

# ITT Plant Performance Learning Services

## ***Fundamentals of Reliable Pump System Design Course Objectives***

### **Life Cycle Costs (LCC)**

Upon completion of this module, the student 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, the student 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 state various factors that impact pump reliability:

- Selecting the right pump
- Installation
- Operation
- Pumpage Material
- Maintenance

Upon completion of this module, you will understand the importance of extending pump life.

You will also be able to describe requirements for extending pump life, including:

- Increasing Seal Life
- Lubrication of Pump
- Dry Run Protection of the Pump

Upon completion of this module, you will be able to describe the effects of various installation factors on pump reliability, including:

- Piping Configuration
- Foundation/Baseplate
- Grouting
- Alignment
- Environment

### **Factors of Pump Reliability**

Upon the conclusion of this module you will be able to identify the factors that impact pump reliability including the following:

- 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

### **Bearing Design and Application**

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

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

### **Bearing Lubrication Types and Methods**

Upon completion of this module, the student will be able to identify the factors involved in selecting an appropriate bearing lubrication system and identify the effects of various lubricants on the bearing life.

### **Considerations for Selecting Pump Construction Materials**

Upon completion of this module, the student will be able to:

- Discuss the factors associated with selecting an appropriate pump material for their application
- Identify the factors that indicate when non-standard pump materials are required
- Discuss the liquid characteristics that impact material selection

### **Caring for Pump Shaft Seals**

Upon conclusion 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

### **Pump Installation Considerations**

Upon completion of this module, the student will be able to discuss pump installation considerations and their impact on pump reliability.

### **Pump Mounting Considerations**

Upon completion of this module, the student will be able to describe, compare, and contrast the features of mounting systems for centrifugal pumps.

### **Standard Base Selection Considerations**

Upon completion of this module, the student will be able to describe, compare, and contrast the types of standard bases.

### **Coupling Selection Considerations**

Upon completion of this module, the student will be able to identify the types of couplings and discuss the factors in selecting the best coupling for an application.

### **Pump System/Piping Considerations**

Upon completion of this module, the student will be able to identify the factors involved in the design and performance of pipe systems.

### **Pump/Pump System Interaction**

Upon completion of this module, the student will be able to discuss the factors involved in (and the effects on) pump and pump system interaction.

### **Pump Selection Considerations**

Upon completion of this module, the student will be able to discuss the factors involved in selecting the best pump for an application.

### **Driver Selection Considerations**

Upon completion of this module, the student will be able to discuss the factors involved in selecting the best pump for an application.

### **System Control Methods**

Upon completion of this module, the student will be able to identify the appropriate use of, and compare and contrast system control methods.

**Energy Saving Actions**

Upon completion of this module, the student will be able to discuss energy saving actions and their impact on the system.

**Condition Monitoring/ Basics of Vibration Monitoring and Effects/Root Cause Analysis**

Upon completion of this module, the student will be able to discuss the effects of the factors important in condition monitoring (for the determination of pump health).

Upon completion of this module the student will be able to identify methods of data collection and discuss the impact of data on condition monitoring.

Upon completion of this module, the student will be able to explain each of the following steps in the root cause failure analysis and analyze root causes of pump failure.

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

**Commissioning and Field Testing**

Upon completion of this module, the student will be able to describe the proper methodology for commissioning, start up, and field testing.