This training course is offered under the **Alliance4Training** brand

Training - Compressors Maintenance

COMPMAI-EN-P | **Face-to-face only** | **5 days**

This course provides a better understanding of the technology, performance and maintenance of centrifugal and positive displacement compressors

Level
Skilled

Public
- Engineers and technicians involved in centrifugal and positive displacement compressor maintenance or engineering
- Employees in charge of maintenance running of the compression systems

Objectives
Attendees will be able to implement the following skills:
- Describe the behavior and the technology of compressors
- Provide the maintaining solutions applied in their compression units
- Establish a diagnosis of the incidents and participate in the troubleshooting meetings

Pedagogical & technical resources
- Functional approach for a better understanding
- Interactive course
- Numerous examples and cases studies from the Oil & Gas production industry and analysis of manufacturer file

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

TECHNOLOGY & OPERATION — 2 days

Centrifugal compressors:
- Different types of centrifugal compressors.
- Component parts and architecture of a centrifugal compressor.
- Technology of the essential components: stator, rotor, bearings, thrust bearing, seals.
- Vibrations, critical speed, dynamic balancing.
- Auxiliary equipment: lubrication system, buffer gas, balancing line...

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- Safety parameters: axial displacement, vibrations, bearing and thrust bearing temperatures, oil pressure...

Reciprocating compressors:

- Different types of reciprocating compressors.
- Component parts and construction of a reciprocating compressor.
- Technology of the essential components: cylinder, piston, valves, sealing systems, crankshaft, connecting rod...
- Auxiliary equipment: lubrication of motion parts and cylinders, cooling interstage and cooling devices systems, connections to the flare.

Rotary positive displacement compressors:

- Different types: screw, liquid ring, lobes, sliding vanes,...
- Component parts and architecture of a rotary compressor.
- Auxiliary equipment: lubrication system.
- Typical using.

MAINTENANCE (PREVENTIVE, CONDITIONAL, CORRECTIVE) 2 days

Preventive maintenance: systematic actions, routine, alignment...
Conditional maintenance: vibrations measurement, oil of lubrication analysis, thermography...
Corrective maintenance: mounting, dismounting, metrology, repairing technics.

ANALYSIS OF A MANUFACTURER DATABOOK 0.5 day

Data sheet.
Technologic choices.
P&ID reading.

TROUBLESHOOTING 0.5 day

Failure and incidents: surge, slugging, over limits functioning...

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Training - Compressors Operation

COMPOP-EN-P | **Face-to-face only** | **5 days**

This course provides a better understanding of the technology, performance and operation of centrifugal and positive displacement compressors

Level
Skilled

Public
- Operation and technical department staff involved in the operation of centrifugal and positive displacement compressors
- Employees in charge of running and checking compression systems

Objectives
Attendees will be able to implement the following skills:
- Describe the technology of centrifugal and positive displacement compressors
- Select the adequate operating conditions
- Explain the main operating problems
- Be involved in a troubleshooting process

Pedagogical & technical resources
- Functional approach for a better understanding
- Numerous examples and cases studies from the Oil & Gas production industry and analysis of manufacturer file
- Applications with dynamic simulators

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

GAS COMPRESSION BASICS — 0.5 day

Compressor types. Selection.
Gas compression: key points, pressure ratio. Gas composition, typical thermodynamical laws and models.
Isothermal, isentropic, actual compression.
Compression work and power.
Single and multistage compression.

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TECHNOLOGY & PERFORMANCE — 2 days

Centrifugal compressors:

- Centrifugal compressor typical parts and arrangements.
- Technology of the essential components: stator, rotor, bearings, thrust bearing, seals.
- Vibrations, critical speed, dynamic balancing.
- Auxiliary equipment: lubrication system, balancing line, mechanical seals auxilairies...
- Safety devices: axial displacement, vibrations, bearing and thrust bearing temperatures, oil pressure...
- Compression mechanism through a compressor stage.
- Operation limits. Surge. Various antisurge systems.
- Characteristic curves of the circuit and the compressor. Influence of the operating conditions: intake pressure and temperature, nature of the gas, rotation speed, IGV position.

Reciprocating compressors:

- Reciprocating compressor parts and arrangements.
- Technology of the essential components: cylinder, piston, valves, packings, crankshaft, connecting rod...
- Auxiliary equipment: lubrication of moving parts and cylinders, interstage coolers and cooling devices systems, flare connections.
- Safety devices: vibrations, rod drop, temperatures...
- Piston side compression map vs operating conditions Theoretical and practical cycles.
- Flow control with typical devices: spillback line, unloading, clearance pocket actuation,(e-)Hydrocom™ system.

Rotary positive displacement compressors:

- Rotary positive displacement compressor technologies.
- Auxiliary equipment.
- Operation: start-up/shutdown, survey, flow control.

