ENGIE Laborelec

Laborelec Academy Training catalogue 2019

Upgrade yourself with skills for the future

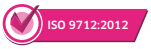
Content

Certificates
Explained

VCA is a certified safety management system for companies conducting high risk activities in a high risk environment. This certificate demonstrates that a company structurally cares about safety, health and welfare at work for all the parties involved.

Occupational Health and Safety Assessment Series.
This internationally applied British standard specifies requirements for an occupational health and safety management system to help organizations to control occupational health and safety risks.

General requirements for the competence of testing and calibration laboratories. This standard specifies the general requirements for the competence to carry out tests and/or calibrations, including sampling. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods.



This international standard, formerly known as EN473, specifies requirements for principles for the qualification and certification of personnel who perform industrial non-destructive testing (NDT).

The American Society for Nondesctructive Testing certification is an impartial validation of the competence of NDT personnel in the field.

Voluntary certification of contractors involved in the design, construction and / or maintenance of electrical installations in explosive atmospheres.

NACE International is a worldwide authority in the domain of corrosion and corrosion protection. The trainers of our introductory course about corrosion protection and paints are at least NACE CIP level 2 certified.

New 2019

Batteries and safety

This course provides an overview of possible technologies used for battery systems. Return of experience will be used to explain the potential hazards of each battery technology. Then, best practices to limit the risks and work safely will be developed. A visit of the control room of ENGIE Batteries Lab will be done to illustrate how the solutions proposed by suppliers are evaluated. This is to complete the explanation done on the consequences of battery choice (performance, implementation, health and safety …).

Program

Level 1: Safe handling of batteries

- Battery: How does it work?
- Overview of different types of batteries
  - Focus on lead-acid and lithium ion
- Potential hazards during installation and maintenance
  - Short circuits, electrical arc, etc.
- Potential hazards during operation and storage
  - Thermal runaway, explosive gas emission, toxic gas emission, fire, etc.
- Intervention rules
- Visit of the control room of ENGIE Batteries Lab
- Questions and Answers

Target audience

Level 1:

- Plant operation and maintenance personnel
  - Goal: increase knowledge to better work with batteries
- Health and safety advisor
  - Goal: increase knowledge to better supervise works with batteries
- Technically-skilled personnel
  - Goal: acquire a background in batteries safety

Level 2: Batteries for Energy Storage Systems

- Introduction to batteries
- Comparison between different types of batteries
  - Focus on lead-acid and lithium ion
- Overview of battery chemistries
  - Impact on performance, cost and safety
- State-of-the-art of Electrochemical storage
- Visit of the control room of ENGIE Batteries Lab
- Technical integration
- Operational Integration
- Market Opportunities & Economics
- Potential hazards during installation and maintenance
  - Short circuits, electrical arc, etc.
- Potential hazards during operation and storage
  - Thermal runaway, explosive gas emission, toxic gas emission, fire, etc.
- Installation solutions
- Questions and Answers

Bring your own cases!

You are most welcome to bring cases and experience for discussion during the level 2 training course to receive opinions from our experts. You will also benefit from hearing from peers who may have had the same experiences in other companies.

Duration

Level 1: ½ day
Level 2: 2 days

Is this training course for you?

Participants will learn more about chemical and technical aspects of batteries and will understand from where risks are coming in order to work safely. The level 2 will allow project managers to find a correct balance between safety and performances.

Target audience

Level 2:

- Technical and project managers

LEARN

Learn how batteries are working and what you can put in place to work safely

MEET

Meet peers from other companies

IMPROVE

Benefit from other people´s experience in battery storage systems

Security 101 (Cyber security awareness)

Description Awareness is key in understanding the possible business impact of cyber security. Gain a critical understanding of its technological needs, threats, and weaknesses. The course will offer guidance to process engineers, information technology personnel, operations managers and other plant personnel responsible for developing and maintaining the cyber security of automation systems.

Modules covered in this course:

- Introduction
- Understanding cyber security for ICS
- ICS threat landscape
- ICS vulnerabilities
- Common cyber security threats
- ICS security myths
- Defense-in-depth cyber security plan
- Types of security attacks and prevention
- ICS security policy requirement

Recommended number of participants No limits (company-wide)
Duration 1 day

Target audience
Managers, engineers, suppliers, integrators etc. (everyone working within the organization)

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Security 201
(Advanced Cybersecurity Training)

Description The course provides participants with the information and skills to evaluate and implement cyber security countermeasures to achieve the target level of security in a new or existing Industrial Control System (ICS).
Participants will learn about the latest developments in ICS networking and cybersecurity, and how to execute vulnerability testing to verify that the level of cyber security of an ICS solution meets specification. Laboratory exercises reinforce the learning objectives by using a classroom network setup leveraging virtual environments.

Modules covered in this course:

- Bridging IT and OT
- Evolution of cyber attacks
- Virtualization
- Setting up a pen test lab
- Hacking and its phases
- Wired networks and wireless networks
- Scanning vulnerabilities
- Executing exploits
- Implementing Defence

Recommended number of participants 5-8
Duration 4 days

Target audience
ICS operations and maintenance personnel, designated single point of accountability (SPoA), IT engineers, IT teams, engineering teams and relevant managers

Security X (Board and Executive Cybersecurity Training)

Description Today's cyber-insecure world requires boards and executives to think critically about the significant cyber issues facing their organizations. Cyber security is no longer relegated to the IT department, it starts at the top and is everyone's business. This training course prepares executive members in a direct and uncomplicated way how to identify, understand, assess and mitigate risks associated with cyber security, and make steps to integrate cyber security into strategy, policy and guidelines.

Immediate benefits from this course:

- Cyber security strategy strengthened with high-level buy-in and leadership
- Recognition of cyber as a business risk
- Decision-making based on subject matter familiarity
- Stronger tactical/strategic response to breaches

Immediate benefits from this course:

- Support for security mission drives investment
- Potential for new lines of business
- Budget for projects to determine exposure to threat and risk
- Set responsibility for tracking landscape evolution and cyber hygiene

Recommended number of participants 3-5
Duration 3-5 hours

Target audience
CEO, CFOs CIO, CISOs, auditors, risk managers, security leaders

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OHSAS 18001:2007

Introduction to additive manufacturing of metal components

Description A course to help reflection on the value of additive manufacturing (AM) for your business. With a focus on metal printing and the selective laser melting (SLM) process, the course will help provide an overview of the possibilities of additive manufacturing (3D printing). The course will go through the available techniques for metal applications and focus in more depth on SLM.

Participants will gain an understanding of the limitations and possibilities that might have an impact on even the design of your parts, or the supply chain. Through case studies we evaluate all phases of the process, from powder selection, file preparation and building parameters to post-processing treatments.

Modules:

- Introduction
  - What is additive manufacturing? Current available technologies and materials, market situation, risks and opportunities.
- Powders
  - Metal powder characterization for SLM, including production process, key properties for QA/QC or certification and review of existing standards.
- Build job preparation
  - Presentation of software tools for additive manufacturing and build preparation procedure.
- Process optimisation
  - Influence of process parameters on the physical/ mechanical properties of SLM parts.

Target audience
Design engineers, maintenance and supply chain staff, purchase staff and middle management

