ROTATING EQUIPMENT ACADEMY

Centrifugal Compressor Seminar

Technologies used in the Energy industries are advanced and continuously developing. This results in a need of maintaining and upgrading the knowledge of engineers: “our engineers do need a good understanding of rotating equipment design, maintenance, operation and selection to get the basis for their further development”.

The seminars of the Rotating Equipment Academy are the answer to that need.

Rotating Equipment Academy’s three-day seminar introduces delegates to centrifugal compressor fundamentals, the principles of operation, performance and basic maintenance.

The delegates will review a rotating compressor package in detail. This provides in-depth coverage of all existing support systems such as lube oil, seal oil and dry gas seal systems as well as the instrumentation systems required to keep these units in efficient operation.

The Rotating Equipment Academy believes strongly in the added value of simulation software and interactive case studies. With an interactive compressor simulation program the start-up sequence and optimal compressor operation will be trained. During the case study an optimal station configuration has to be selected. These sessions are highly interactive and will challenge the attendees to think about the what, why, how and when.

Rotating Equipment Academy can provide several training seminars with a wide variety of topics and modules, all supporting safe and effective operation and maintenance of rotating equipment. The seminars are designed to instruct personnel in subjects that range from the fundamentals of operation, performance, instrumentation to specific maintenance. The content and duration of the training seminars can be tailor made to the customer’s needs and equipment.

An example of a typical centrifugal compressor seminar:

Compressor seminars 2019 on high level

- All session based on the barrel type centrifugal compressor, however sidesteps to different designs can be made were applicable and necessary.
- Location: Client offices or any other suitable location.
- 6 half-day sessions of 4 hours.
- 2 sessions with compressor simulation software
- 1 case session.
- Focus will be on the design, operation and selection of the centrifugal compressor trains.
- Max 12 participants per session.
- More detailed sessions can be offered on request.

Target Group

The target group are engineers in the Energy Industry business whose job have affinity with compressors but have little experience with compressor design, operation and selection.

Training library

All material used and/or generated in the workshops will be available in pdf format.

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Seminar schedule

Day 1	Topic	Description
AM	**Basic compressor design** 1. Casing(s) 2. Inner assembly 3. Diaphragms 4. Rotor 5. Impellers 6. Axial thrust compensation 7. Internal seals 8. Dry gas seals 9. Bearings 10. Coupling 11. Shaft monitoring designs	Maybe before this presentation you will see our Centrifugal Compressor as a big chunk of metal. After it you will appreciate the Centrifugal Compressor as a highly sophisticated, custom made, detailed engineered piece of precision equipment contained in a big chunk of metal. ***Pre-knowledge:*** Basic understanding about turbo machinery. (Poly technical school) ***Objective***: • Identify and locate compressor components. • Understand the principal of components. • Understand how all components work together to become a compressor.
PM	**Sealing Elements** 1. Location of SE in the compressor 2. O-rings, Cup-rings 3. Labyrinth 4. Dry gas seal 5. Barrier seal	You know already why we need sealing elements. In this session we will have a closer look of what they are and how they work. ***Pre-knowledge:*** Understand “basic compressor design” ***Objective*:** • Know different sealing systems. • Identify and locate sealing elements. • Understand why sealing elements are needed. • Understand how the sealing elements work.