OPERATION — 2.5 days

Centrifugal compressors:

- P&ID and logic security matrix analysis.
- Flow rate regulation. Adaptation to service conditions.
- Start-up, shutdown and isolation: hazards related to these phases.
- Survey and monitoring the compressor and auxiliary equipment under normal operating conditions.
- Case studies: typical incidents.
- Applications with dynamic simulator: start-up, shutdown, operation vs suction conditions.

Reciprocating compressors:

- Conventional control: start-up, shutdown associated risks.
- Monitoring the compressor and auxiliary equipment under normal operating conditions.
- Case studies: incidents.
- Applications with dynamic simulator: start-up, shutdown, operation vs suction conditions.

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Training - Equipment Basic Maintenance

EBM-EN-P | Face-to-face only | 5 days

To provide in-depth knowledge related to the equipment technology and maintenance

Level

Knowledge

Public

Engineers from various disciplines: process, maintenance, operation, mechanical, inspection, HSE and supervisors

Objectives

Attendees will be able to implement the following skills:

- Recognize basics of the technologies of rotating machinery and static equipment installed on plants
- Describe the operating principle of this equipment
- List the basic maintenance practices, and reliability criteria

Pedagogical & technical resources

- Sharing of participants' best practices
- Numerous exercises
- Applications and case studies
- Visit of running plant or workshop if available

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

BASICS IN STATIC EQUIPMENT — 1.5 days

Different types of piping valves and flanges types, valve types, safety valves and rupture discs, standards main failure modes and repairs
Distillation columns: operating principle; technology, fundamentals.
Different types of heat exchangers and vessels: technology, selection criteria.
Furnaces and boilers: operating principle; technology, control and safety features.

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Tanks: different types of storage tanks: fixed and floating roof, etc.
Case studies, exercises and applications.

ROTATING EQUIPMENT — 2.5 days

Centrifugal and positive displacement pumps: types, technology and selection criteria.
Centrifugal and positive displacement compressors: types, technology and selection criteria; operation.
Steam turbines and gas turbines: types, technology; operation and maintenance.
Basic machinery reliability, maintenance and troubleshooting.
Auxiliaries, lubrication and maintenance of rotating equipment.
Risks and failures dealing with these types of rotating equipment.
Preventive and corrective maintenance.
Vendor recommendations vs. operating constraints.
Case studies, exercises and applications.

MAINTENANCE GENERAL PRACTICES — 1 day

Types of maintenance: preventive, corrective, condition-based.
Fundamentals of reliability analysis and improvement methods: FMECA: failure modes, effects and their criticality analysis, failure trees, Reliability Centered Maintenance (RCM).
How to use Key Performance Indicators to measure, evaluate and enhance equipment performances.

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Training - Centrifugal Compressors Operation

ECC-EN-P | Face-to-face only | 5 days

This course emphasizes the technology, the performance and operation of centrifugal compressors

Level
Skilled

Public
Engineers and technicians involved in operation, monitoring and maintenance of centrifugal compressors

Objectives
Attendees will be able to implement the following skills:

- Explain the construction technology of a centrifugal compressor
- Explain the influence of operating parameters on the performance of a compressor
- Describe the most common flow control modes and anti-pumping controls
- Describe typical incidents and critical points to monitor

Pedagogical & technical resources

- Case studies based on industrial feedback
- Interactive course
- Various technical drawings of actual compressors
- Use of a dynamic simulator

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

TECHNOLOGY — 1.25 days

Different types of centrifugal compressors. Architecture of a centrifugal compressor.
Technology of the main components: stator, rotor, bearings, thrust bearing, seals.
Vibrations, critical speed, dynamic balancing. Auxiliary equipment: lubrication system, buffer gas, balancing line, etc.
Auxiliary equipment: lubrication system, buffer gas, balancing line, etc.
Safety devices: axial displacement, vibrations, bearing and thrust bearing temperatures, oil pressure, etc.

PERFORMANCES — 1.75 days

Changes in gas velocity and pressure in a centrifugal compressor.

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Mass and volume flow rate vs operating conditions.
Discharge temperature, shaft power vs operating conditions.
Compressor performance vs operating conditions, impeller rotation speed and geometry.
Compressor performance curves and circuit system curves.

OPERATION — 0.5 day

Flow rate control.
Operating limits. Surge and stonewall. Antisurge devices.
Start-up and shutdown: key points.
Compressor monitoring in operation.
Troubleshooting.

DYNAMIC SIMULATION - APPLICATIONS — 1.5 days

Use of a dynamic simulator (Centrifugal compressor + steam turbine).
Exercises on start-up and shutdown phases.
Applications using disturbances generated by the lecturer.

