

NATIONAL METAL & ENGINEERING CURRICULUM

MODULE: DISTRIBUTION SYSTEMS - METERING AND LOAD CONTROL (NE044)

PURPOSE: This module aims to provide the student with the knowledge and skills in the metering and load control of an electrical distribution system.

NOMINAL DURATION: Half module

A full 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: Generation & Distribution of Electrical Energy (NE42)

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

1. Describe the need for metering systems within a distribution network and the accuracy class of the meters used.
2. Describe the basic operation of the kilowatt hour and maximum demand meters and state their respective functions.
3. Correctly connect the kilowatt hour and maximum demand meters.
4. List the applications for electronic and recording type meters within a distribution system.
5. Explain the need for and the purpose of load control within a distribution system.

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: The module contains:

1. **Metering**
- purpose
2. **Metered quantities**
- energy
- maximum demand

3. Accuracy classes for metering systems
4. Kilowatt hour meter
 - construction
 - operation
 - adjustments
 - testing
5. Demand meter
 - construction
 - operation
6. Metering circuits
 - direct metering
 - instrument transformer metering
7. Electronic metering systems
 - types
 - applications
 - connections
8. Recording meters
 - types
 - applications
 - connections
9. Load control
 - purpose
 - methods

* Details of topics available in APPENDIX 1

ON-THE-JOB-TRAINING:

For consolidation, the material in this module should be linked with and complemented by relevant on-the-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. State two reasons for the use of a metering system.
- b. State the two quantities measured for revenue purposes.
- c. State the standard unit for energy measurement.
- d. State the standard units for demand measurement.
- e. List installations where electricity consumption is measured in terms of energy.

- f. List installations where electricity consumption is measured in terms of demand.
- g. Describe the term accuracy class as applied to meters used in a distribution system.
- h. State the meaning of the term accuracy class 0.2
- i. State the meaning of the term accuracy class 0.5
- j. List examples of installations where meters of accuracy class 0.2 and 0.5 are acceptable.

Learning Outcome 2

Assessment: Short answer question
Practical exercise

- Performance:**
- a. Identify the major component parts of the kilowatt hour meter.
 - b. Describe the operation of the kilowatt hour meter.
 - c. State the adjustments available on the kilowatt hour meter.
 - d. State the function of a rotary standard.
 - e. Correctly perform standard tests on a kilowatt hour meter.
 - f. List three types of demand meter.
 - g. Identify the major component parts of a demand meter.
 - h. Describe the operation of a thermal demand meter.

Learning Outcome 3

Assessment: Short answer questions
Practical exercise

- Performance:**
- a. Correctly connect a single-phase kilowatt hour meter.
 - b. Correctly connect a polyphase kilowatt hour meter.
 - c. Correctly connect a demand meter.
 - d. State the need for current and potential transformers in distribution metering.
 - e. Correctly connect medium/low-voltage, high current energy and demand metering.
 - f. Draw the circuit diagram of high-voltage, high current energy and demand metering.

Assessment: Short answer questions
Practical exercise

- Performance:**
- a. List the electronic metering systems available for distribution systems.
 - b. Draw the connections for the measurement of energy and demand using electronic meters.
 - c. List applications for recording type meters in a distribution system.
 - d. State the advantages of recording type meters.
 - e. Draw the connections for recording type meters.

Learning Outcome 5

Assessment: Short answer questions
Practical exercise

- Performance:**
- a. State the purpose of load control in a distribution system.
 - b. List three methods of load control.
 - c. Describe the operation of three methods of load control.
 - d. Draw circuit diagrams showing how load control devices are connected into the system.

APPENDIX 1

Suggested module content:

1. **Metering**
 - purpose
 - revenue raising
 - statistical analysis

Suggested teaching time: 1 hour.

2. **Metered quantities**
 - energy
 - actual energy used
 - standard unit the kilowatt hour
 - measured using the kilowatt hour meter
 - applicable to various types of installation
 - maximum demand
 - measured in kW or kVA
 - measured with maximum demand indicator
 - applicable to very large consumers of electricity

Suggested teaching time: 2 hours.

3. **Accuracy classes for metering systems**
 - bulk supplies
 - general tariff metering

Suggested teaching time: 1 hour.

4. **Kilowatt hour meter**
 - construction
 - single-phase kWh meter
 - polyphase kWh meter
 - operation
 - single-phase kWh meter
 - polyphase kWh meter
 - adjustments
 - full load
 - light load
 - creep
 - testing
 - rotary standard
 - laboratory testing
 - field testing

Suggested teaching time: 4 hours.

5. **Demand meter**
 - construction
 - thermal maximum kVA demand meter
 - thermal maximum kW demand meter
 - electromechanical maximum kW demand meter
 - operation
 - thermal maximum kVA demand meter
 - thermal maximum kW demand meter
 - electromechanical maximum kW demand meter

Suggested teaching time: 2 hours.

- 6. Metering circuits**
- direct metering
 - single-phase kWh meter
 - polyphase kWh meter
 - maximum demand indicator
 - instrument transformer metering
 - necessity
 - current and potential transformers
 - medium/low voltage, high current energy & demand metering
 - high voltage, high current energy and demand metering

Suggested teaching time: 2 hours.

- 7. Electronic metering systems**
- types
 - applications
 - connections

Suggested teaching time: 2 hours.

- 8. Recording meters**
- types
 - applications
 - connections

Suggested teaching time: 2 hours.

- 9. Load control**
- purpose
 - methods
 - time switch
 - audio frequency load control
 - load control meter

Suggested teaching time: 4 hours.