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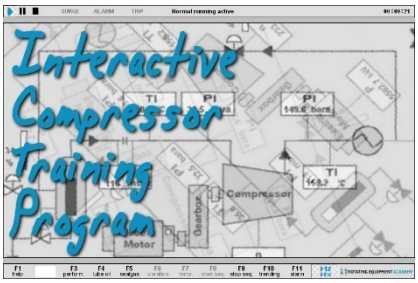
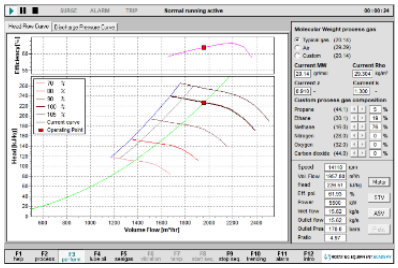
Day 2	Topic	Description
AM	**P & ID Typicals** 1. Instrumentation 2. Operational aspects 3. Diagram explanation 4. Protection system	The heart and basis of the control system: P&ID's. What are we measuring and how do we make sure compressor parts will survive the harsh conditions in which they run. What are the setpoints used. Seal system and oil system will be explained. ***Pre-knowledge:*** Basic knowledge about compressor design, seals and process control and P&ID symbols. ***Objective***: • Know which control components are used. • Understand the principles of operation. • Identify the main support systems and describe their function and operation. • Understand where and why alarms and trips are used.
PM	**Performance map with Interactive session with ICTP (Interactive Compressor Training Program)** 1. Compressor curve 2. Operating vs. Design point 3. Fixed speed vs. variable 4. Operating envelope 5. Limits of the curve Curves: m-p vs. Q-H 6. Influence of suction conditions 7. Practical training supported by ICTP 8. Surge, stall and choke	 Until now we have talked about components but how does the compressor build up pressure in the first place? Why is the performance curve not a straight line and where does it end? How do the suction conditions influence the performance? Is the operating point the same as the design point? A lot of questions to be answered during this session. The best of all is that you will find out yourself during your work with the Interactive Compressor Training Program. So do bring your laptop. ***Pre-knowledge:*** • Understand "basic compressor design". • Basic understanding about processes with compression. • Basic computer skills. ***Objective*:** • Describe the compressor performance curve(s). • Understand how the compressor behaves in a process under changing conditions. • Know and understand why and how the performance curve (map) is limited.

Day 3	Topic	Description
AM	**Compressor Start and Control** 1. Start-up 2. Practical training supported by ICTP 3. Compressor Control a. Discharge throttle b. Suction throttle c. Recycle d. Guide vanes e. Speed variation f. Anti surge g. Load Sharing 4. Practical training supported by ICTP	 You do understand the performance curve already and want to know how we can control the performance of the machine. How can we run the operating point in the most efficient way? Again, we will use the Interactive Compressor Training Program to find out how it works and what the effects are. Laptops please! ***Pre-knowledge:*** • Understand "basic compressor design". • Basic understanding about processes with compression. • Basic computer skills. • Basic understanding about "compressor performance." • Understand the typical compressor P&ID ***Objective***: • Understand how compressor performance can be controlled. • Understand different compressor control mechanism. • Know and understand how a (typical) compressor train is started.
PM	**Case: Optimal station configuration** 1. Define possible station configurations 2. Calculate total compressor power wit QH 3. Gas turbine evaluation based on: a. Efficiency b. Emissions c. Total equipment cost d. Installation cost e. Fit (% overcapacity) f. Footprint 4. Select the best configuration and define selling point. 5. Presentation of the results and discussion.	A client requests a complete compressor train solution for an offshore application somewhere off the coast of India. On this offshore platform the pressure of a gas flow needs to be boosted. The assignment is to advise on an optimal station-configuration. Based on given conditions. This means you should choose the *amount of trains* to be installed and a *fitting driver for these trains*. Your solution will be compared with those of your peer "competitors" based on a combination of criteria: Efficiency, emissions, total equipment and installation cost, 'fit' and footprint However, if you feel the advantages of your chosen solution are not adequately expressed by these criteria, you are free to emphasize your own 'selling points'. The operating conditions for the entire station-flow are listed. You can use the QH-program to estimate the total compression-power that is required and use the gas turbine information, brochures or other material to choose a fitting configuration and driver. ***Pre-knowledge:*** • Understand "basic compressor design". • Basic understanding about processes with compression. • Basic computer skills. • Basic understanding about "compressor performance." • Basic understanding about gas turbine performance ***Objective*:** • Get appreciation how various parameters can influence an optimal compressor train concept • Understand the important design parameters for the train configuration, compressor and gas turbine selection. • Be able to evaluate different train concepts.