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Training - Reciprocating Compressors Operation

EECV-EN-P | **Face-to-face only** | **5 days**

This training improves participants' skills on technology, operation and maintenance of reciprocating compressors

Level
Skilled

Public
Engineers and technicians involved in the operation, inspection and maintenance of reciprocating compressors

Objectives
Attendees will be able to implement the following skills:

- List the different parts of a compressor and explain their characteristics
- Explain the evolution of compressor operating parameters
- Implement appropriate monitoring for each type of compressor
- Be involved in troubleshooting activities

Pedagogical & technical resources

- Actual examples from the Oil & Gas and petrochemical industries
- Trainee participation is continuously encouraged through case studies selected by the lecturer or proposed by the trainees
- Use of a dynamic simulator (start-up/shutdown, general operation, disturbances/troubleshooting)

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

TECHNOLOGY — 1.5 days

Construction and design philosophies.
Components of reciprocating compressors: frame, cylinders, piston and rings, piston rod and crank head, crankshaft and connecting rods, bearings, compartment distance pieces, valves.
Auxiliary systems: pulsation dampeners, lubrication circuits, cooling systems, drains and vents,...
Safety devices.

PERFORMANCES — 1 day

Gas compression: models, discharge temperature, compression work and power.
Compressor efficiency vs valves, piston rings, cylinder cooling system and rod packings behavior.

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Indicator diagram. Compression/expansion cycle.
Case studies: discharge temperature and power calculation, indicator card plotting, efficiency calculation.

COMPRESSOR OPERATION — 0.5 day

Flow control.
Start-up, shutdown.
Performances vs compression ratio, gas composition, pressure and suction temperature.
Multistage compressors.
Case study.

TROUBLESHOOTING — 1 day

Machine monitoring: noise, vibration and temperature.
Typical defects and failures on: valves, piston rings and packings, piston rod,...
Safety devices.
Case studies: typical failures on reciprocating compressors.

DYNAMIC SIMULATION - APPLICATIONS — 1 day

Use of a dynamic simulator.
Exercises on start-up and shutdown phases.
Applications using disturbances generated by the lecturer.

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Training - Electrical Motors: Technology, Operation and Maintenance

EIMEA-EN-P | **Face-to-face only** | **5 days**

This course focuses on the technical development of industrial electrical motors

Level
Skilled

Public
Electrical and mechanical engineers, supervisors, technicians involved in electrical motors maintenance and operation

Objectives
Attendees will be able to implement the following skills:

- Explain how electric motors work
- List the main malfunctions
- Specify the diagnostic tools in use
- Explain repair and inspection techniques

Pedagogical & technical resources

- Visit of a motor repair workshop (when possible)
- Interactive course
- Motor disassembly and assembly in case of an available workshop

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

OPERATION PRINCIPLE & TECHNOLOGY — 2 days

Working principle of induction and synchronous motors.
Features: power, current, torque and power factors.
Technology and main parameters.

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Protective modes in regards with external environments: temperature classes, protection class index, hazardous area motors, ATEX protection.
Electrical and thermal protection of the motor as well as the use of temperature sensors.
API 541 asynchronous guidelines for refinery and petrochemical motors.
Efficiency motor's standards IEC 60 034-30/IEEE 112.

VARIABLE SPEED FEATURES — 1 day

Power and HV/LV range, fields of use and typical applications.
Speed and motor control as well as network consequences. Synchronous motor: torque control and various technologies.
Induction motor: standard starting methods depending on mechanical load, motor power and network capacity; limiting conditions due to the grid; number of start constraints. Electronic starting method (soft starter).

INSTALLATION — 0.5 day

Main characteristics and constraints for a motor installation.
Skid and shim. Shaft alignment. Comparison to reference datasheets. Vibration footprint.

FAILURE DIAGNOSIS IN OPERATION — 0.5 day

Bearings: temperature, vibration, lubrication monitoring.
Mechanical failures.

CONTROL & REPAIR TECHNIQUES - PRACTICAL WORK — 1 day

Part identification in workshop.
Bearings assembly, housing repair, clearance and run-out checks.
Electrical insulation and phases balancing checks.
Impact of frequency inverters and harmonics on electrical coils insulation and the bearings.
Coil insulation repairs: vacuum coils impregnation, technology and quality. Rewinding and coils positioning according to magnetic circuit's notches. Electrical checks (electrical resistance, insulation, polarization...).
Balancing: quality standards, unload and load tests. Repair specification: specification content as well as work acceptance.
Visit of a motor repair workshop (when possible).

