



# ELECTRICAL MOTOR SYSTEM MAINTENANCE & TROUBLESHOOTING

HRDF

[www.zohlgroup.com](http://www.zohlgroup.com)

**COURSE CODE:** H-EE-02

**LEVEL:** Basic to Intermediate

**LANGUAGE:** Bahasa & English

## OVERVIEW

It is estimated that electrical drives and other rotating equipment consume about 50% of the total electrical energy consumed in the world today (and this figure increases to 70% if you only consider industry.) The cost of maintaining electrical motors can be a significant amount in the budget item of manufacturing and mining industries. This course gives you a thorough understanding of electrical motor's protection, control and maintenance and gives you the tools to maintain and troubleshoot electrical motors. You will gain a fundamental understanding of the protection, control and maintenance of electric motors and drives. Typical applications of electric motors in manufacturing, materials handling, process control are covered in detail. The concluding section of the course gives you the fundamental tools in troubleshooting motors confidently and effectively.

## OBJECTIVES & LEARNING OUTCOMES

Upon successful completion of this course, the delegates will be able to:

- Apply and gain an in-depth knowledge on electric motor maintenance and troubleshooting
- Specify protection requirements for motors and maintain electrical motors
- Identify the speed control requirements for motors and discuss the essentials of motors and drives
- Enumerate the main issues with testing of motors to prevent motor bearing failure
- Troubleshoot and fix faults on motors and drives
- Discuss interface control circuits of motors with PLC's/DCS's
- Reduce downtime on electrical motors and improve plant safety
- Develop plant throughput and reduce spares usage and requirements

## COURSE DURATION

2 days (9am—5pm)

Tea Breaks: 10:30am & 3:30pm

Lunch: 1:00pm-2:00pm

**Note:** Please contact our office for Training Date or visit our website for details ([www.zohlgroup.com](http://www.zohlgroup.com))

## METHODOLOGY

This program will be conducted with:

- Interactive Lecturers
- PowerPoint presentation
- Discussions | Practical Exercise
- Role Play | Case Study

## TARGET AUDIENCE

This course is valuable for those associated with the use of electrical motors in the industrial or automation environment. This course will also benefit those working in system design as well as site commissioning, maintenance and troubleshooting.

## LOCATION

Mindset Discovery Center™@ZOHL, M2-6-08, Level 6, 8trium Tower 2, Bandar Sri Damansara, Kuala Lumpur (other Regions please contact our office)

## COURSE CONTENT

### Introduction, Overview & Discussion of Objectives

#### Fundamentals of Motor Technology and Construction

- Basic Principles of Rotating Electric Machines
- Fundamental Principles of Speed Control
- Efficiency, Torque, Inertia, Horsepower/Power Factor
- Torque-Speed Curves
- Induction/Synchronous/Wound Rotor Types
- Basic Construction and Physical Configuration, Windings
- Principles of Operation and Performance

#### Three Phase AC Induction Motors

- Components | Theory of Operation
- Induction Motor Design | Duty Cycles
- Insulation and Cooling Requirements
- Starting Methods | Selecting motors
- Types of Faults, Fault Finding and Testing of AC Machines
- Testing Instrumentation

#### Energy Losses and Efficiency of Three Phase AC Induction Motors

- Standards
- Types of Losses | Tests for Measurement and Computation of Losses and Efficiency
- Dynamometers | Principles of Load Application By Braking
- Torque Measurement Basics
- Types of Practical Dynamometers

#### Motor Failure Analysis

- Frequent Starts | High Inertia | Inadequate Cooling
- Congestion on Fan Cover
- Improper Spacing at End of Motor
- Incorrect Belt Alignment | Solid Belt Guards
- Excessive Loading Causing Bearing Clearance Problems
- Insulation Failures | Bearing Current Problems

#### Testing

- Insulation Life and Resistance | Polarization Index
- DC Hipot | DC Ramp Test | AC Hipot
- Capacitance Test | Dissipation Factor | Partial Discharge
- