Alternative current general basics:**
- Variable voltage
- Trigonometry basics
- Periodic signals
- Impedance
- Circuit elements (Resistance, Inductance, Capacitance)
- Phase displacement basics
- Reactance

**Power general basics:**
- Direct current power
- Alternative current power (apparent/active/reactive power)

**Electrical Measurements:**
- Low voltage electrical measurement
- High voltage electrical measurement
- Measurement reducers (CT & VT)

**Electrical engineering equipment general basics and operation principles of:**
- Motors
- Alternators
- Transformers
- Different break equipment

Course Information

**Location:**
- La Courneuve

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

INFORMATION & REGISTRATION
Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Turbines and generators
Joint bolting techniques

TARGET PROFILE
- Operative staff required to undertake hydraulic bolting procedures

OBJECTIVES
On completion of the course, participants will be able to:
- Be aware of the health and safety requirements in the use of hand and hydraulic torque and tensioning equipment

Content

Principle of bolting:
- To provide an understanding of the key factors contributing to mechanical joint integrity, including: health and safety, engineering drawings and specifications, bolt elongation, bolt load, bolt relaxation, applied and residual load, location of forces, effects of coefficient of friction, lubrication, uncontrolled/controlled tightening, tools, dismantling and inspecting a joint, alignment techniques, preload, torqueing and sequential tightening

Gaskets:
- To provide an understanding of the role of gaskets and gasketed joints, including: what is a gasket, gasket leakage, issues and selection, gasket design, clamp load and initial deformation, minimum clamp force

Hydraulic torque bolting:
- To provide an understanding of the torqueing of fasteners using hydraulic equipment, including: basic hydraulics, hydraulic multiplication, torqueing and wrenches

Hydraulic tension bolting:
- To provide an understanding of the tensioning of fasteners using bolt stretching equipment

Hydratight and ITH equipment:
- To provide familiarisation and safe use techniques of Hydratight and ITH bolt tensioning equipment

Pilgrim equipment:
- To provide an understanding of and safe installation of radial fit taper bolts

INFORMATION & REGISTRATION
Email: rp-training-facility@alstom.com
thermal-service-training@alstom.com

TECHNICAL TRAINING CENTRE: STAFFORD

Course Information

Location:
- Stafford

Course Price:
- This course is sold per seat at £600
Thermal processes
Basic principle & the thermal process simulator

TARGET PROFILE

- Engineers and technicians with a design office, production, installation, operation or maintenance background

OBJECTIVES

On completion of the course, participants will be able to:

✓ List the main systems in a thermal power plant
✓ List the main plant items
✓ Describe the roles of plant items in the process
✓ Identify the main components of the various systems
✓ Visualise the main process phases with a simulator in a user-friendly way while reproducing certain thermodynamic quantities

Content

Plant presentation:
- Main circuits
- Functional breakdown
- Source documents

Basic notions:
- Thermodynamics
- Combustion
- Control

Detailed circuits circulation:
- Principles
- Main circuit items
- Safety systems

Detailed circuits fuel:
- Principles
- Main circuit items
- Safety systems

Detailed circuits steam & water:
- Principles
- Main circuit items
- Safety systems

Detailed circuits air & flue gas:
- Principles
- Main circuit items
- Safety systems

Detailed circuits power:
- Principles
- Main circuit components
- Safety systems

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Method of Training

Practical work:
- 1 thermal-process simulator offering 3 operator stations
- 0.5 days on the simulator

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Everyone – no particular knowledge is required. This course is aimed at those wishing to understand water/steam cycles for thermal power stations

OBJECTIVES

On completion of the course, participants will be able to:

✓ Describe the thermal power station with its various components, localise the thermal power station in the power grid and list and describe the components of the thermal power station

✓ Use thermo-dynamic parameters to characterise the water/steam cycle components, find your way in a power station, geographically locate a specific equipment item and understand how the main components work

✓ Follow the main circuit linked to an equipment item and make a link between the items

Content

Course outline and topics:

- Steam and water cycles - general
- The balance of plant mechanics
- Water systems
- Fundamentals of thermodynamics
- Steam and water main components
- Steam generators
- Steam turbines
- Cold end and cooling systems
- Combined cycles
- Nuclear cycles

Course Information

Location:

- La Courneuve

Course Price:

- This course is sold as a class
- Course price to be issued on request
Shaft alignment of turbogenerator sets
Steam technology

TARGET PROFILE
- Maintenance engineers and technicians who want to improve their knowledge of shaft alignment

OBJECTIVES
On completion of the course, participants will be able to:
- Define shaft alignment
- List the causes and consequences of a shaft misalignment
- List the different measurement methodologies of shaft alignment and their advantages
- Perform shaft alignment measurements and validate them
- Check parallelism
- Check concentricity
- Analyse records
- Calculate alignment correction

Content

Shaft alignment - general:
- Definitions:
  - Supports alignment
  - Rotors alignment
- Aim of shaft alignment
- Causes of misalignment
- Consequences of misalignment
- The characteristics of defects on couplings
- Different type of shaftline
- Validation and the conditions of measurement
- Misalignment of shaftlines when the group is operating
- Measurement of misalignment defects at coupling
- Signs convention

Materials:
- Concentricity check
  - Methodology by contact
  - Analysis of records
- Parallelism check
  - Methodology by contact
  - Analysis of records
- Shaft alignment checks with laser measurements
  - Principle advantages
  - Calculation of alignment correction
  - Different methods of alignment surveys on an operating machine
  - Case studies

Course Information
Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical knowledge

Method of Training
Powerpoint presentation:
- Project technical documentation
- Laser device equipment
- Training bench

INFORMATION & REGISTRATION
Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Mechanics and turbine fitters

OBJECTIVES

On completion of the course, participants will be able to:

✓ Know the safety rules concerning handling
✓ Recognise the various types of lifting device
✓ Recognise the various types of lifting
✓ Handle a steam turbine rotor
✓ Handle steam turbine diaphragms
✓ Proceed to handling reversal of parts

Content

General:
- Definition
- Safety rules and responsibility
- Management obligations
- Crane driver, specific lifting devices
- Anomaly

Slinging and handling reversal:
- Definitions
- Slinging
- Load analysis
- Lifting
- Reversal

Rotors handling:
- Goal and risks of handling
- Lifting devices, tools
- Rotor preparation
- Lifting, displacement and storage of the rotor
- Use of the rotor lifting tool

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Crane operation and slinging certification

Method of Training

Application of equipment:
- Rotors
- Diaphragms
- Turbine casing

Pedagogic tools:
- PowerPoint presentation
- Turbine casing
- Diaphragms
- Rotors
- Lifting devices
- 35T Cranes
TARGET PROFILE

- Operation personnel
- Electrical maintenance personnel
- I&C maintenance personnel
- Mechanical maintenance personnel
- General staff

OBJECTIVES

On completion of the course, participants will be able to:

✓ Have a strong conceptual understanding of the CCPP and the process dynamics
✓ Understand the operation concept of the steam turbine
✓ Understand the start-up prerequisites and start-up procedure of the steam turbine under different operating modes
✓ Understand the process behaviour during plant transient conditions and equipment malfunctions
✓ Analyse the plant transients and trips

Content

Course outline & topics:
- Introduction to the simulator equipment and working environment, basics about the HMI
- Refresher about the steam turbine systems
- Operation and control concept of the steam turbine and steam bypass system
- Limiters for the steam turbine, thermal stress evaluation
- Starting and operating instructions for the steam turbine, startup prerequisites
- Fixed pressure and sliding pressure concept
- Online testing capabilities of the ST
- CCPP startup and shutdown procedures

Course Information

Location:
- Birr
- Customer Premises

Course Price:
- This course is sold per seat at €4000
- Fleet training

Prerequisites

- Have fundamental skills regarding combined cycle power plants and considerable field experience

Method of Training

- Theoretical and practical work with a full scope simulator
- Practical exercises on real life experiences
- An evaluation test based on real life experiences
- Group works and interactive workshops

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
Thermodynamics applied to steam turbines

TARGET PROFILE
- Design, operating or maintenance engineers and technicians

OBJECTIVES
On completion of the course, participants will be able to:
- Follow any kind of steam expansion in the steam turbine on Mollier's diagram
- List and explain terms used in thermodynamics
- List and explain thermodynamics units
- Identify which kinds of steam expansion occur in the steam turbine
- Link problems with the steam turbine (insulation, steam leakage, efficiency etc) due to the thermodynamic parameters
- Draw on a Mollier's diagram the steam expansion and calculate the efficiency of a turbine casing

Content

General:
- Thermodynamic purpose
- What does enthalpy mean?
  - The water steam enthalpy
  - The energy transfer
  - Entropy

Different kinds of water steam expansion:
- In a steam chest
- In the first stage of an HP turbine (partial or total injection)
- In a turbine steam path
- In the gland steam boxes
- In the drains
- The different types of exchangers, (water/steam, steam/steam, water/oil, etc.)

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request
Steam turbines

Overall description

TARGET PROFILE
- Design, operating or maintenance engineers and technicians

OBJECTIVES
On completion of the course, participants will be able to:
- Operate a steam turbine
- Know how to identify expansion sensors
- Know how to recognise the components
- Know how to describe the constraints in a steam turbine: pressures, temperatures, expansions, vibrations, moisture
- Diagnose an operation disturbance
- Place sliding parts and fixed points on a scheme
- Locate a turbine component as quickly as possible

Content
Steam turbine description:
- The shaft line
- The main components: HP, IP & LP modules, bearings, steam chests, steam pipework

The auxiliary systems:
- Lubricating system
- Drains
- Control fluid system
- Monitoring system
- Safeties
- Control system

Course Information
Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

INFORMATION & REGISTRATION
Email: training-centre.power.france@alstom.com
            thermal-service-training@alstom.com
TARGET PROFILE

- Design, operating or maintenance engineers and technicians

OBJECTIVES

On completion of the course, participants will be able to:

✓ Know how to identify displacements to perform on each diaphragm
✓ Make a correct adjustment of diaphragms in horizontal and vertical position
✓ Reduce clearances between fixed and moving parts

Content

Diaphragms:
- Operating general principle
- Main parts and details of constitution

Measurement device:
- Description of the device, how it works
- Description of test implementation, where are the test points
- Measurement analysis and comparing with required values

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical knowledge

Email: training-centre.power.france@alstom.com
  thermal-service-training@alstom.com

INFORMATION & REGISTRATION
TARGET PROFILE
- Design, operating or maintenance engineers and technicians

OBJECTIVES
On completion of the course, participants will be able to:
- Know how to list the maintenance operations to carry out on a component
- Order that list
- Describe the operations to carry out
- List the means to carry out a maintenance operation
- Know how to organise any kind of maintenance on the steam turbine
- Build up a file for any kind of maintenance

Content

General principles:
- Steam turbines maintenance description

The auxiliary systems and the elementary maintenance:
- Auxiliary systems descriptions with their own elementary maintenance

The preventive maintenance:
- Maintenance manuals: the general guidelines
- The turbine shut down for maintenance: the fast cooling
- The steam turbine description and contractual tools
- Preventive maintenance exercises

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical knowledge
- Attendance of "The steam turbine – overall description PDT-ST-10" training course

INFORMATION & REGISTRATION
Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Design, operating or maintenance engineers and technicians who want to acquire basic knowledge in order to recognise the “blade” product

OBJECTIVES

On completion of the course, participants will be able to:

- List the differences between impulse and reaction turbines
- List the differences between right and left blades
- List the differences between impulse and reaction blades
- Know the terminology used for the different components of blades

Content

**General:**
- Steam turbines
- Impulse and reaction turbines
- Right and left blades

**Blades:**
- Different types of blades: impulse turbine principles, reaction turbine principles

**Moment weight:**
- Definition
- Practical calculation methodology on site

Course Information

**Location:**
- La Courneuve

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- People who want a general knowledge of industrial steam turbine risk assessment

OBJECTIVES

On completion of the course, participants will be able to:

✓ Describe the specifics of industrial steam turbines and evaluate insurance risks for coverage during operation and maintenance

Content

General design of steam turbines:
- Operation:
  - Expansion stage principles
  - Impulse and reaction turbines
- Design:
  - Main steam turbine components
  - Design principles (constraints, expansion, shaft line dynamic, seals)
  - Auxiliary systems (lubrication, seals, security, control system)

Assembling:
- Main steps of turbogenerator assembly
- Assembly and adjustment means
- Adjustment examples

Commissioning:
- Checking, adjustments and main tests during commissioning
- Machine acceptance:
  - Performance tests principles
  - Examples of specifications
  - Measurement devices
  - Measurement data processing software

Maintenance:
- Types of maintenance:
  - Curative
  - Preventive
  - Systematic
- Preventive maintenance:
  - Permanent survey
  - Detection
  - Systematic maintenance
  - Non-destructive tests

Spare parts:
- Spare parts criticality
- Safety spare parts list
- Spare parts list for minor overhaul
- Spare parts list for major overhaul

Risks - Damage:
- FMEA simplified method presentation
- Detection methods
- Damage examples, root cause analysis

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Qualified mechanics and turbine fitters

OBJECTIVES

On completion of the course, participants will be able to:

- Identify the different circuits and systems of the steam turbine and its auxiliaries
- List the components of a steam turbine
- Know the safety rules to be applied during a maintenance operation
- Apply the maintenance procedures
- Master the documentation
- Identify on a diagram the fixed points, the sliding parts and the sensors
- Sling, handle, check, disassemble and reassemble a steam turbine
- Draft minutes, reports and all the contractual documents

Content

Turbine operating, documentation understanding and review:
- Auxiliaries circuits, safety system
- Lexicon, reading of the drawings, maintenance procedures, control datasheets, record datasheets, operations follow-up

Safety and quality:
- Management of devices and means, gestures, handling, slinging, products, solvents, consignment and exceptional modes of work
- Responsibility and behaviour
- Hold points and notification, internal checks, statements
- Documentation, reports drafting

Slinging and handling:
- Choice of slings, shackles and lifting eyes
- Angles of lifting (height under lifting hook, procedures, loads to handle)
- Gestures, positioning, part/handling (visibility, marks)
- Part reversal, packing plan, guidance, lifting

Tools and checks:
- Axial and radial clearances
- Checking: reference bearing/rotor, micrometric gauge before and after disassembling, silks rotor and bearing, micrometer, gauge, calliper
- Segments checks
- Radial clearance setting, rotor positioning
- Thrust bearings settings

Disassembly/reassembly:
- Marks (marking of parts, identification, rear, back, left, right)
- State of the parts after disassembly (visual examination), key positioning
- Tightening

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- This course is dedicated to qualified mechanics, turbine fitters

Method of Training

- Practical works will take place on our premises in real conditions in La Courneuve on 125MW and 250MW steam turbines
- Work will be done in order to match the objectives and perform a continuous assessment
- Pedagogic tools
  - PowerPoint presentation
  - Real working instructions
- Practice and case studies
- Practical work on steam turbines:
  - 125MW steam turbine
  - 250MW steam turbine

Email:
training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Steam turbines
General description – Main differences between turbines of the nuclear fleet – Maintenance principles

TARGET PROFILE
- Design, operating or maintenance engineers and technicians

OBJECTIVES
On completion of the course, participants will be able to:
✓ Know how a steam turbine operates
✓ Describe the behaviour of the turbine at a standstill and in operation
✓ Identify the expansion sensors
✓ Recognise the components
✓ Describe the constraints in a steam turbine including pressures, temperatures, expansions, vibrations, moisture
✓ Diagnose an operation disturbance
✓ Identify the fixed points, the sliding parts and the sensors of differential and absolute expansion on a diagram
✓ Locate a turbine component as quickly as possible

Content
Steam turbine description:
- The shaft line
- The main components: modules, bearings, steam chests, steam pipes

Steam turbine operating:
- Thermodynamic energy transformation of steam into kinetic energy and work
- The triangle of speeds
- The two operation types: impulse turbine, reaction turbine
- Twisted blades
- Thermodynamic characteristics of different turbines of the nuclear fleet