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Training - Steam Turbines Operation

EXTAV-EN-P | **Face-to-face only** | **5 days**

This training provides an appropriate knowledge of steam turbine technology, performance and operation

Level

Skilled

Public

Engineers and technicians in charge of steam turbine operation, maintenance and steam turbine projects

Objectives

Attendees will be able to implement the following skills:

- Explain the operating principle and the basics of steam turbine control
- Recognize the technology and different components of single- and multi-stage turbines
- List the main criteria for selecting a steam turbine

Pedagogical & technical resources

Study of industrial cases:

- Different examples of steam turbines design and on-site layout
- Use of a dynamic simulator to demonstrate typical features

Assessment of achievements

Quiz

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

STEAM TURBINE PERFORMANCE — 1.25 days

Steam properties, inlet and exhaust conditions. Ideal and actual expansion.
Monitoring steam characteristics on the Mollier diagram: expansion, heating, efficiency, etc.
Expansion mechanisms: impulse stage, reaction stage and different types of multistage turbine.
Overall performance. Efficiency, steam consumption related to power supply.
Application: analysis of industrial turbine operation.

TECHNOLOGY — 1.5 days

Main types of turbines, new designs.
Technical components: rotor, wheels, casing, bearings and thrust bearings, sealing devices.
Vibrations and critical speeds. Condenser and vacuum devices.
Application: study of different types of turbines and related auxiliary systems.
Practical workshop: study of component parts using a dismantled turbine.

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STEAM TURBINE CONTROL SYSTEMS — 0.75 day

Speed control systems. Controllers: characteristics of conventional and digital controllers.
Equipment technology: sensors, transmitters, controllers.
Safety devices: overspeed, vibrations, temperature.

OPERATION — 1 day

Lubrication and sealing devices.
Important parameters for turbine operation.
Monitoring of steam circuit and lubrication circuit.
Start-up and shutdown sequences of different types of turbines.
Incidents occurring in the steam network, the machine or the ancillary equipment.
Safety and prevention.

DYNAMIC SIMULATION - APPLICATIONS — 0.5 day

Preparation and start-up of a steam turbine driving a centrifugal compressor.

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Training - Fundamentals of Mechanical Maintenance

GENMAIN-EN-P | **Face-to-face only** | **5 days**

This course aims to master the elements of language and understanding of mechanical systems, in terms of design, characterization, maintenance and repair. This will contribute to the maintenance follow-up, but also to the optimized operation of the static and dynamic mechanical systems (rotating machinery)

Level

Knowledge

Public

All technicians from the Oil & Gas industry who work in connection with equipment and mechanical systems (operation, maintenance) and who do not know the fundamentals of design of these systems (or who wish to deepen their knowledge). Jobs mainly concerned: mechanicals, mechanical assistants, mechanical supervisors

Objectives

Attendees will be able to implement the following skills:

- Know the basics of technical drawing, characterize a part, a mechanical assembly
- Identify the different mechanical construction materials
- Know the fundamentals of mechanical system design, the main assemblies (bearing assemblies)
- Know the main power transmission elements (gears, joints...), wisely use the metrology devices used in workshop
- Describe the mechanical strength, chemical resistance and thermal resistance

Pedagogical & technical resources

- Very interactive training given by highly experienced trainers
- Gradual mechanical approach, from the dimensioning of a simple mechanical part to the design basis of a dynamic system such as a rotating machine

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

TECHNICAL REPRESENTATION OF PARTS & SIMPLE MECHANICAL SYSTEMS — 2 days

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Technical drawing agreement: 2D and isometric views, projections, section and cut-away views, perspectives, technical vocabulary.
Dimensioning of parts and mechanical systems, ISO tolerancies and main adjustments.
Dimensional tolerancies and clearance.
Geometric tolerancies and surface condition characterization.
Presentation of the tools in a metrology shop, performances and rules of use.
Practical exercises:

- Dimensioning and full geometric control of a pump shaft.
- Understanding of a simple machine cut-away view.
- Representation of a machine element in 2D projection and perspectives.

ELEMENTS OF CONSTRUCTION — 1 day

Materials used in the Oil & Gas industry: identification of the metals, alloys, plastics and composites, operating and maintenance rules.
Expansion and effects on the assemblies.
Manufacturing process of metallic parts, molding, forging.
Frequent screwed, bolted, welded and stuck constructions.
Characterization of threads and bores, petroleum thread pitch.
Removable power transmission: keys, gears, hinged connections (joint...), cone interface.
Non-removable power transmission: shrink fitting.
Bearings: characterization, types, identification, assembly rules.
Seals of static systems (between flanges) and dynamic systems (mechanical seals on bearing boxes), analysis and selection of the materials.
Pipe, valves and main line accessories: identification, operation and maintenance rules.
Practical exercises: selection, identification and assembly of the ball bearings in a simple process pump.

ELEMENTS OF MAINTENANCE — 1 day

Tightening: importance of torque, order, techniques.
Alignment: understanding the operation, controlling the mating of piping.
Lubrication: properties and characterization of common oil and greases, lubricating systems.
Controlling the condition of parts at disassembly: corrosion, defaults, mating, wear, rupture.
Controlling the clearances at disassembly.
Practical exercise: mechanical completion of a pump on site (control and implementation).

