

MECHANICAL SEAL PRINCIPLES I

Course Introduction:

Mechanical Seals are becoming the Sealing Devices of choice for today's environmentally conscious consumers. Unfortunately, education on Mechanical Seals is often overlooked in today's colleges and universities. This course is designed to educate you with the appropriate knowledge of these devices and how they accomplish their job. A thorough comprehension of Mechanical Seal Principles is often required for you to effectively carry out your day to day business. If you design, specify, repair, maintain, operate or work with Mechanical Seals in any way, this course will provide you with the information required to perform these tasks.

Course Objective:

Upon completion of this course you will be able to describe the purpose of a Mechanical Seal, identify the parts of a Mechanical Seal, describe Mechanical Seal classifications, describe Mechanical Seal materials of construction, describe Mechanical Seal operation, identify Mechanical Seal environmental controls, describe Mechanical Seal design history, and troubleshoot some basic Mechanical Seal failures.

Course Curriculum Length: 40 hours

Course Modules & Syllabus

- **Mechanical Seal Parts**
 - The Mechanical Seal Purpose
 - The Packed Stuffing Box
 - The Purpose of a Mechanical Seal
 - The Sections of a Mechanical Seal
 - Mechanical Seal Construction
 - The Primary Seal Rings
 - The Secondary Seals
 - The Metal Parts
 - Primary Seal Rings
 - The Primary Seal Rings
 - Seal Face Flatness
 - Flatness Defined
 - What is a Helium Light Band?
 - What is an Optical Flat?
 - Reading Light Bands
 - Flatness Readings - Rules of Thumb
 - Seal Face Lubrication
 - The Asperity Theory
 - The Pressure Drop Theory
 - The Pressure Wedge Theory
 - The Dry Running Theory
 - The Three Band Theory
 - Secondary Seals

- The Gland Seal
 - The Shaft Seal
 - O-ring Seals
 - V-ring Seals
 - U-cup Seals
 - Wedge Seals
 - Boot Type Seals
 - Additional Secondary Seals
- Mechanical Seal Hardware
 - The Gland
 - The Spring Mechanism
 - Large Single Coil Springs
 - Multiple Small Springs
 - Metal Bellows
 - Some Common Problems with Metal Bellows Seals
 - Finger Springs
 - Rubber Bellows
 - Some Common Problems with Rubber Bellows Seals
 - The Shaft Sleeve
 - The Drive Mechanism
- **Mechanical Seal Classifications**
 - Inside and Outside Mechanical Seal Configurations
 - Inside Mechanical Seal Configurations
 - Outside Mechanical Seal Configurations
 - Rotary and Stationary Mechanical Seal Configurations
 - Rotary Mechanical Seal Configurations
 - Stationary Mechanical Seal Configurations
 - Component and Cartridge Mechanical Seal Configurations
 - Component Mechanical Seal Configurations
 - Cartridge Mechanical Seal Configurations
 - Metallic and Non-metallic Mechanical Seal Configurations
 - Metallic Mechanical Seal Configurations
 - Non-metallic Mechanical Seal Configurations
 - Single and Multiple Seal Ring Mechanical Seal Configurations
 - Single Seal Ring Mechanical Seal Configurations
 - Multiple Seal Ring Mechanical Seal Configurations
 - Split and Non-split Mechanical Seal Configurations
 - Split Mechanical Seal Configurations
 - Non-split Mechanical Seal Configurations
 - Unbalanced, Balanced, and Double Balanced Mechanical Seal Configurations
 - Unbalanced Mechanical Seal Configurations
 - Balanced Mechanical Seal Configurations
 - Double Balanced Mechanical Seal Configurations

- Pressure at the Seal Outside Diameter
 - Pressure at the Seal Inside Diameter
 - Pusher and Non-pusher Mechanical Seal Configurations
 - Pusher Mechanical Seal Configurations
 - Non-pusher Mechanical Seal Configurations
 - Gas and Non-gas Mechanical Seal Configurations
 - Gas Mechanical Seal Configurations
 - Non-gas Mechanical Seal Configurations
- **Mechanical Seal Materials**
 - Seal Ring Parts
 - Carbon-graphite Seal Ring Parts
 - Ceramic Seal Ring Parts
 - Tungsten Carbide Seal Ring Parts
 - Silicon Carbide Seal Ring Parts
 - Reaction Bonded Seal Ring Parts
 - Sintered Silicon Carbide Seal Ring Parts
 - Duplex Carbide Seal Ring Parts
 - Other materials used as Seal Ring Parts
 - Elastomer Parts
 - Fluorocarbon
 - Ethylene Propylene Rubber (EPR) Elastomer Parts
 - Buna-N (Nitrile) Elastomer Parts
 - Neoprene Elastomer Parts
 - PerfluoroElastomer Parts
 - Kalrez 4079
 - Kalrez 1050LF
 - Kalrez 1050
 - Kalrez 1018
 - Kalrez 3018
 - Kalrez 2035
 - Kalrez 2037
 - Chemraz 505
 - Chemraz 513
 - TFE Elastomer Parts
 - Aflas
 - Fluoraz
 - Vanway (AKA Style 76)
 - Silicone Elastomer Parts
 - Other materials used for as Elastomer Parts
 - Metal Parts
 - Stainless Steel
 - Alloy 20
 - Titanium
 - Monel
 - Hastelloy-B
 - Hastelloy-C