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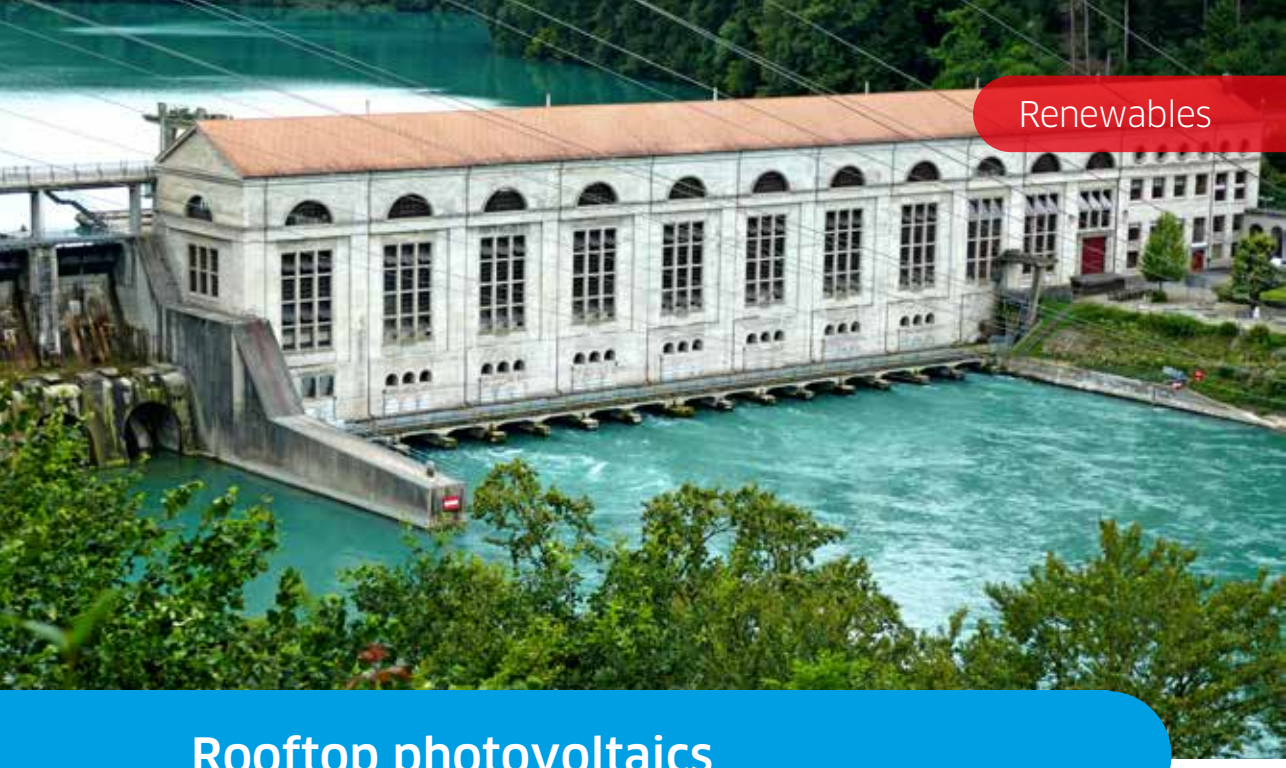
- Design guidelines
  - Development of best practices for the use of SLM equipment and prototyping activities

Recommended number of participants 6-20
Duration (standard) 2 days



Rooftop photovoltaics

Description Participants acquire general knowledge in basic solar energy, including:

- The context of the solar photovoltaic market,
- The potential of solar field,
- The principle of photovoltaic technology, manufacture of a module, performance and characteristics of photovoltaic systems, and their possible applications.
- Understanding the role and operation of the main components of a generator

Recommended number of participants 6-12
Duration (standard) 1 day

Target audience
Business managers and project developers with a basic technical background

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Introduction to the design of solar power plants

Description This course is an introduction to the basic design of solar power plants and is in five parts:

- In the introduction, the different types of solar power plants – photovoltaics power plants versus concentrated solar power plants – are explained. The major differences in terms of site and operational requirements, as well as current and future technology trends, are outlined.
- In the second part, the basic design concepts of multi-MW scale photovoltaic power plants are explained, with a comprehensive overview of the properties of sunlight, the properties of PV modules, strings and plants, design software capabilities, solar resource assessment requirements and specifications of yield calculations.
- The third part focuses on the design of the power plant itself. Subjects covered are: IV-curves, modules versus arrays or strings, PV array sizing considerations, PV inverter sizing considerations, DC to AC ratio, maximum power point tracking, module efficiency, inverter efficiency and plant efficiency.
- The fourth part is dedicated to grid connection aspects of large scale solar power plants. Subjects covered include: the role of the grid operators, grid code requirements, electrical connection studies, overview of simulation tools and models, and functional requirements.
- The final part focuses on the operation and maintenance of PV power plants, performance monitoring, and basic O&M issues.

Recommended number of participants 6-12
Duration 1 day

Target audience
Project developers with a technical background

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Introduction to the design, construction and operation of wind power plants

Description This training is jointly offered by Tractebel and Laborelec, and consists of different modules, covering:

- From wind energy to electrical power
- Energy yield assessment
- Onshore wind procurement
- Wind turbine suppliers
- Site selection and optimization
- Wind farm design
- Constructing a wind farm
- Commissioning a wind farm
- Operation and maintenance

On request, this course can be extended to an introduction to power quality and grid compliance for wind farms, but this will require participants to have some technical background:

- Fundamentals of energy conversion systems
- Grid code requirements
- Power quality
- Electrotechnical simulation models
- Applicable standards

Recommended number of participants 6-12
Duration (standard) 2 days

Target audience
Maintenance staff and asset managers responsible for transformers.

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On-demand training

Description Since renewable energy is an evolving field, we propose training courses based on your needs

- Introduction to the design and operation of concentrated solar power plants
- Hydro
- Marine
- Introduction to geothermal energy

Condition monitoring of power transformers trough oil analysis: Introduction

Description The course begins with a half-day theoretical session addressing various aspects of transformer condition assessment:

- Why perform transformer oil analyses?
- What are the main oil and paper degradation mechanisms?
- Which analyses apply to which types of transformers?
- Why perform different kinds of analyses at different frequencies?
- What is the best frequency for conducting analyses?
- How to interpret test results: trending, comparison with international standards, etc.
- How to use the analysis results to create and implement a maintenance action plan.

In the afternoon, there is a visit to the ENGIE Laborelec oil analysis laboratory. In addition, specific case studies are discussed to train in interpreting results and formulating recommendations.

Recommended number of participants 8-12
Duration (standard) 1 day

Target audience
Maintenance staff and asset managers responsible for transformers.

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Condition assessment and monitoring of power transformers through oil analysis: advanced

Description The objective is to acquire the knowledge needed to define and implement an effective oil analysis programme, to monitor the condition of transformers and to understand oil analysis reports as part of a maintenance strategy.The following issues will be covered during the training:

- Condition monitoring of power transformers through oil analyses:
  - Best practice
  - Which analyses/how frequent
  - DGA: focus on partial discharges, sparking, stray gassing, catalytic effects / interpretation systems.
  - Interpretation of results
  - International standards: IEEE, IEC, Duval, ASTM, etc.
  - Maintenance guidelines
  - Trending and reporting
  - Sampling techniques

- Use of online monitoring for DGA/water: implementation and real-case advantages etc.
  - New developments: importance of methanol as ageing marker, temperature correction of ageing markers, stray gassing of oils in service etc.
  - REX, case studies and real-case exercises concerning power transformers within generation and high-voltage grids.
  - Discussion on reports of the power transformer at Tihange / Doel plant.
  - Use of unused insulating transformer oils:
  - Market trends in the use of inhibited and uninhibited oils.
  - Differences, advantages and drawbacks of uninhibited compared with inhibited oils.
  - Importance of additives, oxidation stability tests, stray gassing, etc.

Recommended number of participants 8-12
Duration (standard) 2 days

Target audience
Maintenance staff, operators, asset managers, staff responsible for transformers, technical project managers.

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OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Condition monitoring of rotating machines through oil analysis

Description

Day 1

- Why perform lubricating oil analyses?
- What are best practices in oil sampling?
- What are the degradation mechanisms for lubricating oils?
- Which analyses apply to which types of equipment?
- What is the best frequency for conducting the analyses?
- How to interpret test results: trending, comparison with international standards, etc.
- How to use the analysis results to create and implement a maintenance action plan.

In the afternoon, there is a visit to the ENGIE Laborelec oil analysis laboratory. In addition, specific case studies are discussed to train in interpreting results and formulating recommendations.

Day 2 (optional)

A workshop in collaboration with oil suppliers and filter manufacturers. Topics include lubricating oil types, filtration techniques, best practices for oil storage and refills, etc.

Recommended number of participants 8-12

Duration 1 day (or 2 days in case of optional workshop)

Target audience

Maintenance staff and asset managers responsible for turbines and other rotating equipment.

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OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Introduction to generators

Description

- General introduction of generators in the plant
- The evolution of electricity principles
- The principle manufacturers, the different generator types
- The generator autopsy, meaning the virtual disassembly of each major components (stator, rotor, bearings, casing)
- How is a generator made/assembled
- The main generator failures (electrical and mechanical), with the resulting effects
- Importance of qualitative maintenance and foreign material exclusion rules

Recommended number of participants 8-12
Duration half day

Target audience

Plant operators and maintenance staff

VCA++

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Gas turbine – GE

Description At the end of the training the participants should understand the working principles and assemblies of the different gas turbine components. This will allow them to perform maintenance activities and to plan maintenance activities. But it will also help to perform failure analyses, evaluate upgrades and to follow and evaluate works performed by OEM.

This training consist of :

- General mechanical background.
- Working principal of gas turbine in general
- Assembly of gas turbine component
- Working and aim of IGV's blow off's
- Damage phenomena
- Combustion and tuning principals
- Gas turbine materials.

