

NATIONAL METAL AND ENGINEERING CURRICULUM

MODULE: AIR CONDITIONING CONTROLS (NR15)

PURPOSE: This module aims to provide the students with the knowledge and skills to commission, fault find and repair simple air conditioning control systems.

NOTE: This is an introductory module for refrigeration mechanics and electricians involved with air conditioning controls.

It will lead to advanced modules in each of the types of control systems. That is electrical, electronic - analog, electronic - DDC & PLC and pneumatic control.

NOMINAL DURATION: One Module

This module is designed on the assumption that most of the students will achieve the competencies specified in 35 to 40 hours.

The length of time taken to complete a module will vary depending on factors such as teaching method used, knowledge and skills at entry and individual students ability.

PREREQUISITES: System Control (NR12)

LEARNING OUTCOMES: On completion of this module, the student will be able to:

1. Describe the air conditioning control principles, concepts, terminology and applications.
2. Read, interpret, design and explain the sequence of operation of simple air conditioning circuit diagrams.
3. Read, interpret, design and explain the sequence of operation of simple air conditioning control system diagrams.
4. Safely fault find and repair the three types of control systems, for simple air conditioning systems.
5. Explain the operation fault find and repair various fluid flow control devices and systems.
6. Explain the principles of energy management and the various systems used in air conditioning.
7. Safely and correctly commission the three types of control systems, for simple air conditioning systems.

STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.

OUTLINE OF CONTENT:

This module contains:

1. **Control System Fundamentals**
 - . principles
 - . terminology
 - . symbols and diagrams
 - . basic applications
2. **Circuit Diagrams**
 - . revision of control circuits
 - . control symbols
 - . air conditioning circuit diagrams
3. **Types of Control Systems**
 - . electrical
 - . electronic
 - . pneumatic
4. **Fluid Flow Control**
 - . sensors
 - . actuators
 - . control systems
5. **Energy Management Principles**
 - . running costs
 - . capacity control
 - . economiser system
 - . night purge
 - . thermal storage
6. **Commissioning Procedures**
 - . electrical
 - . electronic
 - . pneumatic

* Details of above Outline topics are available in APPENDIX 1.

ON-THE-JOB TRAINING:

For consolidation, the material in this module should be linked with and complemented by relevant on-job skill practice or other equivalent experience.

PERFORMANCE CRITERIA:

The criteria for each learning outcome should be:

Learning Outcome 1

Assessment:

Short answer questions.

Performance:

- a. List and explain the principles of air conditioning control.
- b. Define various terms used in air conditioning control.
- c. Describe the operation of various simple control diagrams.
- d. List various applications employing air conditioning control.

Learning Outcome 2

Assessment: Short answer questions and drawings.

- Performance:**
- a. Explain the sequence of operation of a simple air conditioning circuit diagram.
 - b. Draw a circuit diagram for a simple air conditioning system.

Learning Outcome 3

Assessment: Short answer questions and drawings.

- Performance:**
- a. Explain the sequence of operation of a simple air conditioning control system diagram.
 - b. Draw a control system diagram for a simple air conditioning system.

Learning Outcome 4

Assessment: Practical test.

- Performance:**
- a. Identify the control system fault and it's cause.
 - b. Repair the fault.

Learning Outcome 5

Assessment: Short answer questions and Practical test.

- Performance:**
- a. Explain the operation of various fluid flow control devices and systems.
 - b. Identify the fluid flow control system fault and its cause.

Learning Outcome 6

Assessment: Short answer questions.

- Performance:**
- a. Explain the principles of energy management and the operation of various systems.

Learning Outcome 7

Assessment: Short answer questions and Practical test.

- Performance:**
- a. Determine the settings for various control devices
 - b. Safely and correctly start up, adjust and commission a simple air conditioning control system.

APPENDIX 1 EXPANDED DESCRIPTION OF CONTENT

Suggested module content

- 1. Control System Fundamentals**
 - principles
 - functions
 - elements
 - loops
 - actions
 - terminology
 - trade - e.g. A/C, ventilation, etc.
 - psychrometric - e.g. dew point, dehumidify, etc.
 - control - e.g. set point, dead, etc.
 - symbols and diagrams
 - electrical
 - mechanical
 - control
 - basic applications
 - domestic
 - commercial
 - industrial

- 2. Circuit Diagrams**
 - revision of control circuits
 - block, wiring and circuit diagrams
 - power and control circuits
 - low voltage control circuits
 - control symbols
 - electrical symbols for refrigeration and air conditioning controls
 - SAA code
 - air conditioning circuit diagrams (basic)
 - read
 - interpret
 - sequence of operation
 - design

- 3. Types of Control Systems**
 - electrical
 - operating principle
 - safety
 - sensors
 - controllers - on/off, proportional, step
 - actuators - on/off, proportional
 - control system diagrams
 - servicing
 - electronic
 - operating principle
 - safety
 - sensors
 - controller
 - analog
 - digital - DDC and PLC
 - actuators - on/off, proportional
 - control system diagrams
 - servicing

- pneumatic
 - operating principle
 - safety
 - sensors
 - controller
 - on/off, proportional
 - direct and reverse acting
 - bleed and non-bleed
 - actuators - on/off, proportional
 - control system diagrams
 - servicing

- 4. **Fluid Flow Control**
 - sensors
 - actuators
 - air dampers and drives
 - liquid valves and drives
 - control system examples
 - oa/ra/ea dampers
 - face and bypass dampers
 - chilled and hot water circuits

- 5. **Energy Management Principles**
 - running costs
 - power consumption
 - county council rates
 - peak demands
 - off peak
 - capacity control
 - principles
 - advantages and disadvantages
 - economiser system
 - operation
 - advantages and disadvantages
 - night purge
 - operation
 - advantages and disadvantages
 - thermal storage
 - systems
 - operation
 - advantages and disadvantages

- 6. **Commissioning Procedures**
 - electrical
 - safety
 - start up
 - adjustments
 - electronic
 - safety
 - start up
 - adjustments
 - pneumatic
 - safety
 - start up
 - adjustments

ADDITIONAL INFORMATION: MODULE (NR15)

1. SUGGESTED TEACHING/LEARNING STRATEGIES

Integrated theory and practical lessons.

2. SUGGESTED MINIMUM RESOURCES

Typical control circuit diagrams

Typical control system diagrams

Manufacturers catalogues

Control system components

- various complete

- cut-away models

- transparencies

Control systems

Test equipment

3. SUGGESTED ON-JOB TRAINING - FOR MAXIMUM SKILL ACQUISITION

The student should be employed in an industry or section which has involvement directly with air conditioning or systems.

This is an introductory module for refrigeration mechanics and electricians.

It will lead to advanced modules in each type of control system. That is electrical, electronic - analog, electronic - DDC & PLC and pneumatic control.