Maintenance:
- General principles
- Preventive maintenance
- Maintenance preparation
- Maintenance programmes

Characteristics and particulars of the different turbines in the nuclear fleet:
- CP0-CP1 steam turbines
- CP2-P4-P'4 steam turbines
- N4-EPR steam turbines

The auxiliaries systems:
- The functional role of each system, the system description, operational control system and monitoring:
  - Lubricating system
  - Seals
  - Drains
  - Control fluid system
  - Safeties

Course Information
Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical knowledge

Email:  
training-centre.power.france@alstom.com  
thermal-service-training@alstom.com
TARGET PROFILE
- Mechanical engineers and technicians

OBJECTIVES
On completion of the course, participants will be able to:
- Describe the operation of the TM2 type steam turbines
- List the different components
- Describe the different systems
- Swiftly locate a turbine component
- Locate a component on a PID

Content

Steam turbine design theory:
- Steam turbine operation principles
- Turbine speed reducers

Steam turbine description:
- HP Steam turbine
- LP Steam turbine
- The steam path
- Stop valves
- HP & LP Control valves
- Bearings
- Thermal expansions
- Couplings

The auxiliary systems:
- Lubricating systems
- Drains, gland steam
- Control fluid systems
- Monitoring systems
- Safeties
- Control systems

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical knowledge
TARGET PROFILE

- Qualified mechanics and turbine fitters

OBJECTIVES

On completion of the course, participants will be able to:

✓ List the components of a steam turbine
✓ Know the safety rules to be applied during a maintenance operation
✓ Apply the maintenance procedures
✓ Master the documentation
✓ Identify on a diagram the fixed points, the sliding parts and the sensors
✓ Sling, handle, check, disassemble and reassemble a steam turbine
✓ Draft minutes, reports and all the contractual documents

Content

Turbine operating, documentation understanding and review:
- Auxiliary circuits, safety systems
- Lexicon, reading of the drawings, maintenance procedures, control datasheets, record datasheets, operations follow-up

Turbine operating, documentation understanding and review:
- Steam turbine components
- Lexicon, reading of the drawings
- Control datasheets, record datasheets

Safety and quality:
- Gestures
- Handling, slinging
- Products, solvents
- Consignment
- Responsibility and behaviour

Slinging and handling:
- Choice of slings, shackles and lifting eyes
- Angles of lifting (height under lifting hook, procedure)
- Loads to handle

Tools and check:
- Axial and radial clearance
- Checking: reference bearing/rotor, micrometric gauge before and after disassembling, micrometer, gauge, calliper
- Segments check
- Radial clearances setting and rotor positioning
- Thrust bearing settings

Disassembly/reassembly:
- Marks (marking of parts, identification, rear, back, left, right)
- State of the parts after disassembly (visual examination)
- Keys positioning
- Tightening

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Confirmed mechanics knowing how to use metrology and basic mechanical tools

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Target Profile

- Power station engineers and technicians

Objectives

On completion of the course, participants will be able to:

- Describe the operation of a thermal power station
- List the various components
- Describe equipment functions
- List essential safeguards
- Analyse customer requirements

Content

Presentation of the power station:
- Water-steam circuits
- Air-gas circuits
- Fuel circuits
- Power station types:
  - Nuclear
  - Fossil
  - Combined cycle

Generator and auxiliaries:
- Description
- Operation
- Control
- Safeties

Electrical Distribution:
- Principles
- Transfers of sources
- Synchronising
- Protections and safeties

Turbine and auxiliaries:
- Description
- Types
- Operation
- Turbine Control

Boiler and auxiliaries:
- Description
- Types
- Operation
- Command Control
- Automatisms (Basic Principles)

Control system:
- External control (power plant and net)
- Internal Control (boiler)
  - Furnace pressure
  - Drum level
  - Attemperator
  - Load

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request
TARGET PROFILE

- Sales or design engineers in charge of the operation and maintenance of electrical power installations

OBJECTIVES

On completion of the course, participants will be able to:
✓ Be familiar with the generator electrical protections overall
✓ Identify the different types of faults that could happen on a generator
✓ List the generator’s electrical protections and describe their functions
✓ Set and test the generator’s electrical protection relays
✓ Validate the protection calculation note drawn up by the design office
✓ Verify the secondary loops of current and voltage transformers

Content

Basic theoretical knowledge:
- Basic knowledge of alternative currents
- Circuit breaker failure
- Diagrams of the power plant’s distribution
- Short-circuit currents
- Current and voltage transformers
- Principle of symmetrical components

The generator’s protections:
- The generator’s functions
- The generator’s behaviour
- The various types of protections (ANSI standard)
- Generator-grid coupling
- Description of the protections
- Injection and adjustment of the protection relay’s parameters

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mathematical knowledge: complex numbers, vectors, trigonometry

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Excitation - Analogue voltage regulation for generators
Description, operation and maintenance

Content

Generalities about excitation-regulation system:
- Principles or electrotechnical notions
- Configuration of the analogue regulation system

Excitation system and circuits:
- Functional description of the excitation regulation
- Instrumentation and protections
- Power rectifying with thyristors
- Normal operation
- How to proceed in case of trouble
- Maintenance on the equipment

Regulation system (analogue process):
- Description of the regulation system
- Functional description of the automatic channel
- Functional description of the manual channel
- Operating limits and setting
- Normal operation
- How to proceed in the case of a problem

TARGET PROFILE
- Engineers and technicians involved with electrical power plant maintenance and repair processes who need to be able to deal with process failure

OBJECTIVES
On completion of the course, participants will be able to:
- Describe the operation principles of an excitation regulation system and the principles of electrical power generation
- Describe the components and the functioning principle of the excitation regulation system
- Use fault sheets to act and repair immediately if there is a problem with the excitation regulation system

Course Information

Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Electrical and electromechanical knowledge
- Have knowledge in excitation and regulation circuits

Method of Training
- Training support slide show customised to your own regulations
- Visit to the generator workshop (manufacture/assembly) and/or equipment on site
- At the beginning of the course, each trainee will receive the associated training manual
**Content**

**General information about excitation and regulation systems:**
- Principles of electrotechnical notions
- Configuration of the regulation

**Excitation system or circuits:**
- Functional description of excitation
- Functional description of the regulation
- Rectifying the thyristors
- How to deal with problems with excitation
- How to deal with problems with regulation
- Application of software (functional blocks),
  Software setting specifications (parameters)

**Communication with the digital voltage regulation on site (using HMI software):**
- Presentation of the software
- Instructions for connecting a PC
- Reading parameters on the regulator
- Operating limits and setting
- Normal operation
- Application down-loading
- Application up-loading
- Reading or editing parameters
- Up-loading parameters or up-dating
- Perturbography trends, variables analysis and troubleshooting for internal connections of the regulator
- Switchable outputs programming
- Hardware injection
- System states and alarms
- Using the “implementing instructions” document for digital regulation maintenance

**TARGET PROFILE**

- Engineers and technicians involved with electrical operation, maintenance and repair processes in a power plant

**OBJECTIVES**

On completion of the course, participants will be able to:
- Describe the components of the voltage regulation
- Describe in a simple manner the functioning principle of a voltage regulation system
- Describe the elements and functioning of the digital regulation
- Act quickly and safely when problems occur with the digital voltage regulation
- Know how to use the communication software and the setting parameters of the regulation

**Course Information**

**Location:**
- Belfort

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

**Prerequisites**

- Knowledge in electronics
- Be expert in the field of voltage regulation
- Be familiar with digital processing

**Method of Training**

- Customised training support slide show
- Visit to the regulator and connection with the voltage regulator
- At the beginning of the course, each trainee will receive the associated training manual

**Email:** training-center-belfort.power@alstom.com
  thermal-service-training@alstom.com
TARGET PROFILE
- Electrical maintenance personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ Show and explain the system’s basic configuration and its main features
✓ Explain the system software and hardware concepts
✓ Explain the purpose of the various protection functions and state respective standard settings
✓ Configure and parametrise the different protection functions and change their settings (limit values, response times), using the user interface program CAP216
✓ Interpret signals and messages of the system
✓ Troubleshoot the system
✓ Carry out periodic functional checks and regular maintenance
✓ State the electrical safety rules for working on the equipment