ELEMENTS OF REPAIR — 1 day

Surface treatments and coatings.
Overlay welding and reconstitution.
Machining.
Casing repair with staples.
Expertise controlling: dye penetrant testing, metrology, ultrasonic, hardness testing.
Test and requalification: balancing, test, control of performances.

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This training course is offered under the **Alliance4Training** brand

Training - Operation, Maintenance and Inspection of Rotating Machinery

OMIRM-EN-P | **Face-to-face only** | **10 days**

This course provides key competencies related to rotating machinery operation and maintenance tasks

Level

Skilled

Public

Engineers, supervisors and technical staff involved in rotating machinery maintenance and technical inspection

Objectives

Attendees will be able to implement the following skills:

- Explain how to operate rotating machinery (pumps, compressors, steam turbines)
- Explain the key points for fluid flow and gas compression/expansion theory and practical applications
- List the key points for rotating machinery maintenance and inspection operations
- Explain how to achieve these operations
- List the main failure modes related to each here above listed rotating machinery
- Participate in the machinery reliability improvement process

Pedagogical & technical resources

- Interactive lecture
- Case studies based on industrial and actual feedback
- Practical work in workshops on actual equipment
- Use of dynamic simulators: pumps, compressors, steam turbines

Assessment of achievements

Quiz

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

CENTRIFUGAL PUMPS — 2 days

Main parts: casing, rotor, mechanical seals, bearings, coupling, auxiliary systems.
Fluid flow key points with a pumping system.
Operation: performance curves, flow control, start-up and shutdown, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.

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RECIPROCATING & CENTRIFUGAL COMPRESSORS — 2 days

Main parts: casing, crankshaft/rotor, packings/mechanical seals, bearings, coupling, auxiliary systems.
Gas compression key points. Single and multistage compression.
Operation: performance curves, flow control, start-up and shutdown, monitoring, protection curves, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.

TURBINES & EXPANDERS — 1 day

Various types of turbines: steam and gas turbines, expanders. Typical applications.
Main parts: casing, rotor, seals, governors, bearings, coupling, auxiliary systems.
Gas and steam expansion: key points.
Operation: performance curves, speed and power control, start-up and shutdown, monitoring, overspeed protection, general troubleshooting.
Maintenance: assembly and dismantling procedures, main checks.
Typical defaults and failure modes.

LUBRICATION SYSTEMS MAINTENANCE/OIL ANALYSIS — 0.5 day

Purpose, different types of lubricants and lube systems.
Lubrication equipment maintenance: key points.
Oil analysis. Reports. Case studies.

BEARINGS MAINTENANCE — 1 day

Antifriction bearings: clearances/interferences assessments and checks, assembly procedures.
Sleeve and tilt pad journal and thrust bearings:

- Shaft rotation in an oil bearing.
- Clearances checks.
- Instrumentation checks and fitting procedures.
- Case studies.

COUPLINGS & ALIGNMENT — 0.5 day

Different types of couplings and related problems.
Various alignment methods, tolerances.

ROTORS & SHAFTS — 0.5 day

Balancing: API/ISO definitions, tolerances. Balancing methods.
Geometrical shaft checks.

RUPTURE MODES — 1 day

Rupture mechanisms.
Surface damage
Fatigue, wear and tear. Rupture face analysis.
Case studies.

USE OF VIBRATION ANALYSIS — 1.5 days

Different types of measurements and sensors.
Typology of typical defaults affecting rotating machinery.
Spectrum analysis and various techniques for diagnosis.
Case studies.

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Training - Rotating Machinery Vibration Analysis

PAVIB-EN-P | Face-to-face only | 4 days

This course assesses the cause and evolution of mechanical failures by analysis of vibration signals It emphasizes the implementation of an efficient predictive maintenance program

Level
Skilled

Public
Engineers, supervisors and technicians involved in the technical inspection and maintenance of rotating equipment

Objectives
Attendees will be able to implement the following skills:

- Identify the signals to be searched for a given mechanical fault and how to visualize them
- Implement devices to show characteristic images
- Identify vibration images representing a number of typical mechanical defects
- Implement a maintenance plan for each machine based on the criticality

Pedagogical & technical resources

- Study of industrial cases
- Various illustrations of actual systems
- Use a professional measurement tools & software and/or test benches
- The practical approach makes the course suitable for full-time vibration specialists

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

BASIC DEFINITIONS - OVERALL MEASUREMENTS — 0.75 day

Frequency and amplitude. Displacement, velocity, acceleration.
Different types of vibration: periodic, random, shocks.
Overall measurements: limitations, severity charts, high frequency techniques for anti-friction bearings, practical recommendations.

