Steam Turbine Operation

Course Description:

Steam Turbines of several types, which have widely varying configurations and applications, are used extensively in the process industries. These steam turbines represent a significant part of the capital and operating costs of most plants, so that optimizing their selection is of major economic importance.

The course is devoted to design features, efficiencies, operating characteristics, reliability, and maintenance implications of steam turbine drivers.

This course will cover the operating principles of steam turbines, specifications, their design, thermodynamics, effects of efficiency on operating costs, energy usage, effect on plant costs, special materials of construction, selection, troubleshooting, and maintenance.

The course will also cover plant run-length extension surveys, organizing for successful turnarounds and ongoing reliability improvement, and preventive vs. predictive maintenance strategy decisions.

The course will provide the participant with a basic, as well as advanced, steam turbine technology inventory required to successfully select, apply, troubleshoot, and maintain steam turbine equipment.

Who Should Attend?

Persons in staff (senior technicians, operators, supervisors, superintendents) and corporate engineering, plant planning and design, systems design, equipment selection and evaluation, and equipment maintenance areas. Also, equipment and systems specialists in engineering contractor firms and managerial and supervisory individuals responsible for operations and maintenance functions.

The industries most directly involved with the subject matter are those producing chemicals, petrochemicals, petroleum products, natural gases, manufacturing gases, steel and other metals, and plants requiring process refrigeration. Throughout the course, participants will have ample opportunity to have equipment-related questions answered by the instructor.

Course Objectives:

Upon completion of this course, participants will have gained a thorough understanding of the various steam turbine configurations available to virtually every industrial user. Items discussed include mechanical design features, sizing and application criteria, maintainability, reliability, vulnerability, and troubleshooting issues. Participants will learn simple techniques and short-cut methods of machinery selection, which can take the place of tedious hand calculations and will serve as rapid means to determine sensitivity or influence of parameter changes on equipment performance. Participants will be able to determine the most appropriate and efficient matching of compressor or pump to steam turbine driver. Participants will also acquire knowledge of operating and maintenance issues by getting to know mechanical design, machinery components, piping design, as well as proven approaches to monitoring, troubleshooting, and maintenance of compressor installations.

Course Outline:

Module 1

- **Steam Turbines**
    - Operating Principles, Impulse Turbines, Reaction Turbines, Application Ranges, Configurations, Application Constraints
- **Turbine Components**
    - Turbine Rotors, Blading, Diaphragms, Nozzles, Steam Chests, Glands and Gland Systems, Bearings, Balancing, Rotor Dynamics, Governing Systems, Lube Oil Management

Module 2

- **Overview of Selection and Sizing of Steam Turbines for Reliability**
    - Thermodynamics, Steam (Water) Rates, Condensing and Backpressure Turbines, Single and Multistage Types, Process Considerations
- **Operation and Maintenance of Steam Turbines**
    - Commissioning, Start-Up, Run-In and Shut-Down, Surveillance and Health Monitoring, Performance Measurement, Monitoring and Tracking, Steam Turbine Washing, Steam Turbine Inspection, Maintenance, Overhaul and Repair (IMO&R)

Module 3

- **Basic Approaches to Machinery Troubleshooting**
    - Examples from Recent Failure Incidents Attributed to Design Defects, Processing and Manufacturing Deficiencies, Assembly Errors, Off-Design or Unintended Service Conditions, Maintenance Deficiencies, etc.
- **Predictive vs. Preventive Maintenance Techniques**
    - Determination of Which Method to Use

- **Machinery Reliability Audits and Reviews**
    - Overview, Reliability Impact on Plants
- **Possible Modifications**
    - Life extension, rerating and uprating, and revamp efforts of mechanical drive steam turbines (20 to 100,000 HP)