Content

Course outline & topics:
- Electrical safety rules and measures
- Protection functions:
  - Basic theory and applications
  - Numerical generator protection system:
    - System layout, hardware components, software and firmware, signal data flow
    - Documentation:
      - Protection, measuring and metering single line diagrams, tripping logic diagrams, setting lists, the training manual, the operation and maintenance manual
  - User interface program CAP216:
    - Configuration and parameterisation of the system
  - Monitoring functions:
    - Event and data recording, display of measured quantities, recording of disturbances
  - Functional checks and maintenance:
    - Test functions, checklists, error handling, diagnostics, service information, and technical support
    - Firmware and software updates, replacement of components
    - Fault-tracing in electrical systems, interfaces to DCS

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €3200
- Fleet training

Prerequisites
- Have experience in electrical operation and maintenance of Alstom power plants
- Be able to interpret technical documents: Single Line Diagrams (SLD) and drawings

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Open discussions

INFORMATION & REGISTRATION
Email: training.center.birr@power.alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Electrical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:

- Show and explain the system’s basic configuration and its main features
- Explain the system software and hardware concepts
- Explain the purpose of the various protection functions and state respective standard settings
- Configure and parameterise the different protection functions and change their settings (limit values, response times), using the user interface program S1
- Interpret signals and messages of the system
- Input signal testing
- Carry out periodic functional checks and regular maintenance
- State the electrical safety rules for working on the equipment

Content

Course outline & topics:

- Electrical safety rules and measures
- Protection functions:
  - Basic theory and applications
  - Numerical generator protection system:
    - System layout, hardware components, software and firmware, signal data flow
    - Documentation:
      - Protection, measuring and metering single line diagrams, tripping logic diagrams, setting lists, the training manual, the operation and maintenance manual
- User interface program S1:
  - Configuration and parameterisation of the system
- Monitoring functions:
  - Event and data recording, display of measured quantities, recording of disturbances
- Functional checks and maintenance:
  - Test functions, checklists, diagnostics, service information and technical support
  - Fault-tracing in electrical systems, interfaces to DC5

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €3200
- Fleet training

Prerequisites

- Have experience in electrical operation and maintenance of Alstom power plants
- Be able to interpret technical documents: Single Line Diagrams (SLD) and drawings

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Site and equipment visits
- Open discussions
TARGET PROFILE

- Operation personnel
- Electrical maintenance personnel

OBJECTIVES

On completion of the course, participants will be able to:

✓ Explain the function of the generator H2 cooling system and its seal oil and gas cooling systems
✓ Describe from memory the processes of gas sealing and gas extracting from the seal oil by means of the P&ID and the O&M manual
✓ List from memory the operating parameters of the cooling system and its auxiliary systems (differential-pressure control, core monitoring, gas purity meter) and state their permissible ranges
✓ List the H2-specific safety rules and measures for operation of and maintenance on H2-cooled generators

Content

Course outline & topics:

- H2-related safety rules
- The gas cooling system with its gas unit:
  - Configuration, components, and function
- The seal oil system with its seal oil unit:
  - Configuration, components, and function
- Instrumentation and Monitoring
- Interpretation of process value readings such as pressure, flow rates, gas purity, humidity
- Alarms and fault handling scenarios
- Maintenance procedures:
  - Purging of the generator, replacement of oil filter cartridges, regeneration of the gas dryer
  - Cooling and humidification of the brush-gear cooling air
- Periodic checks of levels, pressures, flow rates, temperatures, gas purity, gas leakage, gas reserves
- Periodic functional checks of the various pump units (readiness for operation, change-over functions)

Course Information

Location:
- Birr

Course Price:
- This course is sold per seat at €1600
- Fleet training

Prerequisites

- Have experience in operation and maintenance of Alstom power plants
- Be able to interpret technical documents

Method of Training

- Classroom theoretical training that includes presentations, group work, open discussions and exercises

INFORMATION & REGISTRATION

Email: training.center.birr@power.alstom.com
        thermal-service-training@alstom.com
**Electrical operation & maintenance overview**

**Air cooled generator & auxiliaries**

**TARGET PROFILE**

- Operation personnel
- Electrical maintenance personnel

**OBJECTIVES**

On completion of the course, participants will be able to:

- Present the overall Electrical Operation Concept and show all possible power supply configurations for the auxiliaries using the written Electrical Operation Concept and the SLD
- Explain by means of the power chart the operating range of a turbo generator including its operating limits and state the purpose and function of the respective excitation limit controllers
- Explain the functional blocks of the excitation system for a turbo generator using a relevant schematic diagram
- List and explain from memory the safety rules and measures for carrying out maintenance on electrical equipment
- Learn the overall basics of the electrical system

**Content**

**Course outline & topics:**

- Electrical safety measures
- The single line diagram and overview of electrical main components
- The electrical operation concept
- Generator and exciter design and function, operation ranges and capabilities
- Maintenance overview:
  - Routine checks, electrical tests, inspection of the cooling system inside the generator
  - Generator monitoring
- LV - switch gear:
  - Function, operation, control modes, bus bar transfer modes
- Generator circuit breaker overview:
  - Function and design of the main components (SF6-breaker, operating mechanism), operating modes, monitoring
- Transformers:
  - Function and design, protection, breathers, coolers, pumps, connections, bushings, oil checks, tightness checks
- Overview of Batteries, Battery Chargers
- Inverters, UPS-System:
  - Function and design, operation, routine maintenance
- Fault tracing methods in electrical and electronic systems, interfaces to DCS

**Course Information**

**Location:**
- Birr

**Course Price:**
- This course is sold per seat at €2400
- Fleet training

**Prerequisites**

- Have experience in electrical operation and maintenance of Alstom power plants
- Be able to interpret technical documents: Single Line Diagrams (SLD) and drawings

**Method of Training**

- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Site and equipment visits
- Open discussions
Hydrogen cooled generators with stator water/auxiliary systems
Basics, operating principles, running and maintenance

PRODUCT | PDT-GE-01

TECHNICAL TRAINING CENTRE: BELFORT

INFORMATION & REGISTRATION
Email: training-center-belfort.power@alstom.com
thermal-service-training@alstom.com

TARGET PROFILE
- Technicians and engineers involved in the preparation and start-up of a hydrogen cooled generator in an electrical power plant

OBJECTIVES
On completion of the course, participants will be able to:
✓ Describe the operation principles of a synchronous machine and the principles of electrical power generation
✓ Identify and name the components of the generator and the auxiliary systems
✓ Describe the elements and the functioning principle of a hydrogen cooled generator, the auxiliary systems, and the specific TKJ exciter or the sliprings/brush-holders system (brushgear)
✓ Operate the hydrogen cooled generator with all safety and high availability
✓ Operate the auxiliary systems for H2 generators with all safety and high availability

Content
Generalities about synchronous machines:
- Principles and constitution
- Electrical power generation
- PQ diagram and operating limits

Description of hydrogen cooled generator:
- Functional description of generator
- Ventilation and cooling
- Instrumentation and protections
- Excitation equipment
- Operation and maintenance

Hydrogen cooling system (GRH or MKA):
- Functional description
- Monitoring and maintenance

Seal oil system for hydrogen cooled generator (GHE or MKF):
- Functional description
- Monitoring and incidents

Generator gas system for hydrogen cooled generator (GRV or MKG):
- Functional description
- Preparation, scavenging Air and CO2
- Filling with hydrogen or draining
- Scavenging H2 and CO2
- Monitoring and incidents

Stator water system for hydrogen cooled generator (GST or MKF):
- Functional description
- Monitoring and incidents

Excitation-regulation system for hydrogen cooled generator (GEX or MKC):
- Functional description
- Monitoring and incidents

Option: Operating the hydrogen cooled generator on simulator:
- Start-up and operation of the auxiliary systems on simulator,
- Start-up and operation of the hydrogen cooled generator connected to the grid on the simulator

