

T-001 ROTATING EQUIPMENT DESIGN AND APPLICATION (WITH WORKSHOP VISITS)

A comprehensive course on Rotating Equipment that covers the engineering principles of all rotating equipment and includes practical exposure through visits to OEM workshops

Rotating equipment lies at the heart of any oil & gas plant and its reliable operation is key to ensure uninterrupted production. Rotating machines are complex pieces of equipment that require all personnel involved in their selection, operation, and maintenance to know well their engineering fundamentals, their mechanical behaviour, and their thermodynamic principles.

This course provides a comprehensive and in-depth overview of the engineering fundamentals of rotating equipment, including mechanical and thermodynamic design aspects, safety, safeguarding, condition monitoring, and control aspects. It explains the limits of the operating windows of each type of rotating machine, highlighting the key concepts that guide a correct machine selection for every different application.

The course also highlights the connections between engineering fundamentals and the correct operation of rotating equipment, giving the participants the tools to understand why certain procedures should be followed and what can go wrong if they are not.

The course includes a number of practical exercises where the attendants are requested to apply the concepts explained in the class room, in order to solve problems that are regularly encountered in the field.

In order to draw a connection between the concepts learned in the classroom and the actual hardware in the field, the last two days of the course are dedicated to visits to the workshops of two rotating equipment manufacturers, where a special seminar is held, the equipment components and the manufacturing process are shown and explained.

Who should Attend?

The course is suitable for the following:

- Engineering staff
- Process & Operations Engineers and Supervisors
- Maintenance Engineers and Supervisors
- Technical managers of LNG plants or refineries

Duration

Two weeks

Course structure and content

A two-week technical course aimed at responsible managers and engineers:

Chapter 0 : Introduction

- Safety Induction
- Course Structure
- Course Program
- House Rules

Chapter 1 : Rotating equipment overview

- Driven equipment
- Drivers

Chapter 2 : Pumps

- Pump classification
- Pump Hydraulics
- Pump control

Chapter 3 : Mechanical Seals

- Mechanical seals principles
- Seal arrangements
- Seals maintenance
- API 682 seal piping plans

Chapter 4 : Centrifugal compressors

- Compressors classification
- Compressors fundamentals
- Compressor performance
- Performance control
- Anti-surge system
- Parallel / Series operation
- Shaft seals

Chapter 5 : Gas turbines

- Overview
- Thermodynamics
- Inlet air system
- Air compressor
- Combustion system
- Turbine
- Exhaust
- Hot components
- Power Augmentation

Chapter 6 : Reciprocating compressors

- Overview
- Suction and discharge valves
- Auxiliaries

- Pistons and rings
- Piston rods
- Piston rod packings
- Capacity control
- Condition monitoring

Chapter 7 : Rotor Balancing

- Low-speed balancing
- High-speed balancing

Chapter 8 : Electric motors

- Overview
- Induction motors characteristics
- Variable frequency drive
- Motor ratings
- Bearings

Chapter 9 : Rotordynamics

- Rotordynamic fundamentals
- Lateral analysis
- Stability analysis
- Torsional analysis

Chapter 10 : Drivers

- Steam turbines
- Internal combustion engines
- Hydraulic turbines

Chapter 11 : Alignment

- Basic principles
- Equipment specifics
- Rim and face method
- Reverse indicator method
- 3-Dial or Rim/Face method

Chapter 12 : Couplings & Gear

- Coupling types
- Fixed-speed couplings
- Variable speed couplings
- Gear types overview
- Helical gears design
- High-power gearboxes
- Planetary gears
- Voith Vorecon®

Training Outcome:

On completion of the course, you should be able to:

- Understand the design principle of all rotating equipment
- Understand principles of selection, operation, and maintenance of rotating equipment
- Understand how to use such concepts selecting, operating or maintaining rotating machines.

Course Presenters

Ron van den Handel: with a career of over 35 years with Shell, Ron has worked as rotating equipment engineer in refineries, LNG, upstream plants, and large Shell projects. In the later part of his career Ron was Global Manager for Rotating Equipment in Shell Global Solutions, providing consultancy and advice to all Shell Operating Units and Projects around the world.

Stefano Bisson: Started his career as Rotating Equipment Engineer in Shell looking after the North Sea assets. Since 2012 Stefano provides rotating equipment consultancy to Oil & Gas companies around the world.