

NATIONAL METAL AND ENGINEERING CURRICULUM

MODULE: FUNDAMENTALS OF AIR CONDITIONING (NR005)

PURPOSE: This module aims to provide the student with the knowledge and skills to identify, explain and apply the fundamentals of air conditioning.

NOMINAL DURATION: Half Module

This module is designed on the assumption that most of the students will achieve the competencies specified in 17½ to 20 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: Nil

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

1. Describe the scope and application of air conditioning, comfort conditions and the SAA codes applicable.
2. Apply the principles of psychrometrics to plot, and determine, the properties of air on psychrometric chart.
3. Determine estimated heat load quantities using check figures.
4. Identify and interpret the different air conditioning processes.
5. Determine the temperatures of air using a sling psychrometer.

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. Introduction to Air Conditioning
 - * Definitions
 - * Classification and application
 - * Comfort zone
 - * Basic system layout
 - * Air conditioning processes
 - * Basics of ventilation
 - * SAA codes
2. Psychrometrics
 - * Terminology/definitions
 - * Sling psychrometer
 - * Psychrometric chart

3. Heat load estimation
 - * Elements of heat load
 - * Industry check figures
 - * Calculations

* 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:

Work sheets/written short answer questions.

Performance:

- a. Define various terms and applications as applied to air conditioning.
- b. Explain the function and operation of a basic air conditioning system.
- c. Research and collate information from SAA code publications.

Learning Outcome 2

Assessment:

Integrated theory/practical exercises.

Performance:

- a. List and define the relevant terms applicable to the psychrometric chart.
- b. Plot data on a psychrometric chart, determine and record all the properties of air.

Learning Outcome 3

Assessment:

Written short answer questions/calculations.

Performance:

- a. List the various sources of heat load applicable to air conditioning.
- b. Determine heat load quantities from given data.

Learning Outcome 4

Assessment:

Worksheet/ written short answer questions.

Performance:

- a. Identify the different air conditioning processes.
- b. Explain the basic operation, advantages and disadvantages of each type.

Learning Outcome 5

Assessment: Practical exercises.

Performance: Demonstrate the practical skills required to use a sling psychrometer.

APPENDIX 1

Suggested Module Content

1. **Introduction to Air Conditioning**
 - * definitions
 - * air conditioning
 - * psychrometrics
 - * metabolic rate
 - * occupied zone
 - * standard air
 - * ventilation
 - * comfort conditions
 - * supply/return/outside air
 - * classification and application
 - * comfort air conditioning
 - * residential
 - * retail
 - * office
 - * transport
 - * industrial air conditioning
 - * process
 - * equipment
 - * product
 - * comfort zone
 - * design comfort parameters/charts
 - * effects of temperature/humidity/air movement
 - * system design considerations eg. acoustics
 - * health
 - * basic system layout
 - * components/function
 - * arrangement
 - * location
 - * operation
 - * air conditioning processes
 - * cooling and dehumidifying
 - * evaporative cooling
 - * sensible cooling
 - * sensible heating
 - * heating and humidifying
 - * chemical dehydration
 - * basics of ventilation
 - * purpose/requirements
 - * design considerations (human comfort)
 - * natural ventilation/infiltration
 - * mechanical ventilation
 - * forced
 - * induced

- * SAA codes
 - * fire precautions in buildings
 - * ventilation requirements
 - * refrigerating systems
 - * microbial control
 - * noise control

2. Psychrometrics

- * terminology definitions /S.I. units
 - * dry bulb temperature
 - * wet bulb temperature
 - * dew point temperature
 - * specific humidity
 - * relative humidity
 - * specific volume
 - * enthalpy
- * sling psychrometer
 - * purpose
 - * construction
 - * dry bulb thermometer
 - * wet bulb thermometer
 - * method of use
- * psychrometric chart
 - * purpose
 - * construction
 - * plotting
 - * properties of air
 - * worked examples

3. Heat load estimation

- * elements of heat load
 - * transmission
 - * solar
 - * people/product
 - * appliances/equipment
 - * ventilation/infiltration
- * industry check figurers
 - * watts/metre squared (floor area)
 - * aspect
 - * window size
 - * insulation
- * calculations
 - * floor area
 - * multiplying factor
 - * estimate heat loads

1. SUGGESTED TEACHING/LEARNING STRATEGIES

LEARNING OUTCOME 1

The student should be familiar with the SAA codes which are relevant to the industry. An overview, with student participation, of the sections applicable would suffice to create an awareness of the existence and importance of these codes.

A review of system componentry, introduction of the commonly used terms and an explanation of the operation of a basic air conditioning system will develop the students understanding of air conditioning.

The concept and criteria associated with the "comfort zone" can be introduced and reinforced, by student/teacher discussion and visual aids.

System applications are to be outlined along with a brief resume of processes and design criteria for each to highlight the scope of the industry. Ventilation is to be covered at a basic level to tie together code requirements, human comfort and heat loads.

LEARNING OUTCOME 2

The student should be conversant with facets of the psychrometric chart, the terms that apply and where they are represented. Demonstrate plotting of conditions and have students practice plotting, using given data, to reinforce this knowledge. To further develop the students comprehension of the chart, have them plot conditions as recorded from a system.

LEARNING OUTCOME 3

The student should be able to list, and explain the various elements that contribute to the total heat load on an air conditioning system. Observation and inspection of various buildings, and completion of a basic survey sheet would complement this learning strategy.

Students are to be provided with manufacturers/sales brochures which detail accepted heat load "check figures" and are to estimate the heat quantities for the buildings previously surveyed.

LEARNING OUTCOME 4

The student should be able to identify the main air conditioning processes, and should have the ability to explain the basic differences between them. Inspection of equipment, systems and visual aids combined with work sheet and questionnaires will reinforce these concepts.

LEARNING OUTCOME 5

The student should be able to explain the purpose of the sling psychrometer, its construction and method of use and application. Demonstrations of the handling and use of the instrument can be reinforced by student participation in practical exercises. Practical competency can be tested by having students measure, record and compare results.

2. SUGGESTED MINIMUM RESOURCES

Most of the practical aspects of this module would incorporate both demonstration and student participation. Where applicable, a maximum of two students per item of equipment is advised.

* SAA Codes

- * AS1668. part 1. 1979. Fire precautions in air conditioned buildings
- * AS1668. part 2. 1980. Ventilation requirements
- * AS1677. 1986. Refrigerating systems
- * AS3666. 1989. Microbial control; air handling and water systems of buildings

* Reference material

- * psychrometric charts
- * Manufacturers/sales brochures
- * survey forms
- * selected OHT and hand outs

* Instruments

- * sling psychrometer
- * sound meter
- * pitot tube/inclined manometer
- * anemometer
- * measuring hood

* Equipment

- * Suitable air conditioning unit, incorporating air distribution system

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

The student should be employed in an industry which has involvement with basic air conditioning systems. This module would be suitable for trades assistants, installation personnel, sales people or those seeking a prerequisite for further studies.