RESONANCE — 0.5 day

Simple system behavior: amplitude and phase. Actual rotor and bearings systems. Critical speeds.

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Using phase to study resonance. Identifying and solving problems.

TOOLS FOR DIAGNOSIS — 0.5 day

FFT analyzers: Fourier transforms and actual plots. Accelerometers, fixation methods.
Selecting analysis parameters: scales, units, windows. Using special functions: zoom, cepstrum, envelope detection.
Using non-contacting probes for monitoring large machinery running on plain or tilt-pad bearings.

MACHINERY DEFECTS & VIBRATION SIGNATURE — 2 days

Unbalance. Shaft and coupling misalignment.
Antifriction bearings - Typical defects.
Plain or tilt pad bearings instabilities.
Mechanical looseness, cracks, friction between rotor and static parts. Gear failures.
Electromagnetic defects of induction electric motors.
Drive belt vibration.

PRACTICAL MACHINERY VIBRATION MONITORING — 0.25 day

Vibration control policy: machinery improvement program. Different policies according to the type of machinery and its criticality.
Developing an effective program.

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Training - Centrifugal Pumps and Positive Displacement Pumps

PC-EN-B | Blended-Learning | 4 days

This course covers the centrifugal and positive displacement pumps technology and their operating conditions

Level

Expert

Public

Engineers and technicians involved in centrifugal and positive displacement pump operation, maintenance or engineering

Objectives

Attendees will be able to implement the following skills:

- Explain the operation and operation of centrifugal pumps and technical solutions
- Identify potential incidents on these machines
- Pre-select and size a centrifugal pump

Pedagogical & technical resources

- Actual examples from the refining, petrochemical and chemical industry
- Active participation is encouraged through case studies
- Use of a centrifugal pump dynamic simulator
- E-learning session previously to the presential one

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

HYDRODYNAMICS APPLIED TO A PUMPING SYSTEM — 1.5 day

Pump performance:

- Flow in a pump, velocities triangle, internal flow and energy losses.

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- Theoretical and practical head: characteristic curve.
- Other characteristics: efficiency, power, NPSH required.
- Changes in characteristics vs. rotation, viscosity, impeller shape, cavitation.

Pipe system:

- System curve, resistance of flow and throttling control.
- Operating point: normal and maximum capacities, change in fluid characteristics and incidence on operating conditions.

Exercises with a dynamic simulator.

CENTRIFUGAL PUMP TECHNOLOGY AND SELECTION 1.5 day

Centrifugal pump:

- Impeller and pump shape, suction operating conditions.

Mechanical seal:

- Selection according to API 682 standard and type.
- Friction face heating.
- Safety and environment: typical arrangements (single, dual, dry seal).
- Specific solutions: canned motor pump, magnetic drive pump.

Installation:

- Suction and discharge pipe design.
- NPSH available; base plate and grouting.
- Ancillary lines and equipment.
- Coupling and driven machines.
- Safety and environment.

POSITIVE DISPLACEMENT PUMP TECHNOLOGY & PERFORMANCE 0.5 day

Technology: different types of pumps (rotary and reciprocating pumps). Operation and performance of the different types of pumps.
Influence of clearance, internal leaks, nature of product on flow rate and pressure. Flow rate control.
Installation guidelines: position of tanks, line diameters, metering drums, pulsation dampeners, pressure valves.

PUMP OPERATION 0.5 day

Preparation: filling and draining. Start-up/shutdown: priming, hammer shock, risks to the process and the pump.
Monitoring parameters (vibration levels, noises, bearing housing temperature, motor intensity, pressures).
Parallel and serial operation. Safety conditions.
Reliability: types and source of failures (wear, ruptures, cavitation, leakages); improvement methods.
Exercises with dynamic simulator.

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Training - Centrifugal Pumps and Positive Displacement Pumps

Applications with CORYS dynamic simulator

PC-EN-P | Face-to-face only | 4 days

This course covers the centrifugal and positive displacement pumps technology and their operating conditions

Level

Expert

Public

Engineers and technicians involved in centrifugal and positive displacement pump operation, maintenance or engineering

Objectives

Attendees will be able to implement the following skills:

- Explain the operation and operation of centrifugal pumps and technical solutions
- Identify potential incidents on these machines
- Pre-select and size a centrifugal pump

Pedagogical & technical resources

- Actual examples from the refining, petrochemical and chemical industry
- Active participation is encouraged through case studies
- Use of a centrifugal pump dynamic simulator
- E-learning session previously to the presential one

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites

No prerequisites are necessary to follow this course

Responsable

IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

HYDRODYNAMICS APPLIED TO A PUMPING SYSTEM — 1.5 days

Pump performance:

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- Flow in a pump, velocities triangle, internal flow and energy losses.
- Theoretical and practical head: characteristic curve.
- Other characteristics: efficiency, power, NPSH required.
- Changes in characteristics vs. rotation, viscosity, impeller shape, cavitation.