The training is build op in different modules. The complete training session will be 3 days and threats the following modules:

Day 1 and 2
- Introduction
- General buildup of the unit.
- Inlet guide vanes
- Fix point, Thermal expansions and thrust in the unit
- Cooling air flow.

Day 3
- Practical Speedtronic Mark V
- General operations
- Combustion and Tuning

Recommended number of participants 8-12
Duration 3 days

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine - GE F Class evolution to 9 FB

Description This training explains the differences between 9FA and 9FB. It is a short overview for people knowing the 9FA and attend to be involved in activities on 9FB units.

Content:
Hardware Differences to achieve the higher efficiency.

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine - GE DLN2.6 combustion

Description After this training, the trainee will be able to tune the combustion system.

- DLN2.6+ philosophy
- DLN2.6+ hardware
- DLN2.6+ control loops (Full Load Auto Tune and conventional)

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine – Speedtronic Mark V

Description After this training, the trainee will be able to trouble shoot in the system.

- For I-Dos based as for Simplicity based HMI:
- System setup
- Reading rungs
- Understand the most important controls
- Logic forcing
- Changing constants
- Making trends

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine – Speedtronic Mark V I

Description After this training, the trainee will be able to trouble shoot in the system

- System setup
- Reading rungs
- Understand the most important controls
- Logic forcing
- Changing constants
- Making trends

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineersa

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Gas turbine – Speedtronic Mark V Ie

Description After this training, the participant will be able to trouble shoot in the system.

- System setup
- Reading rungs
- Understand the most important controls
- Logic forcing
- Changing constants
- Making trends

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine - ALSTOM GT 26

Description At the end of the training the participant will have basic knowledge and understanding of the GT26

Content:
The basic setup of a GT26 and all of its major components will be discussed, from Air Intake (Filter House) until the Exhaust Gas Diffuser, together with the (complicated) Cooling Air System. Also the required maintenance will briefly be discussed

Recommended number of participants 8 - 12
Duration 1 day

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

VCA++

OHSAS 18001:2007

Gas turbine - SIEMENS V 94.2/94.3

Description After the course, the participants should understand the working principals and assemblies of the different gas turbine components.
This will allow them to perform maintenance activities and to plan maintenance activities. But it will also help to perform failure analyses , evaluate upgrades and to follow and evaluate works performed by OEM.

This training consist of :
- General mechanical background.
- Working principal of gas turbine in general
- Assembly of gas turbine component
- Working and aim of IGV's blow off's
- Damage phenomena
- Combustion and tuning principals
- Gas turbine materials.

Recommended number of participants 8 - 12
Duration 2,5 days

Target audience
Maintenance people, mechanical engineers, project people, operators and controls engineers

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Gas turbine training – GE LM 6000 Dry Low Emissions (DLE)

Description After the cours, the participant will be able to understand the operation of an LM6000 (regulation, staging, variable geometry, ABAL operation, acoustics and blowout, etc...), explain what mapping is as well as understand and correct any operational issue's you might encounter during your operations.

De training consists of following modules:
- General principles of DLE combustion
- Construction of the DLE combustor and premixers
- Combustion acoustics
- Flame temperature control
- Fuel -airflow control
- Transient operability
- Control system
- Control operations
- DLE HMI screen
- OLE combustor mapping
- 11.Datalog
- 12.DLE problems

Recommended number of participants 6 - 8
Duration 3 days

Target audience
Production, maintenance and project people LM6000, specialist I&C

VCA++
OHSAS 18001:2007

GE LM 6000 controls (Woodward)

Description Understanding GE LM series gas turbine controls, giving participants an in-depth knowledge of:

- Hardware structure, and relevant alarms that can occur
- Understanding the structure of the core software
- How to navigate through the control software, retrace alarms, tune parameters and use troubleshooting tools on the HMI stations

Theoretical course on Woodward control systems for your GE LM gas turbine. The course addresses the following topics:

Hardware: NetCon – Micronet - Micronet+ - Atlas
- Control system architecture and system components
- CPUs and redundancy
- Rack I/O modules
- Remote I/O - Linknets RTC / HT
- Communication busses (LON, CAN bus, etc.)
- FMV and drivers

GAP software
- Introduction to GAP 3 (or GAP2 if required)
- LM core and sequencing software
- Navigation through application software
- Practical navigation exercises based on your application software

Troubleshooting tools
- Monitor GAP / Control Assistant / Appamanger / Datalogs

The controls training is adaptable to each specific installation at customer request.

Recommended number of participants 8 - 10
Duration 3 days

Target audience

Operations & Maintenance personnel and I&C specialists involved with Woodward control systems

VCA++

OHSAS 18001:2007

Gas turbine Siemens SGT4000F - Customized GT controls software and combustion system / monitoring

Description Controls and combustion monitoring (hardware and software) built around the following topics:

- Overview of installed hardware (instrumentation / control system) and protection functions
- GT control structure and functions - how to find the specific control modules in the GT Control system
- Combustion-related controls hardware
- Combustion monitoring – use of ARGUS system / Delphin Datalogger
- Active control elements to limit combustion humming
- Changing parameters in the control system (which parameters can be changed, risks, etc.)
- Presentation of experiences relating to SGT4000 controls (e.g. humming experiences, Siemens outage experiences, recommendations for best practices, such as parameter download and basic checks before, during and after overhaul)

The controls training is adaptable to each specific installation at customer request. Training will be through predominantly “hands–on” rather than theoretical “classroom” sessions. The following documentation is to be provided by participants at least four weeks prior to training:

- PID for combustion system and instrumentation system
- Block diagram / system description GT controls
- Access (passwords) for Argus / WINTS systems

Recommended number of participants 8 - 10
Duration 3 days

Target audience
Operations & Maintenance personnel, I&C specialists and project team members

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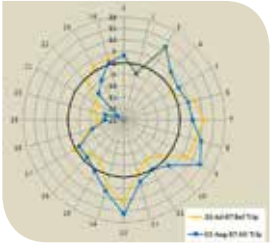

Steam turbine construction, operation and maintenance

Description Reach especially O&M personnel an in dept understanding on all aspects related to ST maintenance and the link to operation

De training is composed out of different chapters:

- General principles of steamturbines
- Design and construction
- General assembly of turbines
- Shaftline and thermal dilitation
- Maintenance
  - Damage and degradation mechaninsms
  - Inspection techniques
  - Maintenance in practice

After the training, the trainee will have gained good understanding of the general operating principles of steam turbines and advanced insights in all aspects of steam turbine maintenance

Recommended number of participants 8-12
Duration 3 days

Target audience
Maintenance and operation technicians

VCA++

OHSAS 18001:2007

Steam turbine hands-on training

Description The steam turbine hands on training is developed as on the job training for steam turbine maintenance activities.

This steam turbine training is developed as a hands-on, on the job training for steam turbine maintenance activities. It creates a training environment where all aspects of a real outage are covered by executing all activities on a small training turbine:

- build up general knowledge of the construction of an engine and its main components
- trainees execute all main tasks encountered during disassembly, cleaning and reassembly of a steam turbine.
- use of correct tooling: measuring instruments, specific tooling, hoisting equipment, …
- insights in basic repair and control techniques (welds, blue prints, ..)
- use of a quality system and emphasizing the importance
  - protocols
  - work methods
  - quality plan
  - planning
- organizational aspects of an outage: planning, preparation, safety, FME principles, shift co-ordination (aspects explained and covered during the mechanical activities)
- the importance of teamwork and communication between all involved parties.

Program

- General introduction
- History of the steam turbine used
- Steam turbine basics
- In the field training

After the course, the trainees are able to manage maintenance activities in order to lead correctly major inspections.

Recommended number of participants 4-6
Duration 5 days

Target audience

Enthusiastic mechanics who have mechanical skills, but want to increase their competences for turbine maintenance activities

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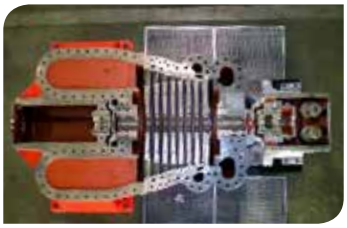
OHSAS 18001:2007



Indoor lighting: requirements, conception, technologies and energy concerns

Description Lighting requirements, conception, technologies and energy concerns

- Vision and photometry fundamentals
- Light source technologies
- Light fitting and auxiliary characteristics
- LED technology
- Analysis of an existing lighting installation
- Requirements of the EN 12464 standard
- Stages of a new lighting project
- How to use simulation software
- Energy concerns in lighting

Recommended number of participants 6-12
Duration 2 days

Target audience
Staff responsible for lighting installations (conception and maintenance).