Course Information
Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical, hydraulic, electrical and electromechanical knowledge

Method of Training
- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual
TARGET PROFILE

- Newcomin technicians involved in the operation, maintenance and repair of the plant operation processes

OBJECTIVES

On completion of the course, participants will be able to:

- Identify and name the components of the generator and of the excitation regulation specific system
- Describe the operating principle of a synchronous machine and of electrical power generation
- Describe the components and operating principle of a generator and of a specific TKJ exciter
- Operate the generator safely and deal with problems and incidents

Content

Generalities about synchronous machines:
- Principle
- Constitution
- Power generation
- PQ diagram and operating limits

Description of an air cooled generator:
- Functional description of a generator
- Ventilation and cooling
- Instrumentation and protections
- Excitation equipment
- Operation and maintenance

Excitation and regulation system:
- Functional description of the excitation-regulation
- Instrumentation and protections
- Voltage regulation
- Operation and setting
- How to proceed when there are problems

Generator and unit electrical protections:
- Functional description of the electrical protections
- Operation and maintenance
- How to proceed when there are problems

Operating the air cooled generator on simulator:
- Start-up and operation of the air cooled generator connected to the grid on the simulator

Course Information

Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical, hydraulic, electrical and electromechanical knowledge
- Knowledge of excitation regulation and electrical protection

Method of Training

- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual

INFORMATION & REGISTRATION

Email: training-center-belfort.power@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Technicians and engineers involved in the preparation and start-up of hydrogen cooled generators in electrical power plants

OBJECTIVES

On completion of the course, participants will be able to:

✓ Describe the operation principles of a synchronous machine and the principles of the electrical power generation
✓ Identify and name the components of the generator and of the specific excitation-regulation system.
✓ Describe the elements and the functioning principle of an air cooled generator, and of the specific TKJ exciter or the brush-gear device
✓ Operate the air cooled generators safely and deal with any problems or incidents

Content

Generalities about synchronous machines:
- Principles and constitution
- Electrical power generation
- PQ diagram and operating limits

Description of hydrogen cooled generator:
- Functional description of generator
- Ventilation and cooling
- Instrumentation and protections
- Excitation equipment
- Operation and maintenance

Excitation-regulation system:
- Functional description of the excitation-regulation
- Instrumentation and protections
- Voltage regulation
- Operation and setting
- How to proceed in case of trouble

Generator and unit electrical protections:
- Functional description of the electrical protections
- Operation and maintenance
- How to proceed in case of trouble

Operating the air cooled generator on a simulator
- Start-up and operation of the air cooled generator connected to the grid or simulator

Course Information

Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical, hydraulic, electrical and electromechanical knowledge
- Knowledge of excitation regulation and electrical protection

Method of Training

- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual

INFORMATION & REGISTRATION

Email: training-center-belfort.power@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Engineers, technicians or operators involved with the operation, maintenance and repair of plant processes

OBJECTIVES

On completion of the course, participants will be able to:

✔ Identify and name the components of the generator and its auxiliary systems
✔ Describe the elements and the operating principle of the hydrogen cooled generator and its auxiliary systems
✔ Be aware of particular hydraulic phenomena on the auxiliary systems
✔ Operate the hydrogen cooled generator and its auxiliary systems safely, avoiding frequent or ill-timed stops and preventing ageing and degradation of the elements

Content

Description of generator and auxiliary systems:
- Functional description of generator
- Instrumentation and protections
- Description of the auxiliary systems

Generator hydrogen cooling system GRH or MKA:
- Functional description
- Preparation and start-up
- Operation and monitoring

Generator seal oil system GHE or MKW:
- Functional description
- Preparation and start-up
- Operation and monitoring

Generator gas system GRV or MKG:
- Functional description
- Preparation, scavenging air and CO2
- Filling with hydrogen or draining
- Scavenging the H2 and CO2
- Operation and monitoring

Generator stator water system GST or MKF:
- Functional description
- Preparation and start-up
- Operation and monitoring

Course Information

Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical, hydraulic, electrical and electromechanical knowledge

Method of Training

- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual

INFORMATION & REGISTRATION

Email: training-center-belfort.power@alstom.com
thermal-service-training@alstom.com
Hydrogen cooled generators and auxiliary systems

Basics, operating principles, running and incidents

TARGET PROFILE

- Engineers, technicians or operators involved with the operation, commissioning, maintenance or repair of the plant processes

OBJECTIVES

On completion of the course, participants will be able to:
✓ Describe the principles of operation of a synchronous machine and principles of electrical power generation
✓ Describe the components and principles of operation of a hydrogen cooled generator and its auxiliary systems
✓ Operate the generator and its auxiliary systems, avoiding frequent or ill-timed stops
✓ Be able to react quickly and safely when there are problems or incidents

Content

**Generalities about synchronous machines:**
- Principles and constitution
- Electrical power generation
- PQ diagram and operating limits

**Description of hydrogen cooled generator:**
- Functional description of a generator
- Ventilation and cooling
- Instrumentation and protections
- Excitation equipment
- Operation and maintenance

**Generator seal oil system GHE or MKW:**
- Functional description
- Preparation and start-up
- Monitoring and operation on simulator

**Generator gas system GRV or MKG:**
- Functional description
- Preparation, scavenging Air and CO2
- Filling generator with hydrogen
- Scavenging H2 and CO2
- Monitoring and operation of a simulator

**Generator stator water system GST or MKF:**
- Functional description
- Preparation and start-up
- Monitoring and operation of a simulator

**Excitation-regulation system GEX or MKC:**
- Functional description
- Operation and operating limits
- Monitoring and incidents

**Operating the hydrogen cooled generator on simulator:**
- Start-up and operation of the auxiliary systems on a simulator
- Start-up and operation of the hydrogen cooled generator connected to the grid on a simulator

Technical Training Centre: Belfort

Course Information

**Location:**
- Belfort

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical, hydraulic, electrical and electromechanical knowledge

Method of Training

- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual

INFORMATION & REGISTRATION

Email:
training-center-belfort.power@alstom.com
thermal-service-training@alstom.com
Hydrogen cooled generators and auxiliary systems
Operating principles, running and incidents on a simulator

TARGET PROFILE
- Engineers, technicians or operators involved with the operation, maintenance and repair of the plant processes

OBJECTIVES
On completion of the course, participants will be able to:
✓ List the electrical characteristics
✓ Explain in a simple manner the functioning of a generator
✓ List the components constituting the stator, the rotor and the excitation equipment of the generator
✓ Operate the generator and its auxiliary systems, avoiding frequent or ill-timed stops
✓ Be able to react quickly and safely when there are problems or incidents

Content
Description of hydrogen cooled generator:
- Functional description of a generator
- Description of excitation equipment
- Normal operation and monitoring

Generator cooling system GRH or MKA:
- Functional description of a generator
- Preparation and start up
- Normal operation and monitoring

Generator seal oil system GHE or MKW:
- Functional description of a generator
- Description of excitation equipment
- Normal operation and monitoring

Generator gas system GRV or MKG:
- Functional description
- Preparation, scavenging air and CO2
- Filling with hydrogen or draining
- Scavenging the H2 and CO2
- Operation and monitoring

Generator stator water system GST or MKF:
- Functional description of a generator
- Description of excitation equipment
- Normal operation and monitoring

Course Information
Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Mechanical, electrical and electromechanical knowledge
- Be familiar with the assembly and operation of the generator and the auxiliary systems

Method of Training
- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual

INFORMATION & REGISTRATION
Email: training-center-belfort.power@alstom.com
thermal-service-training@alstom.com
**Content**

**Description of hydrogen cooled generator:**
- Functional description of a generator
- Functional description of excitation equipment
- Instrumentation and protections
- Operation and incidents on a simulator

**Generator cooling system GRH or MKA:**
- Functional description
- Start-up and monitoring

**Generator seal oil system GHE or MKW:**
- Functional description
- Start-up and monitoring
- Operation and incidents on a simulator