Pipe system:

- System curve, resistance of flow and throttling control.
- Operating point: normal and maximum capacities, change in fluid characteristics and incidence on operating conditions.

Exercises with a dynamic simulator.

CENTRIFUGAL PUMP TECHNOLOGY & SELECTION 1.5 days

Centrifugal pump:

- Impeller and pump shape, suction operating conditions.

Mechanical seal:

- Selection according to API 682 standard and type.
- Friction face heating.
- Safety and environment: typical arrangements (single, dual, dry seal).
- Specific solutions: canned motor pump, magnetic drive pump.

Installation:

- Suction and discharge pipe design.
- NPSH available; base plate and grouting.
- Ancillary lines and equipment.
- Coupling and driven machines.
- Safety and environment.

POSITIVE DISPLACEMENT PUMP TECHNOLOGY & PERFORMANCE 0.5 day

Technology: different types of pumps (rotary and reciprocating pumps). Operation and performance of the different types of pumps.
Influence of clearance, internal leaks, nature of product on flow rate and pressure. Flow rate control.
Installation guidelines: position of tanks, line diameters, metering drums, pulsation dampeners, pressure valves.

PUMP OPERATION 0.5 day

Preparation: filling and draining. Start-up/shutdown: priming, hammer shock, risks to the process and the pump.
Monitoring parameters (vibration levels, noises, bearing housing temperature, motor intensity, pressures).
Parallel and serial operation. Safety conditions.
Reliability: types and source of failures (wear, ruptures, cavitation, leakages); improvement methods.
Exercises with dynamic simulator.

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Training - Pumps Operation

PUMPOP-EN-P | **Face-to-face only** | **5 days**

This course provides a better understanding of centrifugal and positive displacement pumps technology and operating principles

Level
Skilled

Public
- Engineers and technicians involved in centrifugal and positive displacement pump operation or engineering
- Employees in charge of running and checking pumping system

Objectives
Attendees will be able to implement the following skills:
- Describe the behavior and the operation of pumps
- Analyze the technical solutions applied in their units
- Establish a diagnosis of the incidents and participate in the troubleshooting meetings
- Identify essential elements in pump selection

Pedagogical & technical resources
- Functional approach for a better understanding
- Numerous examples and cases studies from the Oil & Gas production industry and analysis of manufacturer file

Assessment of achievements
Written test upon training course completion

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

PUMPING PREREQUISITES — 0.5 day

Pump performance:
- Hydraulic pumping fundamentals.
- Pressure, flowrate, specific gravity, friction losses, centrifugal force, height/pressure relation, mechanic and hydraulic power, vapor pressure curve, energy conservation.
- Pump choice and typical upstream implementations.

TECHNOLOGY & PERFORMANCE — 2 days

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Centrifugal pumps:

- Functional approach: study step by step of the main functions; process (impeller, wear rings, balancing, pump body shape...); sealing: mechanical sealing, typical arrangements (single, dual, dry seal), selection according API 382 standard, materials, type, friction face heating; support (axial and radial, thrust and journal bearings); lubrication (oil and grease...); monitoring (rotor displacement, vibrations, temperature, pressure...).
- Building step by step a monocellular centrifugal pump.

Positive displacement pumps:

- Different types of pumps: rotary and reciprocating pumps.
- Operating principle and utilization of the different types of pumps.
- Influence of clearance, internal leaks, nature of product on flow rate and pressure.
- Flow rate control.
- Installation guidelines: position of tanks, line diameters, metering drums, pulsation dampeners, pressure valves.

Particular choices:

- Coupling and driven machines.
- ATEX: material consequences.

OPERATION & MONITORING — 1.5 days

Preparation: filling, draining; spare pumps: heating, ancillaries.
Start-up/shutdown: priming, controls, hammer shock, risks for process and pump.
Surveillance: parameters (vibration levels, noises, bearing housing temperature, motor intensity, pressures); impact of stream parameters; hazards.
Parallel and series operations: risks, dysfunction.

TROUBLESHOOTING — 0.75 day

Troubleshooting of most frequent problems (cavitation, priming situation, low flowrate...).

SAFETY IN OPERATION — 0.25 day

Leaks, vibrations, feed, overcharge...
Analysis of industrial incidents and accidents.

