



Course: **Certificate in Electric Motor Controls (EMC)**

Guided Learning Hours: 30

Pre-requisite: **Basic knowledge in Electricity or Electronics**

Abstract

This course attempts to present the technical subject of electric motor controls in a language as non-technical as possible. During this course, learners will understand the workings of contactors, relays, thermal overload protection devices, manual starters, magnetic starters and common controllers.

In order to ensure that the learner fully understand the concepts relating to electric motor control, the course content was structured to maximized the contact hours allocated for practical work. Currently 75% of the course involves hands on, practical training.

This unit will provide learners with the ability to design and build common starters and control panels. Learning will take place through a combination of lectures and laboratory sessions

Target Audience

Electricians, engineers, technicians and maintenance personnel.

Learning Outcomes

On completion of this course, learners will be able to:

1. Understand the basic components which comprise electric motor control.
2. Be able to design and wire basic full voltage reversing and non-reversing combination starters
3. Be able to select contactors and starters
4. Understand the basic control schematics of common reduced voltage starters.

Course Content

1. Understand the basic components which comprise electric motor control

Contactors: Types of contactors; operation of contactors; Interlocking of contactors; contactor ratings; auxiliary contacts and time delay blocks; coil voltage and frequency.

Relays: Types of relays (Latching, Reed, Mercury, solid state, protective); operation of relays; relay ratings; operation of a thermal overload relay; Wiring of an overload relay; ambient compensated thermal overload relays; definition and application of Class 10, Class 20, Class 30 overload relays.

Pilot Devices: Definition of a pilot device; types of pilot devices (pushbuttons, selector switches, pilot lights, toggle switches); Application of Pilot devices in motor control.

Timers: Design, function and operation of timers, ON delay, OFF delay

2. Be able to design and wire basic full voltage reversing and non-reversing combination starters

Design, operation and function of full voltage combination starters (FVR and FVNR); electrical and mechanical interlocking of contactors in reversing starter; Definition of the terms Jogging, Inching and Plugging; Differences between manual starters and magnetic starters.

3. Be able to select contactors and starters

IEC and Nema ratings of contactors and starters; Contactor utilization categories (AC1, AC2, AC3); Application of contactors based on categories; Contactor ratings and construction; differences between application and design standards; Overload heater tables.

4. Understand the basic control schematics of common reduced voltage starters.

Reduced Voltage Starters: Meaning of the term reduced voltage; Effect on motor starting current and torque; Open and Closed transition; Basic control schematics of common reduced voltage starters (Star/delta, Primary resistance, Autotransformer); applications of reduced voltage starters; advantages and disadvantages of reduced voltage starting.

Assessment Criteria

In order to achieve Learning Outcome...	The Learner must...
<p>1. Understand the basic components which comprise electric motor control</p>	<p>1.1 Compare various types of contactors, relays, pilot devices and timers in relation to design, operation and application</p> <p>1.2 Demonstrate how to interlock contactors mechanically and electrically.</p> <p>1.3 Explain the principle of operation of thermal overload relays</p> <p>1.4 Discuss how control transformers are designed and how they are used in control work</p>
<p>2. Be able to design and wire basic full voltage reversing and non-reversing combination starters</p>	<p>2.1 Know how full voltage non-reversing starters are constructed and applied and understand the differences between manual and magnetic starter.</p> <p>2.2 Know what is meant by combination starters and how they are applied</p> <p>2.3 Understand the use of basic sensors and pilot devices (limit switch, pressure switch, level switch, indicating light, selector switch).</p> <p>2.4 Know how reversing starters work</p> <p>2.5 Understand the terms jogging, inching, plugging.</p> <p>2.6 Be able to design and wire basic combination starters, reversing starters, and starters with jogging features.</p> <p>2.7 Know how contactors and relays are applied in simple process control. Be able to design simple control schematics and wire control panels.</p>
<p>3. Be able to select contactors and starters</p>	<p>3.1 Be able to describe the difference between application and design standards.</p> <p>3.2 Understand the difference between IEC and Nema ratings of contactors and starters.</p> <p>3.3 Understand contactor Utilization categories (AC1, AC2, and AC3) and how</p>

	<p>to apply them.</p> <p>3.4 Understand how construction of contactors varies with ratings.</p> <p>3.5 Understand thermal overload classification.</p> <p>3.6 Be able to select overload heating elements from published tables.</p>
4. Understand the basic control schematics of common reduced voltage starters.	<p>4.1 Know the meaning of reduced voltage and how it is applied in motor starting.</p> <p>4.2 Understanding the effects of reduced voltage on motor starting current, and motor starting torque.</p> <p>4.3 Understand the meaning of Closed and Open transition and the advantages and disadvantages when applied to motor starters.</p> <p>4.4 Understand the basic control schematics of common reduced voltage starters (Star/Delta, Primary resistance, Autotransformer) and use them to wire practical starters.</p> <p>4.5 Understand how to select type of reduced voltage starter for particular application.</p>

Essential Learning Resources:

Learners will need access to a wide range of publications relating to Electric Motor Control and a suitably equipped laboratory for practical training.

Textbooks and Manuals

1. Practical Aspects of Electrical Motor Controls
 - Published by Telemecanique