**Generator gas system GRV or MKG:**
- Functional description
- Preparation, scavenging Air and CO2
- Filling with hydrogen or draining
- Scavenging of H2 and of the CO2
- Start-up and monitoring
- Operation and incidents on a simulator

**Generator stator water system GST or MKF:**
- Functional description
- Start-up and monitoring
- Operation and incidents on a simulator

**Operating hydrogen cooled generator and auxiliary systems on simulator:**
- Start-up and operation of the auxiliary systems on a simulator
- Start-up and operation of the hydrogen cooled generator connected to the grid on a simulator

**Course Information**

**Location:**
- Belfort

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

**Prerequisites**
- Mechanical, hydraulic, and electrical knowledge
- Be expert in the field of generator
- Be familiar with the auxiliary systems

**Method of Training**
- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual
TARGET PROFILE

- Technicians starting out in the generator business

OBJECTIVES

On completion of the course, participants will be able to:

- Describe the operation principles of a generator and of electrical power generation
- Explain in a simple manner the functioning of a generator
- List the components constituting the stator, the rotor and the excitation equipment of a generator
- Understand the generator
- Operate the generator
- Operate the auxiliary systems

Content

Generalities about synchronous machines:
- Principles
- Constitution
- Electrical power generation
- PQ diagram and operating limits

Air cooled generator:
- Functional description
- Ventilation and cooling
- Instrumentation
- Excitation equipment
- Protections

Hydrogen cooled generator with stator water:
- Functional description
- Ventilation and cooling
- Instrumentation and protections
- Excitation equipment
- Generator seal oil system
- Generator gas system
- Generator stator water system

Course Information

Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mechanical, electrical and electromechanical knowledge
- Have basic knowledge in generators

Method of Training

- Training support slide show
- Visit to the generator workshop (manufacture/assembly) and/or training centre hall
- At the beginning of the course, each trainee receives the associated training manual
Air cooled generators
Basic and operating principles

TARGET PROFILE
- Technicians starting out in the air cooled generator business

OBJECTIVES
On completion of the course, participants will be able to:
✓ Describe the operation principles of a generator and of electrical power generation
✓ Explain in a simple manner the functioning of an air cooled generator
✓ List the components constituting the stator, the rotor and the excitation equipment of an air cooled generator
✓ Understand the generator
✓ Operate the air cooled generator

Content

Generalities about synchronous machines:
- Principles and constitution
- Electrical power generation
- PQ diagram and operating limits

Air cooled generator:
- Functional description
- Ventilation and cooling
- Instrumentation
- Excitation equipment
- Excitation-regulation system
- Protections

Course Information
Location:
- Belfort

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites
- Have experience in electrical operation and maintenance of Alstom power plants
- Be able to interpret technical documents
- Have experience with Single Line Diagrams (SLD) and drawings

Method of Training
- Classroom theoretical training that includes presentations, group work, open discussions and exercises
- Practical hands-on exercises
- Open discussions

INFORMATION & REGISTRATION
Email: training-center-belfort.power@alstom.com
        thermal-service-training@alstom.com
TARGET PROFILE

- Engineers and technicians

OBJECTIVES

On completion of the course, participants will be able to:

✓ Better understand the role, principles and operation of steam generators (SG)
✓ List the essential elements of a steam generator
✓ Know main characteristics
✓ Know terminologies used in specifications (TS), call to tender (CT), technical specifications (ST), relating to SG
✓ Analyse TS, CT and ST to work out a pertinent synthesis of these documents
✓ Identify the different components and types of steam generator

Content

General principles:
- Steam/Water cycle
- Heat sources
- Heat exchanges
- Vaporisation
- Circulation
- Superheating and resuperheating

Main types of steam generator:
- Drum-type
  - Natural circulation
  - Controlled circulation
- Once through SG
  - Wet separator
  - Dry separator
  - Supercritical
  - Heat Recovery Steam Generator (HRSG)

Combustion principles:
- Types of fuels
- Introduction to combustion

Steam generator architecture:
- General layout
- Furnace
- Heat exchanger arrangement
- Auxiliaries

Setting principles and general safeties:
- Basic principles
- Main loops

Course Information

Location:
- La Courneuve

Course Price:
- This course is sold as a class
- Course price to be issued on request

Prerequisites

- Mathematical basics: unit conversion and scale change

Method of Training

- Presentation including group work and exercises

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
TARGET PROFILE

- Engineers and technicians

OBJECTIVES

On completion of the course, participants will be able to:

✔ List the various fuels used in power plants
✔ Understand the characteristics and processes applied to the main fuels
✔ Be conversant with the relevant terminology employed in requirements definitions, technical specifications and bid-call documents in the field of SG’s
✔ Analyse technical specifications and bid-call documents in order to draft precise descriptions of these documents
✔ Identify the various modes of combustion, and the related constraints

Content

**General principles:**
- Steam/Water cycle
- Heat sources
- Heat exchanges
- Vaporisation
- Circulation
- Superheating and resuperheating

**Best principles of combustion:**
- Combustion chemistry
- Flame temperature
- Excess air

**Fuels:**
- Gaseous fuels
- Liquid fuels
- Solid fuels

**Fuel preparation:**
- Storage and conditioning
- Crushing and mixing of coal
- Conveying

**Combustion:**
- Combustion of liquid and gaseous fuels
- Spraying
- Heating types
- Coal combustion
- Direct/indirect heating
- Heating types
- Unburned fuel loss

**Emission control and solid waste:**
- Origin of pollutants
- Emissions regulation
- Special processes (Denox, DeSox, ESP)

Course Information

**Location:**
- La Courneuve

**Course Price:**
- This course is sold as a class
- Course price to be issued on request

**Prerequisites**

- Mathematical basics: unit conversion and scale change

**Method of Training**

- Presentation including group work and exercises

INFORMATION & REGISTRATION

Email: training-centre.power.france@alstom.com
thermal-service-training@alstom.com
Boiler inspection seminar series
Session 1 - Boiler inspection fundamentals

TARGET PROFILE
- Maintenance/planning personnel
- Engineering personnel
- Operations personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ List the most common stresses that limit boiler component life
✓ Differentiate the causes for multiple points of stress that can rapidly diminish pressure part reliability (fuel, water quality, material selection, operator error, past maintenance practices)
✓ Identify critical inspection points both common to different boiler designs and unique to a variety of fossil fuels
✓ Prioritise planning activities to maximise plant equipment reliability

Content
Session 1 of the boiler inspection seminar series is designed to benefit personnel recently assigned to the task of maintaining the boiler and its auxiliaries. Emphasis is on common points for all boiler inspections

The lessons focus on the following systems and equipment:
- Large coal, oil or gas-fired boilers
- Modern industrial boilers with gas tight furnaces and superheater assemblies
- Circulating fluidised bed boilers
- Heat recovery steam generators

This course begins with boiler design variations, based on application and fuel. Topics then focus on steel selection, water treatment and steam quality. The central theme in this session is pressure part failure mechanisms, causes and prevention

Fundamentals of boilers are addressed from multiple perspectives:
- Steam generator design principles
- Fossil fuel combustion concerns as well as ash and slag issues
- Causes of boiler tubing deterioration
- External fossil fuel corrosion of boiler pressure part tubing
- Internal boiler water corrosion of pressure part tubing

Course Information
Location:
- Chattanooga, TN

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attendess
- On-site training class, price on request

Method of Training
- Alstom’s Materials Testing Centre is typically utilised during the session to provide a better understanding of the processes involved in the fabrication of high pressure, high-temperature pressure parts
- Presentation including group work and exercise

Technical Training Centre: Windsor

Email: thermal-service-training@alstom.com
Content

This seminar is designed to benefit personnel responsible for inspecting, operating and maintaining the boiler and its auxiliaries. Emphasis is on the details of inspection and preventative measures to improve component reliability.

The lessons focus on the following systems and equipment:
- Large coal, oil or gas-fired boilers
- Modern industrial boilers with gas tight furnaces and superheater assemblies
- Key auxiliary system components such as: hanger supports, ductwork, casing, access doors, burner/windbox assemblies including fuel firing hardware, air heaters, soot blowing equipment, internal baffles, boiler water circulating pumps, and trim piping

Topics address the stresses from the standpoints of the fireside, waterside, and structural supports over a range of thermal conditions. Each topic includes activities that must take place before, during and after the boiler outage.

