

## Fundamentals of Reliable Pump Operation Course Objectives

### Pump Fundamentals and Basic Hydraulics Review

Upon completion of this module, you will be able to:

- Describe components and functions of the pump
- Describe the types of pumps available
- Describe performance of the centrifugal pump
- Define terms “Best Efficiency”, “NPSH”, etc.
- Identify information shown on Pump Performance Curves
- Interpret and apply Pump Performance Curves
- Interpret and apply System Performance Curves

### Life Cycle Costs (LCC)

Upon completion of this module, you will be able to:

- Discuss key factors that impact Life cycle Costs
- Identify the importance of the entire system approach
- List the elements of LCC
- Discuss the impact of tradeoffs for the elements of LCC

### System Approach

Upon completion of this module, you will be able to:

- Discuss the system components and identify how each component affects the system as a whole
- Identify critical system objectives
- Discuss how to preserve the critical system objective within the system approach

### Factors of Pump reliability

Upon completion of this module, you will be able to identify the factors that impact reliability, including:

- System design
- Pump selection
- Installation
- Operation
- Maintenance practices

### Pump Operation Safety

Upon completion of this module, you will be able to identify safe and unsafe operational practices for:

- Components upstream of the immediate locale of the system
- Individual pumps and components in the immediate locale
- Components downstream of the immediate locale of the system

### Procedures for Pump Operation

Upon completion of this module, you will be able to describe procedures for proper centrifugal pump operation, including:

- Start up procedures
- Shut down procedures
- Pre-heat considerations
- Thermal expansion considerations

**Normal Operation**

Upon conclusion of this module, you will be able to describe, compare and contrast common / typical methods of centrifugal pump operation, including:

- Continuous Operation
- Intermittent Operation
- Constant Speed Operation
- Variable Speed Operation
- Throttled Operation
- By-pass Operation
- Maximum/Minimum Speed
- Maximum/Minimum Flow

**Other Modes of Operation**

Upon completion of this module, you will be able to describe, compare and contrast less common methods of centrifugal pump operation, including:

- Parallel Operation
- Series Operation
- Dissimilar Pump Operation
- Multiple Suction Configurations
- Multiple Discharge Configurations
- Sump Operation
- Self Priming Operation

**Coupling Considerations**

Upon completion of this module, you will be able to:

- Describe, compare, and contrast the features of the following types of couplings:
  - Rigid
  - Flexible
  - Gear Type
  - Universal Joint Type
  - Elastomeric
  - Spring Type
  - Metal Disc Pack
  - Magnetic
  - Clutches
- Describe the factors involved in coupling selection and identify improperly selected couplings

**Caring for Pump Shaft Seals**

Upon completion of this module, you will be able to:

- Describe the purpose of shaft seals
- Identify the different seal types and describe the application and benefits of each type
- Identify the different seal arrangements and their application
- Identify the causes of seal failures
- Describe how to extend seal life

**Bearing Design and Application**

Upon completion of this module, you will be able to:

- Identify different bearings and classifications
- Describe the application of each bearing type
- Identify lubrication methods and benefits of each method
- Identify bearing installation process and configurations
- Identify the different types of available bearing closures and the advantages and disadvantages of each type

**Pump Selection Considerations**

Upon completion of this module, you will be able to:

- Describe the effects of the following considerations on proper pump selection:
  - Hydraulic
  - Mechanical
  - Installation
  - Operational
  - Reliability
  - Life Expectancy
  - Environmental
  - Specifications
  - Spare Parts

**Troubleshooting**

Upon completion of this module, you will be able to describe the contributing factors and characteristics of:

- Pump System Problems
- Mechanical Pump Problems
- Temperature/Vibration Problems
- Troubled Operations/Performance Issues

**Driver Selection Considerations**

Upon completion of this module, you will be able to:

- Define common terminology used for drivers
- Describe, compare, and contrast the features of various:
  - Motor types
  - Variable speed drives
  - Other drives
- Describe the factors involved in driver selection and identify improper driver selection

**Condition Monitoring and Root Cause Failure Analysis**

Upon the conclusion of this module, you will be able to:

- State the benefits of implementing a comprehensive condition monitoring program
- Describe the tools used in condition monitoring
- Describe the basic concepts used in root cause analysis and identify the benefits
- Identify the process steps in the root cause analysis process and describe how they are used