- Inconel 718
 - Inconel 600
 - Bronze
 - Nickel
- **Mechanical Seal Operation**
 - Single Mechanical Seal Operation
 - How do single Mechanical Seals function?
 - Back-to-Back Mechanical Seal Operation
 - How do back-to-back Mechanical Seals function?
 - Problem 1
 - Problem 2
 - Problem 3
 - Problem 4
 - Tandem Mechanical Seal Operation
 - How do tandem Mechanical Seals function?
 - Face-to-Face Mechanical Seal Operation
 - How do face-to-face Mechanical Seals function?
 - Concentric Mechanical Seal Operation
 - How do concentric Mechanical Seals function?
 - Gas Mechanical Seal Operation
 - How do gas-lubricated Mechanical Seals function?
- **Mechanical Seal Environmental Controls**
 - API Plan 2
 - What is API Plan 2?
 - API Plan 11
 - What is API Plan 11?
 - API Plan 12
 - What is API Plan 12?
 - API Plan 13
 - What is API Plan 13?
 - API Plan 21
 - What is API Plan 21?
 - API Plan 23
 - What is API Plan 23?
 - API Plan 31
 - What is API Plan 31?
 - API Plan 32
 - What is API Plan 32?
 - API Plan 41
 - What is API Plan 41?
 - API Plan 52
 - What is API Plan 52?
 - API Plan 53
 - What is API Plan 53?
 - API Plan 54
 - What is API Plan 54?

- API Plan 62
 - What is API Plan 62?
- **Mechanical Seal Generation Design**
 - First Generation Mechanical Seals
 - What are features of a First Generation Mechanical Seal?
 - Unbalanced
 - High Seal Face Wear
 - High Energy Costs
 - Fits Needs of Pump OEMs only
 - Limited Material Selection
 - Limited Temperature Range
 - Limited Pressure Range
 - Limited Speed Capabilities
 - Prone to Clogging
 - Causes Shaft Fretting
 - High Heat Generation
 - Wide Seal Faces
 - High Fugitive Emissions
 - Component Design only
 - Inadequate Instructions and Misinstallation
 - Second Generation Mechanical Seals
 - What are features of a Second Generation Mechanical Seal?
 - Balanced
 - Lower Energy Costs
 - Lower Seal Face Wear
 - Lower Heat Generation
 - Higher Pressure Range
 - Extended Material Selection
 - Higher Temperature Range
 - Higher Speed Capabilities
 - Non-clogging Design
 - Non-fretting Design
 - Narrower Seal Faces
 - Lower Fugitive Emissions
 - Cartridge Seal Availability
 - Fits Needs of Maintenance
 - Third Generation Mechanical Seals
 - What are features of a Third Generation Mechanical Seal?
 - Double Balanced
 - Totally Non-fretting Design
 - Gas Seal Design
 - Narrowest Seal Faces
 - Fits Needs of both Maintenance and OEM
 - Highest Operating Parameters of all Seal Generations

- **Mechanical Seal Troubleshooting**
 - Mechanical Seal - Wear Track Symptoms
 - Wear Track Wider than Narrow Seal Face
 - Centered or Miscentered Wear Track
 - Even or Uneven Wear Track
 - Mechanical Seal - Seal Face Symptoms
 - Scoring or Erosion of the Seal Faces
 - Chipping on the Outside or Inside Diameter of the Seal Face
 - Coking or Crystallization of the Seal Face
 - Heat Cracking or Checking of the Seal Face
 - Blistering of the Seal Face
 - Mechanical Seal - Elastomer Symptoms
 - Hard or Compression Set (Squared) Elastomers
 - Extrusion or Nibbling
 - Explosive Decompression
 - Soft, Mushy or Swollen, Twisted Elastomers
 - Mechanical Seal - Parts Inspection
 - Scoring of Inside or Outside Diameters of Seal Faces and Metal Parts
 - Corroded or Pitted Parts
 - Flattened Set Screw Cup Points
 - Mechanical Seal - Bellows Symptoms
 - Crack at or Near Weld
 - Coated or Clogged with Product