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Training - Rotating Equipment

ROTMACH-EN-P | Face-to-face only | 5 days

This course provides a good knowledge of the performance, technology and operation of rotating machinery

Level
Knowledge

Public
Engineers, supervisors and technicians involved in rotating machinery operation, maintenance or engineering

Objectives
Attendees will be able to implement the following skills:

- recognize the technology of major rotating machines
- specify how they operate
- list the selection criteria of the equipment in relation to its operation and maintenance taking into account costs and security aspects

Pedagogical & technical resources

- Study of actual equipment and mechanical parts in the workshop
- Use of drawings, datasheets, pictures and videos of actual equipment
- Pumping test bench practical works
- Incidents analysis and improvement proposals

Assessment of achievements
Quiz

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

PUMPS — 2 days

Different types of pumps, applications in the process industry.
Operating principle and technology of positive displacement pumps.
Performance curves of a centrifugal pump: head, efficiency, shaft power, NPSH.
Technology of centrifugal pumps, different layouts.
Mechanical seals: different arrangements, related auxiliary systems.
Operating limits: cavitation, hammering, priming issues, parallel run, operating range.
Start-up and operation monitoring.
Troubleshooting and common failures. Safety and prevention.

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RECIPROCATING & ROTARY POSITIVE DISPLACEMENT COMPRESSORS — 1 day

Different types of positive displacement compressors.
Reciprocating compressor architecture: number of stages, cylinders, overall layout, standard applications.
Technology of main components and auxiliaries.
Influence of process conditions on compressor performance: suction or discharge pressure, suction temperature, gas composition.
Flow control, specific safety devices. Start-up procedures. Troubleshooting.

CENTRIFUGAL & AXIAL COMPRESSORS — 1 day

Description of different types of centrifugal and axial compressors: horizontal/radial split casing centrifugal compressors, axial compressors, integrally geared compressors.
Technology of main components and auxiliaries.
Compression mechanism through a compressor stage. Performance curves vs operating conditions.
Operation limits: low and high speed limits, stonewall, surge, typical anti surge protection systems.
Flow control: throttling valve, rotation speed control, inlet guide vanes. Specific precautions for start-up.
Troubleshooting. Safety.

TURBINES — 1 day

Description of different types of turbines, typical applications.
Steam turbines, gas turbines, turbo-expanders.
Operating principle, classification and technology: exhaust conditions, expansion mechanism through a turbine stage.
Operation: start-up and performance monitoring. Flow control, safety devices.

Sessions

Pau - From 10/19/2026 to 10/23/2026 — **4240 €/HT**

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Training - Electricity Trading

TDE-EN-P | Face-to-face only | 1 day

This course provides an understanding of risk management in the various electricity trading activities

Level
Skilled

Public
Executives, engineers and managers concerned with risk management tools in electricity markets

Objectives
Attendees will be able to implement the following skills:

- Assess the threats associated with each phase of electricity marketing and implement control measures.

Pedagogical & technical resources
Case studies.

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

ELECTRICITY MARKETS — 0.5 day

Production methods.
Players in the sector.
Products and markets.
Characteristics of the physical market.

RISK MANAGEMENT IN ELECTRICITY MARKETS — 0.5 day

The basics of risk management.
Risk typologies.
Value at Risk (VaR).
Hedging and modelling.
Calculating sensitivities on the electricity market.
Calculating V@R on the contract using Monte Carlo and parametric methods.

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Sessions

Rueil-Malmaison - 04/24/2026 **1680 €/HT**

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Training - Natural Gas and Electricity Trading

TEG-EN-P | Face-to-face only | 2 days

This training provides participants a global and synthetic view on the risk management of the various trading activities of gas and electricity

Level
Skilled

Public
All managers who need to learn the ways of managing risk in the market of natural gas and electricity

Objectives
Attendees will be able to implement the following skills:

- Understand gas and electricity trading operations and effectively use the various hedging tools in the face of financial risks
- Implement control measures, including market risk and credit risk

Pedagogical & technical resources
Case studies and examples

Assessment of achievements

- Trainees are assessed throughout the training through practical application phases and interactions with the trainer
- A final on-the-spot evaluation may also be carried out at the end of the course and/or at the end of each module using tests designed to verify the learners' understanding and assimilation of the knowledge linked to the training objectives

Prerequisites
No prerequisites are necessary to follow this course

Responsable
IFP Training instructors, with expertise in the field and trained in modern teaching methods adapted to the specific needs of learners from the professional world

Program

MARKETS — 0.5 day

Main features of gas and electricity markets.

RISK MANAGEMENT — 0.5 day

Basic statistics.
Risk typologies:

- Credit risk.
- Market risk.
- Operational risk.

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Value at risk.

HEDGING & MODELING — 0.5 day

Nature.
Products:

- Futures, forwards, swaps, options.

CASE STUDIES — 0.5 day

Compute sensitivities on a gas procurement contract.
Compute the V@R of the contract using Monte Carlo and parametric methods.

Sessions

Rueil-Malmaison - From 09/22/2026 to 09/23/2026 — **2560 €/HT**

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