Predictive maintenance (inspection and analysis) will be the primary focus, but critical recommendations will address preventative and corrective maintenance.

Throughout the series of boiler lessons, subjects are detailed for the benefit of predictive, preventative and corrective boiler and auxiliaries maintenance. Some examples are below:

**Predictive:**
- Determining the life expectancy of an overheated header
- Conducting effective inspections to help justify component refurbishment or replacement

**Preventative:**
- Limiting drum carryover of salts that can damage superheater tubes and turbine blading
- Reducing the incidents of component failures by understanding component design and operation

**Corrective:**
- How to systematically document repeat component failures until a root cause is found
- How to execute outage work to improve component performance

This course progressively addresses the subject of boiler inspections starting with the fundamentals of inspecting thick-wall (headers/drums), thin-wall (tubes) pressure parts as well as sub-components closely associated with reliable operation.

Course Information

**Location:**
- Chattanooga, TN

**Course Price:**
- This course is sold per seat at $1250 with a minimum of 20 attendees
- On-site training class, price on request

**Prerequisites**
- Attended boiler inspection fundamentals seminar or has previous knowledge in this area

**Method of Training**
- Alstom’s manufacturing facility is typically utilised during the session to provide a better understanding of the processes involved in the fabrication of high pressure, high-temperature pressure parts
- Presentation including group work and exercise

Target Profile

- Maintenance/planning personnel
- Engineering personnel
- Operations personnel

Objectives

On completion of the course, participants will be able to:
- Identify the many causes for boiler and auxiliaries deterioration and failure
- Prioritise activities and plan ways to maximise boiler system reliability
- Identify critical repairs that prevent pressure part damage
- Discuss the relationships between fuel, maintenance and operations

Location:
- Chattanooga, TN

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attendees
- On-site training class, price on request

Prerequisites:
- Attended boiler inspection fundamentals seminar or has previous knowledge in this area

Method of Training:
- Alstom’s manufacturing facility is typically utilised during the session to provide a better understanding of the processes involved in the fabrication of high pressure, high-temperature pressure parts
- Presentation including group work and exercise

Technical Training Centre: Windsor

2 Days

35 Trainees (max)
Boiler inspection seminar series
Session 3 - Pressure part failure analysis & prevention

TARGET PROFILE
- Maintenance/planning personnel
- Plant engineering personnel
- NDE and metallurgical staff
- Corporate engineering personnel
- Welding engineering personnel

OBJECTIVES
On completion of the course, participants will be able to:
- Identify both failure mechanism and/or component based assessment techniques to be applied to any boiler or auxiliary
- Determine the best preparation method to implement the condition assessment
- Describe the parts and processes that ensure thorough destructive and non-destructive examination and reliable future operation of the boiler by timely and cost effective repair, modification and/or replacement decisions for aged boiler components

Content
Topics will address the stresses from the standpoints of the fireside, waterside, and structural supports over a range of thermal conditions

Each topic will include activities that must take place before, during, and after the boiler outage. Predictive maintenance (inspection and analysis) will be the primary focus, however critical recommendations will address preventative and corrective maintenance

The lessons focus on the following systems and equipment:
- Boiler water circulating pumps
- Desuperheaters
- Dissimilar metal welds
- Economiser tubing and headers
- High temperature headers
- High energy piping
- Steam and mud drums
- Superheater and reheater tubing
- Waterwall headers
- Waterwall tubing
- Special case components:
  - Pulveriser main vertical
  - Shaft and tanks

The following subjects will be detailed for the benefit of predictive, preventative and corrective boiler and auxiliaries maintenance:

Predictive:
- Effectively applying non-destructive examination to determine the full span of attack
- Determining when destructive examination is warranted

Preventative:
- Reducing repeat failures
- Determining where material verification can prevent a weld failure

Corrective:
- Applying the right NDE technique to a pre-boiler or boiler component
- Determining the depth of a subsurface crack

The boiler inspection seminar series of four courses progressively addresses the subject of boiler inspection from the fundamentals of inspecting thick wall (headers/drums) and thin wall (tubes) pressure parts as well as those subcomponents closely associated with reliable operation

TECHNICAL TRAINING CENTRE: WINDSOR

Course Information
Location:
- Chattanooga, TN

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attenders
- On-site training class, price on request

Prerequisites
- Previous knowledge in power plant inspection and maintenance or attended previous boiler inspection fundamentals seminar

Method of Training
- Alstom’s Pressure Part Manufacturing and Materials Technology Centre is typically utilised during the session to provide a better understanding of the processes involved in the analysis of high pressure, high temperature pressure parts
- Presentation including group work and exercises

Email: thermal-service-training@alstom.com
TARGET PROFILE

- Maintenance/planning personnel
- Plant engineering personnel
- NDE and metallurgical staff
- Corporate engineering personnel
- Welding engineering personnel

OBJECTIVES

On completion of the course, participants will be able to:

✓ Describe the lab analysis processes that ensure thorough destructive and non-destructive examinations relative to past, present and future operating practices
✓ Apply timely and cost effective repair, modification and/or replacement decisions for aged boiler components
✓ Share relevant case study examples of failure mechanisms and learn where deceptive appearances of similar failures may mislead proper corrective actions
✓ Recognise when site evaluation of issues such as welding problems, high temperature excursions and localised stress concentration can be corrected before potential failures cripple the power plant

Content

In the Advanced assessment phase of this series of courses the lessons will take stress analysis to a higher level where component life and integrity assessment can be projected beyond the traditional 30-year period, factoring in the risks associated with ever increasing cyclic operation

This course will give the participants an opportunity to ask about how the laboratory analysis (both metallurgical and computer based) can be applied to the entire plant cycle including such areas as deaerator tanks or turbine blades

The lessons focus on the following systems and equipment:

- High energy piping
- High temperature headers
- Superheater and reheater tubing and their oxide scale layers
- Economiser tubing and headers
- Water wall headers and tubing including flame spray or cladding layers
- Steam and mud drums
- Dismal metal welds, and welding in general

Predictive, preventative and corrective boiler and auxiliaries maintenance tasks are addressed from the perspective of pre-outage, outage and post-outage periods:

Predictive:
- Determining remaining life expectancy using laboratory analysis and computer based models

Preventative:
- Identifying the root cause of tube failures preventing repeat failures

Corrective:
- Determining when a flawed weld repair is the cause of secondary failure

The boiler inspection seminar series of four courses progressively addresses the subject of boiler inspection from the fundamentals of inspecting thick wall (headers/drums) and thin wall (tubes) pressure parts as well as those sub-components closely associated with reliable operation

Course Information

Location:
- Chattanooga, TN

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attendess
- On-site training class, price on request

Prerequisites

- Attended previous boiler inspection fundamentals and NDE condition assessment seminar or has previous knowledge in power plant inspection and maintenance

Method of Training

- Alstom’s professionals at our labs (Windsor, CT Power Plant Labs and Chattanooga, Materials Testing Centre) not only have the expertise in high temperature material behaviour, but also can demonstrate the best ways to integrate their developed understanding of the issues and interrelationships of operation, design and related concerns of power generation
- Presentation including group work and exercises

Email: thermal-service-training@alstom.com
Boiler performance optimisation seminar
Tier 1 - Unit design & performance

TARGET PROFILE
- Plant and boiler performance engineers
- Plant instrument/controls engineers/technicians
- Testing staff
- Operations/shift supervisors

OBJECTIVES
On completion of the course, participants will be able to:

- Identify performance problems with boilers and pulveriser firing systems
- Evaluate the impacts of off-design performance
- Devise testing programmes to evaluate performance shortcomings
- Identify test data inconsistencies
- Plan corrective measures for performance problems
- Communicate with operations to determine if the required changes are understood and applied to everyday operation

Content
The boiler performance optimisation seminar tier 1 – Unit design and performance seminar is designed to aid personnel assigned the task of measuring and maintaining plant and boiler performance objectives. The emphasis will be on boiler performance in general and on combustion system optimisation in particular. The lessons focus on the following systems and equipment:

- Utility boilers
- Fuel firing equipment/firing systems
- T-fired/wall-fired/oil and gas
- Pulverisers
- Flue gas emissions optimisation
- Soot blower optimisation
- Boiler controls

With the exception of pulveriser performance, the theories and calculations presented in the topics above during the seminar can be applied to oil and gas fired boilers.

