

NATIONAL METAL AND ENGINEERING CURRICULUM

MODULE: TRANSPORT/MARINE REFRIGERATION (NR16)

PURPOSE: This module aims to:-

1. Use previous knowledge of theoretical and practical principles of refrigeration/electrical to develop further knowledge relating to the general topic areas of transport refrigeration.
2. To introduce the student to the type of refrigeration systems used in the following methods of transport:-
Rail
Road
Air
Sea
3. Enable students to develop knowledge/skills relating to specific tasks on "specialised systems".
4. Develop student knowledge on specific storage conditions for produce and materials.

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: Installation NR11
System Control NR12
Ventilation NR13)

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.

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

1. Identify appropriate insulation materials and construction methods suitable for mobile, refrigerated storage.
2. State the preparation requirements (packaging etc) for produce and materials prior to transportations.
3. Compare the advantages/disadvantages of dedicated refrigeration modules to pre-refrigerated containers.

4. Understand the legislation/insurance and security aspects of the transportation of produce and material across state/international borders.
5. Use appropriate test equipment to check the condition/temperature of produce and materials whilst they are stored in a transportation container.
6. State the storage requirements of a variety of produce and materials during transportation.
7. List the service requirements for several different types of transportation air conditioning systems that could be found in the following:
 - Rail cars
 - Buses
 - Aeroplanes
 - Passenger boats
8. Carry out a range of service produces that would have to be carried out on one of the following types of transportation airconditioning systems.
 - Rail cars
 - Buses
 - Aeroplanes
 - Passenger boats
9. Demonstrated a competent procedure to fault find on a transportation refrigeration or airconditioning system, including diagnosis and repair.
10. Given an electrical system that operates a power source other than a state power authority ie. 12 volt d.c. on a truck, take a range of meter readings from throughout the control and power system.
11. Demonstrated a competent procedure to fault find on a transportation refrigeration or airconditioning electrical system including diagnosis and repair.
12. Demonstrated an ability to control emissions of prescribed substances into the atmosphere while undertaking any practical procedures during this module of work, especially on systems that utilise flexible connections/pipework in their pipework.

OUTLINE OF CONTENT:

This module contains:

1. Construction methods including insulation requirements for containers/modules that have to withstand the rigours of transportation.
2. Study of the various types of systems available to transport produce/materials:
 - ie. Pre-requisites modules
 - Containers with dedicated refrigeration plant
 - Large volume refrigerated storage areas.

3. The necessary requirements to prepare produce o materials for transport and their storage requirements during transport.
4. Federal and State Legislation, Insurance and Security aspects that should be considered by a service technical involved in transportation refrigeration.
5. Different types of test equipment available on the market, their suitability for various tasks and their correct method of use.
6. Procedures to be followed when carrying out tasks on various specialised refrigeration systems that are used to transport procedure/materials.
7. Procedures to be followed when carrying out tasks on various specialised airconditioning systems that would be found in various modes of transport.
8. Fault finding methods that may have to be carried out on specialised systems that utilise components not normally found on refrigeration/airconditioning systems.
9. Generated electrical power sources of various voltages from 12 V d.c. to 415 V a.c. their characteristics and how they differ from an electrical power source general by a State power authority.
10. Reinforcement of previous knowledge on the practical/theoretical components of the ozone depleting substances and the introduction new aspects as they relate to flexible connections etc. as outlined in the Automotive Industrial Code of Good Practice.

* 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, Practical Exercises

Performance:

- a) Given adequate resources the student will develop a list of insulation requirements to suit several different storage temperatures and transport modes.
- b) The student will carry out a minor repair procedure on a refrigerated container's carcass.

Learning Outcome 2

Assessment: Student Project

Performance: a) The student will present in written form the pre-transport preparation that should be carried out on several different types of foodstuffs. Stating the effects of not carrying out these preparation procedures in terms of reduced storage time.

Learning Outcome 3

Assessment: Student Project

Performance: a) Student will be split into several groups and sent out to visit companies involved in transport refrigeration. On their return they will be required to submit a report outlining the advantages/disadvantages of systems viewed.

Learning Outcome 4

Assessment: Cause Studies

Performance: a) After a visit to the College by an expert in this field ie. (Customs Department representative) the students will work through several case studies and discuss with other member of the class the possible outcomes.

Learning Outcome 5

Assessment: Short answer, Practical exercises

Performance: a) The student will select the most appropriate items of test equipment to carry out several specific tasks.
b) Given a range of "simple" tasks the student will select and use appropriate test equipment to carry out the tasks.