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Electromagnetic compatibility (EMC)

Description EMC in industrial installations
a three-day course of good workmanship about cabling, earthing and shielding techniques in industrial environments.

On the basis of basic concepts of electrical theory and recognizable examples, demos and simple explanations, the student gets an idea of the interfering coupling mechanisms to sensitive electronics and how they can be prevented or remedied.

Days 1&2
- Signal caracteristics
- Electric impedance of conductors
- Inductive coupling
- Electrical coupling and radio waves
- Shielding
- Earthing and bonding
- Grouping and segregation of cabling
- Hot spots in industrial environments

Day 3 : options
- Drives basic (2h)
- Drives advanced (90 min)
- Drive bloopers (45 min)
- Lightning protection (2h)
- Surge Protective devices + installation (1h)
- Cabinet organization (45 min)
- Measurement & control items (30min)
- IT-TT-TN earthing systems and EMC (90 min)
- Shielding of HV-cables (30 min)
- Casus-bloopers (20 min)
- Lightning protection of radio base stations (2h)

Recommended number of participants 6-10
Duration 3 days

Target audience
Electricity technicians and installation designers.

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Electrical protection – MT theory

Description The following aspects will be addressed during the training:

- Defect types
- Simplified calculations of short- circuit current
- Measuring transformers
- Basic concepts (selectivity, reliability, …
- Neutral grounding
- Protection types and applications
- Conductor protection
- Transformer protection
- Decoupling protection
- Evolution of protection technologies.
- Introduction to IEC 61850

Recommended number of participants 8-10
Duration 2 days

Target audience
Maintenance and Operation technician and engineers

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Introduction to corrosion protection and paints

Description Participants will acquire a basic knowledge of paints, including relevant requirements and quality control. The course will enable participants to identify which paint works require more attention than others and to ensure best practices.

- Introduction to corrosion mechanisms and corrosion control
- Paint components: binder resin, solvents, and pigments
- How to select the best paint for a specific application
- How to read technical specifications and datasheets
- Application methods: spray, brush and roller
- Overview of surface preparation techniques: solvents, hand tools, power tools, blast cleaning and water jetting
- Paint failures, bad application techniques
- Standards and inspection issues
- Case studies

Recommended number of participants 6-12
Duration 1 day

Target audience
Project engineers, quality assurance managers, mechanical maintenance personnel and operation technicians.

VCA++

OHSAS 18001:2007

NACE - CIP Level 2

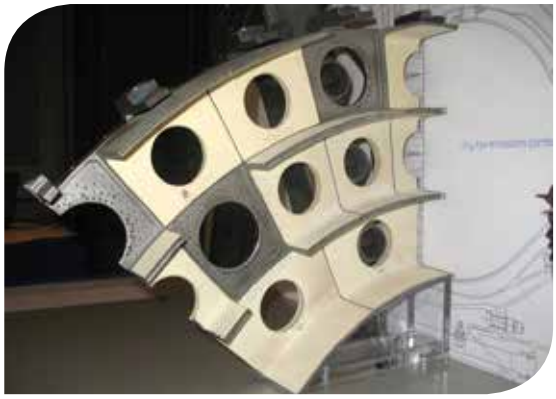
Electrical Protection for Power Plants

Description Acquire and consolidate the basics of the electrical protection operation, understand the degenerative phenomena of electrical faults, and know and understand the purpose and operation of protections in alternators.
Course content:

- Introduction to the domain of electrical protection
- How a unit (generator, transformers, auxiliaries, connection to the grid) is protected
- The functioning of each protection
- Understanding the functioning of a tripping matrix and its logic
- Internal or external faults, locking relays

After completion of the course, the participant will be equipped to carry out a first analysis of an incident and to participate in more detailed discussions.

Recommended number of participants 8-12
Duration 2 days



Target audience
Operations & Maintenance technicians and engineers.

VCA++

OHSAS 18001:2007

NACE – CIP Level 2

ATEX Level 0: fundamentals of ATEX rules and principles

Description

- What is an explosion?
- General information about ATEX: industrial risk, legal requirements
- Fire and explosion parameter: LEL, UEL, MIE, Kst, Kg, Pmax, flash point, auto-ignition temperature,…
- Ignition mechanisms: friction, static electricity, impacts, overheating
- Overview of European directives and zoning
- Overview of ATEX protection modes : what do I need to know?
- ATEX zone intervention rules: general rules, tools, adapted clothes, work permit

Recommended number of participants 6-12
Duration half day

Target audience

All workers in ATEX zones.

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OHSAS 18001:2007

ATEX level 1: mechanical and electrical course

Description

- The explosion risk and general issues concerning explosive atmospheres (legal obligations, what is an explosion, examples of explosions, etc.)
- Important parameters concerning fires and explosions: LEL, UEL, MIE, Kst, Kg, Pmax; understanding why some gases are more dangerous than others
- Ignition sources and ignition mechanisms: friction, static electricity, impacts, overheating, self-heating
- Safety of installations and workers: European directive 1999/92/EC, zoning (what are the different zones and what can I do in each zone?)
- Design of ATEX equipment: European directive 2014/34/EU, equipment marking (how to read it), documents related to the directive (explosion protection document, risk analysis, EU type certification)
- Overview of the protection modes of ATEX equipment: What do I need to know? What is the difference between ATEX and non-ATEX equipment? Is it all built in the same way? How do intrinsic safety and flameproof enclosures work?
- Installation and maintenance rules of ATEX devices according to their protection mode
- ATEX zone intervention rules: general rules, tools, adapted clothes, work permit
- Maintenance rules regarding seals, bearings, screws, cables, electrical connections, cable glands (is it sufficient to have an ATEX cable gland?), etc.
- The main goal is to ensure that ATEX devices keep all their features even after maintenance or installation
- Questionnaire at the end of the session to obtain the ISM-ATEX certificate

Level 1 training is formulated by Ineris and recognised by the EU.

Recommended number of participants 6-12
Duration 2 days

Target audience

All persons working with ATEX equipment, supervised by personnel trained to level 2, or for operational use.

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OHSAS 18001:2007
ISM-ATEX

ATEX level 2: mechanical and electrical course

Description The training covers similar content to level 1 but in more details. Additional issues are covered, such as:

- How should I zone an installation?
- When is an equipment certified by a notified body?
- Rules concerning conception of materials (the given rules follow the standard EN60079)
- More details about protection modes: intrinsic safety “i”, increased safety “e”, flameproof “d”, pressurisation “p”, liquid immersion “k”, constructional safety “c”, etc.
- Certification rules for assemblies
- What can I do with equipment dating from before 2003 to make it conform to the current ATEX directive?
- How can I calculate the acceptable cable length for intrinsic safe equipment?
- How should I measure the creep distance for increased safety equipment?
- How should earthing be done?
- Particular requirements for rotating equipment including fans
- Installation and maintenance of ATEX equipment: rehabilitation techniques, new parts, mechanical seals, belts, screws, bearings,etc.
- Inspection and control of installations
- Practical case studies are discussed during training
- Questionnaire at the end of the session to obtain the ISM-ATEX certificate

Level 2 training is formulated by Ineris and recognised by the EU.

Recommended number of participants 6-12
Duration 4 days

Target audience

All persons directly managing workers in ATEX zones, such as senior technical maintenance staff and asset managers responsible for transformers.

VCA++
OHSAS 18001:2007
ISM-ATEX

Introduction to process control for operations and maintenance personnel

Description The goal is to gain a better understanding of the control systems of a power plant.

Practical introduction to automation:

- What is a control loop? A controller? How do they work?
- How to understand process dynamics?
- What are the links between process and controller?
- PID controller: basic approach
- Control structure: feedback, feedforward, cascade, ratio
- A word about bumpless transfer and anti-windup
- Application to the main control loops in a power plant
- High level overview of temperature, flow, pressure and level measurements

Recommended number of participants 8- 10
Duration 2 days

Target audience
Operations and maintenance personnel.

VCA++

OHSAS 18001:2007

Controllers and control structures: Operational aspects

Description The goal of the training is to understand how to set up control systems, and to gain knowledge and competencies in operational aspects of developing and modifying control structures.

- Bumpless transfer (Manual -> Automatic and Automatic -> Manual mode)
- Bumpless parameter changes
- Anti-windup strategies
- “MIMO process” control with a unique controller
- Non linearity risk and handling
- Logic handling
- Measurement failure diagnostic and handling

Recommended number of participants 8-10
Duration 2 days

Target audience
I&C engineers and technicians.

