

Best Technology Solutions (BTS)

Training Program



# Centrifugal Compressor & Steam Turbines

Training Program



## Introduction:

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This seminar entails a study of gas compression and expansion laws applied to industrial processes followed by an illustration of the different types of rotating machines usually encountered in plants, and their related aspects. The aim is to provide a satisfactory approach to the problems posed by compressors and turbines and the means to solve them.

## Target Audience:

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This seminar is directed towards Supervisors, Team Leaders and Managers in Maintenance , Engineering and Production . The seminar will also benefit anyone who wishes to update themselves on Centrifugal Compressors and Steam Turbines, judge the suitability of them for their needs, and learn how to operate and maintain them for the benefit of their organisations.

## Key Benefits:

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- enable the delegate to develop a proactive maintenance regime within the organisation.
- give the delegate confidence to carry out failure analyses thereby avoiding repetitive failures.
- allow tighter control of maintenance budgets by the avoidance of unplanned equipment failures in service.



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## Training Methodology:

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The seminar will be conducted along workshop principles with formal lectures, case studies and interactive worked examples. Relevant case studies will be provided to illustrate the application of each tool in an operations environment. Each learning point will be re-enforced with practical exercises. There will be ample opportunities for discussion and sharing experiences.

## Organizational Impact:

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Predictive maintenance of rotating plant is vital to the budgetary success of the operations organisation. On completion of this seminar the delegate will be able to critically analyse the methodologies employed within the organisation and instigate improvements where required.

## Personal Impact:

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Technical knowledge is key to effective control and peer respect within any maintenance organisation; when this is achieved personal satisfaction follows. This seminar will give the delegate the required level of technical knowledge and skill to achieve that personal satisfaction.

## Competencies:

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- Understanding of monitoring techniques as applied to compressors and turbines.
- Ability to put in place measures to quantify equipment condition.
- Interface with and control service providers.
- Identify and specify new compressor and turbine plant.

## Course Objectives:

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At the end of this seminar participants will have:

- An understanding of the construction and operational constraints of centrifugal compressors and steam turbines.

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- Knowledge of how to optimally maintain the equipment for the benefit of the company
- Hints and Tips for practical application of monitoring technologies so as to achieve the best results.

## Course Outline:

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### Day 1 - Gas Laws & Compression Theory

#### Compression and Expansion Fundamentals

##### ❖ Gas Equations

- Ideal gas equation and practical application
- Isentropic, polytropic compression
- Mass and volume capacity

##### ❖ Practical compression laws

- Effect of process temperature
- Power of compression

##### ❖ Mollier diagrams

- For gas and steam

#### Compression and Expansion Mechanisms

##### ❖ Compression Basics

- Euler's law, applications for compressors and turbines,
- characteristic curves
- velocities triangle

❖ **Blade types**

- Impulse profile and Reaction profile – where each type are used and why

❖ **Dynamic Effects**

- Mach number: effect on temperature, pressure and density;
- Subsonic and supersonic machines

❖ **Simple Calculations**

- Dimensionless coefficients, specific speeds

**Day 2 – Practical Applications**

**Compressor and Turbine Performance and Operation**

❖ **Affinity Laws for centrifugal impellers**

- Calculating effect of speed change
- Calculating effect of impeller changes

❖ **Characteristic curves**

- Effect of change on operating and process parameters

❖ **Operational Problems**

- Surge
- Stonewall
- Range of working efficiency

❖ **Capacity control methods**

- Speed change

- Inlet guide vanes

❖ **Commissioning**

- Pre start checks
- Vibration survey
- Runup/rundown analyses

**Day 3 – Steam Plant & Turbines**

**Steam turbines**

❖ **Turbine Characteristics**

- Speed
- Specific consumption
- Efficiency

❖ **Steam Conditions**

- Influence of inlet steam state
- Effects of exhaust steam

❖ **Control Systems**

- Speed governor
- Pressure & temperature control systems

❖ **Safety devices**

- Overspeed
- Overpressure



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❖ **Associated Equipment**

- Condensers
- Pumps
- Boilers

**Day 4 - Turbine Construction & Maintenance**

**Construction and Systems**

❖ **Construction**

- Casings
- Diaphragms
- Stator
- Blades

❖ **Bearings & Seals**

- Rotor, journal and thrust bearings
- Internal and shaft seals
- Coupling

❖ **Rotor Dynamics**

- Balance
- Critical speeds

❖ **Associated Systems**

- Lubrication system
- Seal systems

- **Typical mechanical incidents**



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#### Day 5 – Engineering Aspects

##### ❖ Engineering

- API specifications
- Information required for bidding
- Factory tests