Learning Outcome 6

Assessment: Student Project

Performance: a) Students will be given a list of produce to be transported in a variety of manners and they will state the minimum storage requirements.

Learning Outcome 7

Assessment: Short answer, Practical exercises

- Performance:**
- a) The student will provide a series of responses to questions on several different types of air conditioning systems that could be found on the following modes of transport:
 - Rail cars
 - Buses
 - Aeroplanes
 - Passenger boats
 - b) Students will carry out preventative maintenance procedures on two different types of transport air conditioning systems.

Learning Outcome 8

Assessment: Practical exercises

- Performance:**
- a) Given a transport air conditioning system with a known faulty component the student will select an appropriate replacement and carry out the change over procedure.

Learning Outcome 9

Assessment: Short answer, Practical exercise

- Performance:**
- a) The student will identify appropriate fault finding methods for given faults and suggest the correct repair procedure.
 - b) On an actual unit the student will diagnose the fault and carry out the required repairs.

Learning Outcome 10

Assessment: Short answer, Student exercise

- Performance:**
- a) State the voltage, amperage and resistance values that would expect to be measured on a range of electrical equipment.
 - b) Using common apparatus test equipment take a number of readings from several different electrical installations.

Learning Outcome 11

Assessment: Practical exercises

- Performance:**
- a) Given several different transport refrigeration or air conditioning systems that have faults on their electrical systems the student will use the appropriate methods and test equipment to diagnose and repair them.

Learning Outcome 12

Assessment: Ongoing through whole module

- Performance:**
- Throughout the student's study in this module the student will demonstrate an awareness to limit the emissions of CFC's into the atmosphere.

APPENDIX 1.

1. CONSTRUCTION METHODS

- Insulation requirements
- Insulation materials
- Vapour barriers
- Stresses/Strain of mobile equipment
- Lightness of materials/strength
- Storage methods ie. stacking
- Provisions for service
- Channelling for air flow
- Ownership of containers

Suggested Teaching Time: 4 hours

2. TRANSPORT REFRIGERATION SYSTEMS

- Container refrigeration systems;
 - With their own units
 - Pre-chilled
 - Liquid nitrogen systems
- Marine holds
- Marine cold rooms
- Rail car refrigeration storage
- Aircraft refrigerated containers
- Refrigerated pantechnicons
- Transport storage depots

Suggested Teaching Time: 6 hours

3. PREPARATION AND STORAGE REQUIREMENTS

- Food spoilage
- Heat load calculations
- Temperature/relative humidity
- Food packing/preparation
- Controlled atmosphere gasses
- Temperature recording devices
- Effect of constant motion on produce/materials
- Air flow

Suggested Teaching Time: 4 hours

4. LEGISLATION/SECURITY/INSURANCE

- Customs and excise
- State and international borders
- Responsibility for "load"
- Freight seals
- Security of freight
- Insurance costs
- Responsibility for insurance
- Type of insurance cover;
 - Liability
 - Theft
 - Breakdown

Suggested Teaching Time: 4 hours

5. TEST EQUIPMENT

- Availability
- Usage and Care
- Calibration
- Application
- Use of information gathered
- Permanently installed/portable
- Expected results
- Methods of measurement

Suggested Teaching Time: 4 hours

6. MAINTENANCE PROCEDURES

- Refrigeration system
- Hydronic system
- Electrical system
- Control system
- Temperature/Relative humidity recorders
- Lubrication requirements
- Schedules
- Time allotted
- Evaporative cooling
- Heating

Suggested Teaching Time: 6 hours

7. FAULT FINDING

- Research technical data
- Fault finding techniques
- Historical data
- Refrigeration circuit analysis
- Electrical circuit analysis
- Expected results
- Technical manuals
- "Hands on" techniques
- Symptoms/causes
- Monitoring equipment

Suggested Teaching Time: 6 hours

8. ELECTRICAL POWER SOURCES

- Operation of generators/alternators
- Transformers
- Rectification
- Load on drive motor
- Regulators
- Fusible links
- AS 3000 considerations
- Operating parameters
- Filter circuits
- Circuit analysis

Suggested Teaching Time: 4 hours

9. OZONE DEPLETION

- This topic is a review of previous modular work and the students should demonstrate an awareness of this issue at all times.

Suggested Teaching Time: 2 hours