



Module Outline

Welcome to the AIRAH 'Pumps in HVAC&R Part 2 – Pump application, installation and operation' course

The purpose of this course is to provide participants with the information required to assist in understanding the appropriate Installation, Operation and Maintenance requirements when applying pumps in a HVAC&R system.

Some prior knowledge and/or experience in HVAC&R systems and their components will help ensure participants gain optimum benefit from the course.

How to Work Through this Course:

You can navigate through the course content by using the navigational arrows in the course content or the table of contents in the side bar. You can return to the main menu at any time by using the link provided in the table of contents

Activities / Assessment overview etc

For every one of the Topics in this course, there is a self-assessment section. You need to complete this assessment (which may entail reading articles, visiting websites or referring to one of the reference texts), to demonstrate your knowledge and competency. There are multiple self-assessments methods used including:

- Multiple choice questions
- Drop and Drag to diagram
- Labelling diagrams and other images
- Performing calculations
- Matching statements with answers

Introduction

This course looks at the information required to identify different types and characteristics of pumps. It looks at how a pumps works, the materials and components used and the fundamental considerations for selection of a pumps for the appropriate duty.

This module covers the following topics.

Topic 1: Applying centrifugal pumps

- Pumping arrangements
- Single pump operation
- Pumps – continuously falling characteristics curve
- Pumps – rising and falling characteristics curve
- Pumps – operating in parallel and in series
- Pump instability
- System instability

Topic 2: Selecting a pump

- Selection considerations
- Installation configuration and pump type
- System design and specification
- Safety factors
- Pump performance characteristic curve
- System operating point
- Comparing competing pump selections

Topic 3: Installation and commissioning

- Installation specification
- Installing for operation/maintenance safety
- Electrical safety
- Supporting the pump
- Vibration
- Pump installation
- Pipework
- Pre-commissioning and commissioning
- Functional testing
- System fine tuning

Topic 4: Operation and maintenance

- Transition from construction to operation
- Systems operators
- O&M manuals
- Pump operation
- Monitoring pumps

- Performance assessment
- Managing system performance
- Intelligent pump diagnostics
- Pump maintenance
- Life Cycle Analysis (LCA)

Topic 5: Testing and troubleshooting

- Testing a centrifugal pump
- Measurement of flow
- Measurement of pump speed
- Troubleshooting

Learning Outcomes

At the completion of this course participants will be able to:

- Identify the variety of arrangement in which centrifugal pumps are applied.
- Describe the characteristics of single pump operation.
- Describe the characteristics of pumps with continuously falling characteristic curves.
- Describe the characteristics of pumps with rising and falling characteristic curves.
- Describe the characteristics of pumps operating in parallel.
- Describe the characteristics of pumps operating in series.
- Identify the common methods to vary pump flow.
- Describe pump/system instability and noise and vibration considerations.
- Describe the information required when selecting a pump for a particular application.
- Recommend pump types for particular installation configurations.
- Explain system resistance calculations and the safety factors used.
- Describe the pump characteristic curve and the system resistance curve.
- Explain system operating point and best operating point.
- Identify the methods available to match a pump to the system duty.
- Select the required pump from a pump selection chart.
- Identify the characteristics of the required pump from a specific pump performance chart.
- Differentiate between NPSH, NPSHA and NPSHR and calculate for a simple system.
- Describe the installation issues related to safety in operation and maintenance
- Outline the main pressure considerations when locating a pump on a system
- Describe how to support a pump to prevent vibration
- Outline the fundamentals of pump and pipework installation good practice
- Explain the importance and procedures of pump commissioning
- Describe system testing procedures and commissioning documentation
- Outline the benefits of system fine tuning.
- Describe the main issues when transitioning from construction to pump operation
- Outline the main objectives of pump operators
- Explain the purpose and content of operation and maintenance manuals
- Describe pump start-up and shut-down procedures
- Outline the benefits of monitoring pumps and pump KPIs
- Outline the main considerations when managing system performance system
- Identify the imperatives for pump maintenance and maintenance staff safety
- Describe the requirements for providing access to pumps and facilitating pump maintenance
- Describe the types of maintenance strategies that can be applied to pumps.
- Identify the main areas where laboratory testing differs from on-site testing.
- Outline the methods that can be used to determine the flow rate and speed of a pump.
- List the typical reasons for poor pump performance.
- Describe trouble shooting procedures for detecting and diagnosing the source of pump trouble.