VCA++

OHSAS 18001:2007

Process control: PID tuning

Description The goal of the training is to understand how to tune control systems. Participants will gain knowledge and competencies in tuning robust controllers in the context of process dynamics:

- What kind of processes?
- Process identification (1st to 4th order, dead time, integrator, etc.)
- Roles and dangers of the 3 control actions (P,I,D)
- How is it implemented in DCS?
- Process linearisation
- Tuning rules depending on process type (mainly “rules of thumb”)
- Cascade control: structure and tuning
- Practical session - identification - parameter calculation - trial and error improvement

Recommended number of participants 8-10
Duration 3 days

Target audience
I&C engineers and technicians

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OHSAS 18001:2007

Analysis of main loops

Description Participants will gain a deeper understanding of the installed process: control structure, logic, and the link with operator screens (HMI).

- Process oriented description and analysis of the selected installed control loops
- Exploring the link between screens (HMI) and control structure to enhance the added-value for the operator

Recommended number of participants 8-10
Duration 4 days

Target audience
Operators

VCA++

OHSAS 18001:2007

Advanced nuclear I&C and principal regulation systems

Description After completion of the course, the participant will have a good understanding of the nuclear process and how it is controlled, as well as the interactions of different systems and the evolution of physical parameters.
The participant will understand the principal control circuits of the primary and secondary loop, its normal operation, controlled and commanded values, and degraded modes.
The interactions between the different systems are explained and the importance of the balance between all components will be emphasised.

The training consists of 5 modules:

Module 1	1 day	Nuclear processes and the primary loop
Module 2	1 day	Steam turbine control and network
Module 3	1 day	SG level regulation and ΔP regulation
Module 4	1 day	Summary and big transients
Module 5	1 day	Cyber-security (short module)

Module 1 must precede modules 2, 3 and 4. Module 4 must follow modules 1, 2 and 3. Module 5 is independent.

Recommended number of participants 6-12
Duration 5 days

Target audience
Technicians I&C

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OHSAS 18001:2007

Introduction to solid fuels, gaseous fuels and liquid fuels combustion

Description The course objective is to cover the basics of solid fuels, gaseous fuels and liquid fuels combustion (tailored to the needs of participants), and to further study the impact of the combustion process on boiler and burner technologies. The specific pollutant emissions to be expected and their methods of mitigation are also covered.

- Combustion and its parameters, heating value
- Solid fuels, gaseous fuels, liquid fuels, pre-treatment of fuels, fuels for start-up
- Types of coal (sub-bituminous, bituminous, lignite, etc.)
- Milling behaviour
- Combustion process: air requirements, incomplete combustion, combustion controls
- Influence of the minerals on combustion (ash analysis)
- Influence of moisture content
- Erosion and corrosion, corrosion mechanisms, chlorine corrosion, molten sulphate corrosion, dew point corrosion, CO corrosion, etc.
- Influence of heavy metals and trace elements
- Types of burners, slagging and fouling risk, air staging
- Boiler and boiler cleaning
- Impact of furnace size
- Impact of the coal on emissions
- Safety issues
- Trouble shooting examples and case studies are used throughout the course

Recommended number of participants 6-12
Duration 2 days

Target audience
Operators and engineers

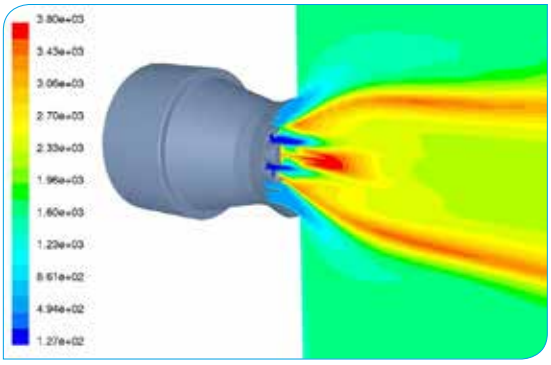
VCA++
OHSAS 18001:2007
ISO 17025:2005 (002-Test/002-Cal)

CFBC – Circulation fluidised bed combustion

Description Participants will gain a general understanding of CFBC, including:

- Brief description of the CFBC
- Solid fuels, fuels pre-treatment, fuels for start-up
- Combustion
- CFBC modelling
- CFBC and suppliers
- Controls
- The boiler, boiler cleaning
- Fuel efficiency and net electrical efficiency
- Trouble shooting
- Safety issues
- Erosion prevention
- Corrosion prevention
- Refractories, other materials
- Chemistry
- Bottom ash separation, bottom ash cooling, ash recycling, bed material and recycling, bottoms
- In-bed mixing
- Dosing of fuels and additives
- Prevention of sintering of the bed
- Emissions into the air, in-situ FGD, dedicated FGD, N_2O and NO_X, CO, UBC, fly dust, fly ash, trace elements
- Cyclones and separation of solids
- Lessons learned
- Improving CFBC
- Particles (according to Geldart)
- Operations, starts, stops, low loads
- Special fuels, special materials and adaptations
- Fuel drying
- Risk management
- Literature
- EU policies: fly ash, bottom ash, gypsum, in-bed FGD, CCS, sustainable energy.

Recommended number of participants 6-12
Duration 3 days



Target audience

Engineers, managers with a technical background, project developers, operators, suppliers.

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Introduction to flue gas treatment

Description The following subjects are highlighted:

- Wet limestone-gypsum flue gas desulphurisation, production of gypsum and treatment of FGD effluent. Alternative flue gas desulphurisation technologies may also be covered.
- Dust removal, using an electrostatic precipitator (ESP) or a fabric filter (FF)
- Secondary reduction of NO_X, either by selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR)

On request, the content of the course can be expanded to cover subjects such as mercury, trace elements, advanced FGD treatment, alternative flue gas desulphurisation, SO_3 and the air preheater.

1-day course on theory, state-of-the-art technology and operational and maintenance aspects of:

- FGD and FGD WWTP
- SCR / SNCR
- ESP / FF
- Air preheater – brief

The course includes an open technical exchange with participants on:

- the main parameters to be followed during operation
- their interactions
- the possible actions of the operators

Recommended number of participants 8-12
Duration 1 day

Target audience
Operation and maintenance staff.

VCA++

OHSAS 18001:2007

ISO 17025:2005 (002-Test/002-Cal)

Introduction to water chemistry

Description A general introduction to water chemistry and its three main aspects.

- Chemistry of the water-steam cycle
  - Introductory concepts: types of chemicals used in a boiler, types of boilers, etc.
  - Potential issues in a water steam cycle: corrosion, deposition, etc.
- Cooling water circuits
  - Main components (including condenser and cooling tower)
- Demineralised water preparation
  - Characteristics of raw water
  - Introduction to water treatment plants

Recommended number of participants 8-12
Duration 2 days

Target audience
The course addresses a wide audience, including operators, power plant chemists, plant operation or maintenance engineers, consultants and technical project managers.

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OHSAS 18001:2007

Chemistry of the water-steam cycle

Description

- Detailed aspects of chemistry in a water steam cycle (types of chemicals used in the boiler depending on the treatment and type of boiler, etc.)
- Potential issues in a water-steam cycle (such as corrosion and deposition)
- Monitoring and analytical programme, and knowledge of the specifications for the water steam cycle (normal values – targets – alarm levels)
- Chemistry aspects during transition periods: start-up – shutdown – preservation
- Actions in the event of an alarm
- Example of incidents (deviation compared to normal chemistry)
- Exercises and quiz

Recommended number of participants 8-12
Duration 1 day

Target audience

The course addresses a wide audience, including operators, power plant chemists, plant operation or maintenance engineers, consultants and technical project managers.

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OHSAS 18001:2007

Cooling water treatment

Description The training course includes the following topics:

- Design of the circuit including condenser (material, cleaning technologies, etc.) and cooling tower if present on-site
- Importance of site specific discharge limits (temperatures, chemical product, etc.)
- Scaling
  - How to avoid scaling in the cooling circuit (including using scale inhibitors)
  - Description of the main parameters to monitor the risk of scaling
- Biofouling and pathogens
  - How to avoid biofouling in the cooling circuit (coating, biocide, etc.)
  - Description of the main parameters to be followed for a good disinfection (ORP, chemical concentration, biology, etc.)
- Corrosion
  - Introduction to potential corrosion issues in cooling circuits
  - How to avoid corrosion in cooling circuit (corrosion inhibitor, corrosion probes, etc.)
- Conservation
  - How to preserve the cooling circuit during shutdown (cooling tower, condenser, intake, etc.)
- Exercises and quiz

Recommended number of participants 6-12
Duration 1 day

Target audience

Operation and maintenance personnel involved in chemistry. If chemistry experts participate, the trainer will go deeper into specific cases.