Fundamentals of boiler performance are addressed from multiple perspectives:

- Steam generator design principles
- Fuel, ash, air, and water/steam properties
- Basic turbine performance
- Boiler efficiency and heat transfer analysis
- Fossil fuel combustion
- Combustion optimisation
- Pulveriser performance
- Boiler operation and troubleshooting

Course Information
Location:
- Varies

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attendess
- On-site training class, price on request

Prerequisites
- A minimum of 3 years of performance engineering or plant engineering is recommended
Content

The boiler performance optimisation seminar tier 2 – NOx/CO emissions seminar is designed to aid personnel assigned the task of maintaining optimum NOx/CO emissions from a coal fired steam generator.

The instructors have field experience and will share their experiences of maintaining and optimising firing systems. Each participant will receive a comprehensive set of course notes and a copy of ‘Clean Combustion Technologies’, a reference book on steam generation and emissions control, fifth edition, as published by Alstom Power Inc.

The emphasis will be on combustion system optimisation of a tangential firing system and include the following systems and equipment:

The lessons focus on the following systems and equipment:
- Fuel firing equipment/tangential firing systems
- Control of primary and secondary air
- Optimisation of NOx/CO Emissions from the firing systems
- NOx control with selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) systems

Fundamentals of achieving optimum NOx emissions are addressed from multiple perspectives:
- Tangential firing systems
- Operational concepts of tangential firing
- Control of NOx emissions with Alstom’s LNCFS™ firing system
- Key operating variables that affect NOx
- An overview on tuning a LNCFS™ firing system
- Inspection guidelines for Maintaining a LNCFS™ firing system
- Control of NOx emissions with SCR and SNCR systems

Prerequisites
- Although not required, attendance in the Alstom boiler performance optimisation, tier 1 - Unit design and performance seminar is recommended.

Course Information

Location:
- Varies

Course Price:
- This course is sold per seat at $1,250 with a minimum of 20 attendees
- On-site training class, price on request

INFORMATION & REGISTRATION

Email: thermal-service-training@alstom.com
HP Coal pulverisers
Maintenance & performance training seminar

TARGET PROFILE
- Maintenance personnel
- Maintenance planning personnel
- Engineering personnel

OBJECTIVES

On completion of the course, participants will be able to:
- Identify key areas of milling system design, and explain how they each affect capacity
- Identify the functions and critical care issues for both major and auxiliary pulveriser systems and components
- Identify the points and processes for effectively inspecting a mill during operation, short outages, and overhauls
- Describe the adjustments that should be made based on inspection findings
- Discuss in general overhaul procedures for major pulveriser components
- Explain proper methods for setting air flow and milling system discharge fineness
- Identify causes and responses to pulveriser fires

Content

This seminar is designed to benefit personnel responsible for maintaining the performance, reliability, and availability of their power plant’s coal pulverisers.

This course addresses preventative and corrective maintenance to optimise equipment performance, and recommends procedures and practices before, during, and after mill maintenance overhauls.

The training will enhance the knowledge of the participants to better:
- Identify critical inspection points and conduct inspections
- Execute routine maintenance and adjustments
- Differentiate typical from abnormal wear
- Increase reliability and availability
- Optimise grinding capacity and efficiency

The following subjects will be addressed during the seminar:
- Coal pulverisation fundamentals
- Maintenance summary of the mill’s major components
- Maintenance summary of key auxiliary systems
- General liner and wear protection
- Spare parts and critical service support options
- Fastener application guidelines
- General overview of installation and disassembly of such systems as the journals, springs, classifiers, bowl liners, vane wheel and gearing
- Performance testing and adjustment for coal milling systems:
  - Air flow measurements and control
  - Air-to-coal flow optimisation
- Coal grinding and fineness efficiency issues
- Pulveriser fire prevention and post-event inspection
- Troubleshooting

Course Information

Location:
- Varies

Course Price:
- This course is sold per seat at $1250 with a minimum of 20 attendants
- On-site training class, price on request

Email: thermal-service-training@alstom.com
TARGET PROFILE

- Maintenance personnel
- Maintenance planning personnel
- Engineering personnel

OBJECTIVES

On completion of the course, participants will be able to:

- Identify key mill design features that impact capacity
- Identify the functions and critical care issues for both major and auxiliary pulveriser systems and components
- Identify the points and processes for effectively inspecting a mill during operation, short outages and overhauls
- Describe the adjustments that should be made based on inspection findings
- Discuss in general overhaul procedures for major pulveriser components
- Explain proper methods for setting air flow and milling system discharge fineness
- Identify causes and responses to pulveriser fires

Content

This seminar is designed to benefit personnel responsible for maintaining the performance, reliability, and availability of their power plant’s coal pulverisers.

This course addresses preventative and corrective maintenance to optimise equipment performance, and recommends procedures and practices before, during, and after mill maintenance overhauls.

The training will enhance the knowledge of the participants to better:

- Identify critical inspection points and conduct inspections
- Execute routine maintenance and adjustments
- Differentiate typical from abnormal wear
- Increase reliability and availability
- Optimise grinding capacity and efficiency

The following subjects will be addressed during the seminar:

- Coal pulverisation fundamentals
- Maintenance summary of the mill’s major components
- Maintenance summary of key auxiliary systems
- General liner and wear protection
- Spare parts and critical service support options
- Fastener application guidelines

- General overview of installation and disassembly of such systems as the journals, springs, classifiers, exhauster fans, bowl liners, vane wheel, and gearing
- Performance testing and adjustment for coal milling systems:
  - Air flow measurements and control
  - Air-to-coal flow optimisation
  - Coal grinding and fineness efficiency issues
- Pulveriser fire prevention and post-event inspection
- Troubleshooting

Please Note: the three distinctly different systems (RP, RPS, RS) will be covered

Course Information

Location:
- Varies

Course Price:
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- On-site training class, price on request

Email: thermal-service-training@alstom.com
Heat recovery steam generators (HRSG)  
Operation & inspection seminar

TARGET PROFILE
- Operations personnel  
- Maintenance personnel  
- Maintenance planning personnel  
- Engineering personnel

OBJECTIVES
On completion of the course, participants will be able to:
✓ Describe ‘Best Practices’ operating guidelines, both base-loaded and cycling units  
✓ Identify opportunities for performance improvements  
✓ Assess HRSG inspection examinations and component failure mechanisms, such as FAC  
✓ Plan preventive maintenance and routine care  
✓ Learn the critical differences of inspection, maintenance and performance that impact HRSGs in a unique manner. This will help plant personnel who may be familiar with the traditional fossil fired boiler

Content
This seminar relates HRSG inspection and maintenance work on the gas turbine and balance of plant for both combined cycle and co-generation facilities

Subjects cover the arrangement of both horizontal and vertical units, cycle performance, control, pressure part and non-pressure part degradation, water treatment, metallurgical design issues for cyclic operation, advanced condition assessment and remaining life estimation, and practical inspection and repair activities

The training will enhance the knowledge of the personnel responsible for maintaining the performance, reliability, and availability of their power plant’s HRSG

The following subjects will be addressed during the seminar:
• Design and operation fundamentals  
• Comprehensive inspection plans and routine care  
• Gas side flow problems  
• Inspections - from basic to advanced NDE techniques  
• Thin and thick wall pressure part repairs

The above subjects have been thoughtfully revised from traditional fossil fired boilers to address aspects that are unique to HRSG's

Course Information
Location:
- Varies

Course Price:
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- On-site training class, price on request

INFORMATION & REGISTRATION
Email: thermal-service-training@alstom.com