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OHSAS 18001:2007

Demineralised water preparation

Description The training course on demineralised water includes the following topics:

- Characteristics of raw water
- Raw water pre-treatment plant (overview of the technologies used on-site, characteristics, attention point, follow up, monitoring, etc.)
- Review of the water treatment plant. The training is adapted depending on the technologies used on-site (resins or membranes):
- Demineralisation by ion exchange (resins)
  - Design
  - Structure of the resin and the characteristics of different type of resins (stability, capacity, etc.)
  - Functioning of the ion exchange
  - Processes of demineralisation and regeneration
  - Monitoring
  - Effluent (characteristics, quantities, permissions, attention points)
- Demineralisation with membrane technologies
  - Design
  - Calculation of scaling potential
  - Optimisation of chemicals injection
  - Monitoring
  - Biocide control
  - Chemical cleaning procedure
  - Start up and shut down procedure
  - Preservation of membrane installation
- Exercises and quiz

Recommended number of participants 6-12
Duration 1 day

Target audience
Chemists and laboratory managers

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OHSAS 18001:2007

Water cycle chemistry of the primary circuit

Description After completion of the course the participant will be able to:

- Determine the chemical products to be injected into the primary water loop and why they are used
- Understand why certain chemical products are injected during transients
- Determine monitoring and evaluation parameters during operation and in the event of chemical-related problems

Recommended number of participants 6-12
Duration 1 day

Target audience
Chemists and laboratory managers.

VCA++

OHSAS 18001:2007

Water chemistry of the secondary circuit

Description After completion of the course the participant will be able to:

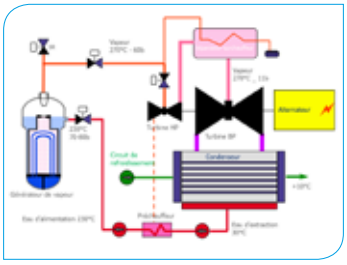
- Determine the chemical products to be injected into the secondary loop and why they are used
- Understand the sequestration of salts in the steam generator and its impact
- Determine the monitoring and evaluation parameters during operation and in the event of chemical-related problems

Recommended number of participants 6-12
Duration 1 day

Target audience
Chemists and laboratory managers.

VCA++

OHSAS 18001:2007



Introduction to welding technology

Description The course gives an insight into the complex world of welding. It is a guidebook for all those who are assigned to tackle welding operations for new installations or for welding repair work, mainly in the power generation sector. Participants will be able to determine priorities in relation to welding work, whether new-build or repair work, and determine whether general best practices are respected.

2-day training:

- Basic materials knowledge and behaviour applied to welding
- Typical welding processes, their scope and application
- Introduction to the major elements in welding (filler metal, gas, welding equipment, joint design)
- Relevant standards and directives
- Basics of post weld heat treatment
- Brief overview of quality assurance and non-destructive testing of welds

3-day training:

- Similar to the 2-day programme but with in-depth focus on:
  - Weld metallography
  - More detailed review of the norms and standard used for welds
  - Quality assurance and non-destructive testing of welds
- Case studies, mostly from the power generation sector

Recommended number of participants 6-12
Duration 2 or 3 days

Target audience
Maintenance and quality personnel in the power generation sector.

VCA++

OHSAS 18001:2007

Introduction to non-destructive testing (NDT)

Description Participants will gain a basic knowledge of non-destructive testing, including what tests are available and for what purposes they can be used. The focus is on applicability in the power generation field with a large number of case studies and a practical laboratory demonstration. The course includes an introduction and overview of non-destructive techniques, followed by modules with more detailed explanations and a demonstration of a specific technique:

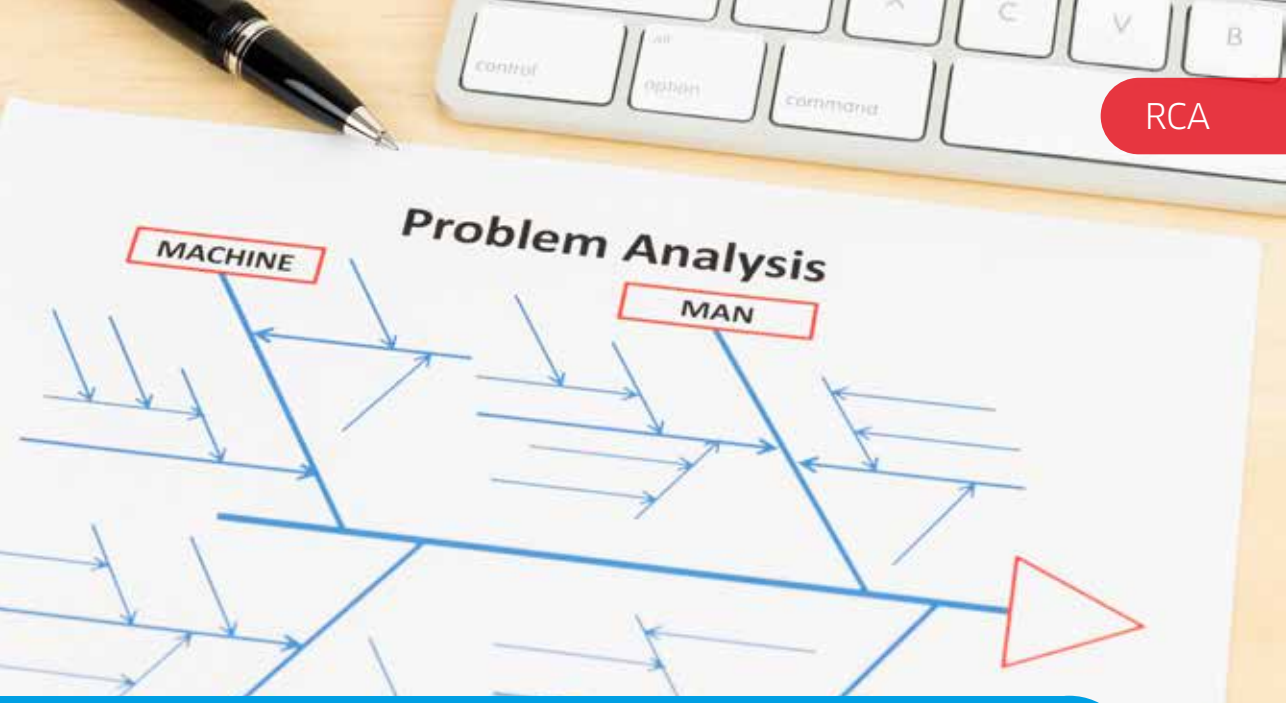
- Penetrant testing
- Magnetic particle testing
- Ultrasonic testing
- Eddy current testing
- Radiographic testing

For a 1-day course, the participant can choose 2 modules.

Recommended number of participants 8-10
Duration 1.5 days

Target audience
Engineers and mechanical maintenance and operation technicians.

VCA++
OHSAS 18001:2007
ISO 9712:2012
ASNT

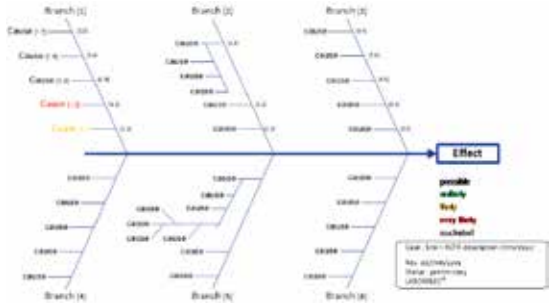


Introduction to root cause analysis

Description The training is divided into two parts:

- Part 1: General principles of root cause analysis, implementation and identification of the necessary parameter registration;
- Part 2: Example exercises of root cause analyses in common damage situations in power plants that must be solved interactively.

Recommended number of participants 8-12
Duration 1 day



Target audience
Asset managers, quality assurance managers, plant operation engineers, maintenance engineers

VCA++

OHSAS 18001:2007

Materials technology for boilers, steam turbines and gas turbines

Description

- Introduction and theory
- Introduction to typical damage mechanisms in boilers (hydrogen embrittlement, stress corrosion cracking and creep)
- Welding defects
- Failure analyses and remaining lifetime determination
- Interactive resolution of real cases
- Exercises and quiz

Gas turbine materials

- Superalloys: composition and microstructure, properties, latest developments
- Coatings: different types, application techniques, properties
- Failure and degradation phenomena
- Reconditioning of used blades
- Methodology for remaining lifetime assessment
- Interactive resolution of real cases
- Exercises and quiz

Recommended number of participants 8-10
Duration 2 days

Target audience

The course addresses a wide audience including operators, plant operation and maintenance engineers, consultants and technical project managers.

VCA++

OHSAS 18001:2007

Materials technology for gas turbine applications

Description

- Superalloys: composition and microstructure, properties, latest developments
- Coatings: different types, application techniques, properties
- Failure and degradation phenomena
- Reconditioning of used blades
- Methodology of remaining life assessment
- Practical examples
- A visit to the metallographic laboratory is included.

Recommended number of participants 8 - 10
Duration 2 days

Target audience

Engineers and mechanical maintenance and operation technicians.

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OHSAS 18001:2007

Materials technology in boilers and steam turbines: integrity assessment and failure analysis

Description

- Introduction
- Integrity assessment and failure analysis: brief explanation of damage mechanisms and case studies: short term overheating - long term overheating (creep) - thermal fatigue - thermal shock - welding defects - hydrogen embrittlement - fretting corrosion - high temperature corrosion - fatigue corrosion - stress corrosion cracking - cavitation - erosion - erosion-corrosion
- Remaining life determination: application of boiler life management
- Overview of available non-destructive and destructive testing

Recommended number of participants 8 - 10
Duration 1 day

Target audience

Anyone who comes into contact with boilers and steam turbines and wants to have a background in common material problems for these components.

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OHSAS 18001:2007

Spectral Interpretation

Description

- Introduction to interactions between irradiation and materials
- Characteristics of a spectrum (P.E. peaks, exhaust peaks, decay, foreground and background Compton effect)
- Energy calibration
- Effective calibration
- Acquisition of spectra
- Quality Control
- Examining a primary spectrum (Which isotopes are expected?)
- Examining a primary spectrum (oxygenation monitoring)
- K-40
- Origin of isotopes in a primary spectrum and possible interference (counting and recounting, oxygenation, downstream CPU, pairs "father / son")
- Libraries used at Tihange
- Reading analysis protocols (importance of full analysis, identified peaks, unidentified peaks, MDA analysis, interference)

Recommended number of participants 6-12
Duration 2 days

Target audience

Engineers, managers with a technical background and chemists

VCA++

OHSAS 18001:2007

Materials technology in nuclear power plants

Description

- Introduction to the metallurgy
- Theoretical explanation of the different failure phenomena illustrated with specific practical examples of failures
- Corrosion types for different materials (steel, stainless steel, nickel based alloys) and environment:
  - General corrosion
  - Galvanic corrosion
  - Local corrosion (pitting, crevice corrosion, etc.)
  - Fretting-corrosion
  - Intergranular corrosion or attack (IGA)
  - Stress corrosion cracking (SCC)
  - Corrosion fatigue
  - Flow accelerated corrosion (FAC)

Recommended number of participants 8-10
Duration 1 day

Target audience

Engineers and mechanical maintenance and operation technicians.

VCA++

OHSAS 18001:2007

Vibration analysis based on Laborelec vibration monitoring system (LVMS)

Description This training course provides an introduction to the use and interpretation of measurements made with the Laborelec Vibration Monitoring System (LVMS). It includes an introduction to the theory and practice of lateral vibration analysis of large rotating machinery. Theoretical concepts are explained by means of case studies arising from extensive experience of vibration monitoring, as used in more than 100 shaft lines around the world.

For operators

There are two possibilities for this training course:

- **Half day:** introduction to the interpretation of vibrations and visualisation of the vibration behaviour of large rotating machines using the LVMS, including initial execution with the support of ENGIE Laborelec's vibration experts. Important concepts covered are:
  - What is a vibration?
  - Which vibration sensors are used? What are the working principles?
  - How are the vibrations handled in LVMS?
  - What graphics are available?
  - Which information is given by these graphics?
  - How to handle the LVMS screens and how to collaborate with remote LBE experts.

- **2 days:** This more advanced version allows operators to more independently interpret the LVMS data and to take relevant corrective actions or operating decisions autonomously. This module includes a full day of practice on computers in order to become fully comfortable with the LVMS behaviour, as well as practical interpretation, giving participants a more in-depth knowledge and experience with LVMS.

Recommended number of participants 5-12

Duration

- Operator - introduction: half day
- Operator - advanced: 2 days

Target audience

Power plant operation and maintenance personnel. Technically skilled personnel who would like to acquire a background in the purpose and benefits of vibration analysis on large turbo machines.

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OHSAS 18001:2007

Turbo machines vibration analysis

Description This course provides an introduction to the theory and practice of lateral vibration analysis of large rotating machinery.
All theoretical aspects can be demonstrated and explained through case studies based on our extensive experience of vibration monitoring with Laborelec's Vibration Monitoring System (LVMS), as used on more than 100 shaft lines around the world:

- Basic elements of vibration analysis theory (harmonic vibrations, spectral analysis, resonance, stiffness, damping)
- Introduction to the major rotor elements, and the dynamic behaviour of a shaft line (rotor, fluid film bearings, foundation, etc.)
- Typical measurement techniques for vibration monitoring
- Relevant standards for the evaluation of vibration amplitudes (ISO 7919 and ISO 10816)
- Basics of rotor balancing
- Typical signature of vibration problems associated with turbo machines (mechanical and thermal unbalance, blade loss, rub, (mis)alignment, fluid instabilities, etc.)
- Case studies, including the use of a rotor model, will be used to illustrate important signatures:
  - Rub (Newkirk, Intermittent rub, etc.)
  - Thermal unbalance of the shaft
  - Blade loss
  - Asynchronous vibration due to instabilities in the oil film
  - Steam whirl
  - Effect of alignment on vibrations

Recommended number of participants 8-16
Duration 2 days

Target audience

Power plant operation and maintenance personnel. Technically skilled personnel who would like to acquire a background in the purpose and benefits of vibration analysis of large turbo machines.

VCA++

OHSAS 18001:2007

Predictive maintenance: monitoring techniques

Description The role of monitoring techniques in predictive maintenance:

- Corrective and preventive maintenance
- Importance of P-F (potential-to-functional failure) interval
- An overview of the different types of techniques that may be used.
- Vibration analysis
- Oil analysis
- Thermography
- Electrical measurements

Recommended number of participants 8-16
Duration 1 day

Target audience
Operators & technicians in the field of predictive maintenance.

VCA++

OHSAS 18001:2007

Performance workshop

Description Achieving improved equipment performance monitoring in order to reduce daily losses. With this performance workshop ENGIE Laborelec aims to instil a perspective of continuous improvement through better understanding of equipment behaviour.

Day 1

- Introduction, expectations and scope of the training course
- Setting up the energy balance, the importance of the energy balance in determining unmeasured parameters and to reflect on equipment performance
- Steam calculations, the differences between sensible and latent heat, the use of enthalpy and steam tables to make calculations
- Performance of the boiler, thermodynamics of heat exchangers, calculation of heat transfer and the resulting important influencing factors on performance
- Workshop on unit and boiler efficiencies in different operational conditions, the impact of different coal qualities, the impact of changing ambient conditions

Day 2

- Performance of the water/steam cycle, the Carnot cycle efficiency, steam turbine efficiencies, typical losses on pre-heaters and bypasses
- Performance of the condenser, impact of the condenser backpressure on cycle performance, frequently encountered operational issues which impact backpressure increase
- Workshop on cycle efficiency with operational data analysis, impact of steam extraction, attemperation spray flows, increasing condenser backpressures
- Measurement errors, data compression and the impact of the data historian
- Overall power plant performance management, a pragmatic approach and tools to be used
- Typical controllable losses for operational monitoring
- Discussion on important KPIs for the power plant

Recommended number of participants 8-12
Duration 2 days

Target audience
Tailored to the needs of participants

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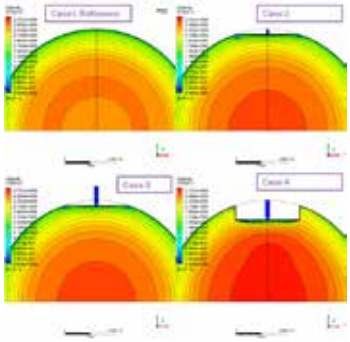
OHSAS 18001:2007



Energy efficiency in industrial cooling systems

Description This course begins with an introduction to industrial cooling systems. Participants learn how to identify possible improvements to an existing installation and how to quantify the energy savings opportunities.

Content of the training course:

- Priorities and methodology for energy efficiency improvement: optimisation of cooling needs and cooling equipment, opportunities for heat recovery
- Types of cooling: dry cooling, evaporative cooling and compression cooling
- Description of equipment and typical energy savings measures: optimisation of cooling parameters, floating condensing pressure, intelligent defrosting systems, speed controls on cooling tower fans, etc.
- Practical examples: various case studies based on experience with energy audits
- Exercises on practical calculations concerning energy saving measures

Recommended number of participants 5-10
Duration half day

Target audience
Technical and energy managers, process engineers.

VCA++

OHSAS 18001:2007

Energy efficiency in indoor lighting

Description In addition to its practical application, good lighting contributes to the wellbeing of the occupants of a building. Beginning with the basic concepts of lighting, the course presents methods for pre-dimensioning and assessing efficient lighting installations, and how to quantify possible energy savings in existing installations.

Content of the training:

- Basic introduction to lighting, photometry and colorimetry
- Sources and auxiliaries
- Light fittings: photometric distribution and electrical safety
- Criteria for equipment choice
- Standardisation, management and maintenance systems
- Relighting: what, why, how?
- Method for pre-dimensioning an installation

Recommended number of participants 5-10
Duration 1 day for the basic module + an optional half-day for the “dimensioning” module.

Target audience
Consultants, architects, technical and energy managers.

VCA++

OHSAS 18001:2007

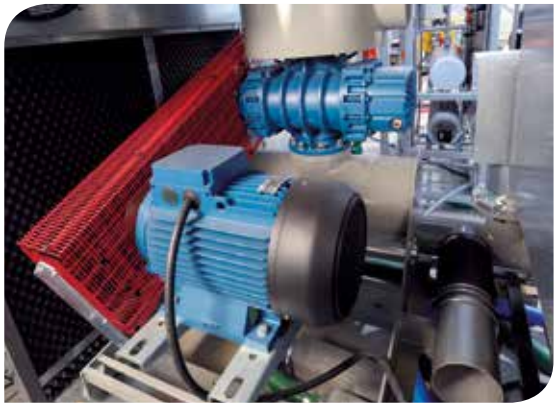
Energy efficiency in compressed air systems

Description This course begins with a basic introduction to compressed air systems. Participants learn how to identify possible improvements to an existing installation and how to quantify the energy savings opportunities.

Content of the training:

- Technical description of compressed air installations:
  - The most commonly used compressors (screw, piston, centrifugal, etc.)
  - The need for compressed air dryers and the different types
  - Individual control (load/unload, VFD) and group control (mechanical cascade control, electronic control)
  - Auxiliary equipment (air receiver, oil/water separation, distribution, filters)
- Potential energy savings in the production, distribution and consumption of compressed air:
  - Rational use of compressed air
  - Alternatives to compressed air applications
  - Reducing leakage
  - Limiting head losses
  - Reducing working pressure
  - Using a VFD compressor
  - Central control
  - Air receivers
  - Lowering the temperature of incoming air
  - Replacing filters
  - Heat recuperation
- Practical examples: various case studies are presented based on experience with energy audits

Recommended number of participants 5-10
Duration Half day



Target audience
Technical and energy managers, process engineers.

VCA++

OHSAS 18001:2007

Energy efficiency in tertiary buildings

Description This training course begins with a basic introduction to energy consumption in buildings. Participants learn how to identify possible improvements to an existing building and how to quantify the energy savings opportunities.

Course content:

- Explanation of the Energy Performance of Buildings (EPB) Directive and derived local regulations
- Definition of thermal comfort and comfort parameters: PMV, PPD;
- Thermal losses and energy consumption: principles of heat loss calculation and calculation of annual consumption on the basis of the degree-days method
- Heating installations: centralised and decentralised heating systems (boilers, heat pumps, etc.)
- Ventilation and air conditioning: assessment of needs, current technologies and improvement opportunities
- Sanitary hot water: calculation of needs and energy consumption, possible improvements, including solar power
- Energy consumers in offices (vending machines, IT equipment, etc.): assessment of consumption and best practices for their efficient use
- Practical examples illustrate all aspects of the course

Recommended number of participants 5-10
Duration 1 day

Target audience
Technical and energy managers, process engineers.

VCA++

OHSAS 18001:2007

Energy efficiency in industry

Description The course presents a methodology for the continuous improvement of energy efficiency in industry, based on practical experience gained through extensive experience of energy audits.

Course content:

- Climate policy and energy efficiency: European directives, and derived local regulations
- Methodology for continuous energy efficiency improvement in the enterprise: gathering and analysis of data, detection and quantification of improvement opportunities, performance monitoring
- HVAC in tertiary buildings: thermal comfort, thermal losses and consumption, centralised and decentralised heating, ventilation and air conditioning systems, needs, equipment and possible improvements to sanitary hot water, etc.
- Electric motors and variable speed drives: current technologies with focus on energy efficiency of motors, and on variable frequency drives and applications in flow rate adjustments, with practical examples of calculations
- Compressed air: description of current equipment with a focus on assessing energy consumption and on energy savings opportunities in production, distribution and consumption of compressed air
- Industrial cooling: description of the main cooling systems (dry, evaporative, compression) with the focus on energy efficiency by optimisation of parameters, equipment improvements and heat recovery
- Industrial heating: description of the main heating systems (hot water, steam, thermal oil) with the focus on energy efficiency by optimisation of parameters, equipment improvements and heat recovery
- Indoor lighting: basic principles, sources of light and auxiliary appliances, management systems
- Practical examples and exercises: various case studies presented based on experience with energy audits (3-day course)

Recommended number of participants 5-10
Duration 2 days or 3 days (with exercises and practical examples)

Target audience
Technical and energy managers, process engineers.

VCA++

OHSAS 18001:2007

Energy efficiency in industrial heating systems

Description The course begins with a basic introduction to heating systems and steam. Participants learn how to identify possible improvements to an existing installation and how to quantify the energy savings opportunities.

Course content:

- Description of the main heating systems (hot water, steam, thermal oil) with a focus on energy efficiency by optimisation of parameters, equipment improvements and heat recovery opportunities
- CHP systems with steam recovery

Recommended number of participants 5-10
Duration 1 day

Target audience
Technical and energy managers, process engineers.

VCA++

OHSAS 18001:2007

Interested?
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> Unique combination of contract research and operational assistance
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> More than 50 years of experience

ENGIE Laborelec

Training Calendar @Laborelec Belgium 2019

Upgrade yourself with skills for the future

February 2019

Mo 25	Tue 26			Turbomachine-vibration analysis	
Mo 25	Tue 26	Wed 27	Thu 28	ATEX Level 1 & 2 mechanical and electrical course ISM certified training NL	

March 2019

Mon 04	Tue 5			LVMS vibration monitoring	
Mon 11	Tue 12	Wed 13	Thu 14	ATEX Level 1&2 ISM certified training ANGL	
Mon 25				Introduction to condition monitoring of power transformers through oil analysis	
Tue 26	Wed 27			Condition assessment and monitoring of power transformers through oil analysis	

April 2019

Tue 02	Wed 3			Batteries for Energy Storage Systems	
Thu 04				Safe handling of batteries	
Mon 08				Energy Efficiency in Tertiary Buildings	
Tue 09				Energy Efficiency in Industrial heating systems	
Wed 10				Energy Efficiency with Indoor Lighting	

May 2019

Mon 06	Tue 07	Wed 08		EMC: electromagnetic Compatibility (ndls)	
Thu 16				ICS Cybersecurity awareness Training (101)	
Mon 20	Tue 21			Introduction to Non-Destructive testing	
Mon 20	Tue 21			Intro: 3 D printing of metal component	
Mon 20	Tue 21			Energy Efficiency in Industry	
Mon 20	Tue 21	Wed 22		EMC: electromagnetic Compatibility (fr)	

June 2019

Mon 03	Tue 04	Wed 05	Thu 06	Introduction to Water Chemistry	
Fri 07				ICS Cybersecurity concepts training advanced (201)	

September 2019

Thu 26	Fri 27			Indoor lighting : requirements, conception, technologies and energy concerns.	

October 2019

Mon 07	Tue 08	Wed 09		EMC: electromagnetic Compatibility (fr)	
Mon 14	Tue 15	Wed 16	Thu 17	ATEX Level 1 & 2 mechanical and electrical course ISM certified training NL	
Wed 23	Thu 24	Fri 25		EMC: electromagnetic Compatibility (ndls)	

November 2019

Mon 18	Tue 19	Wed 20	Thu 21	ATEX Level 1&2 ISM certified training ANGL	

Notes

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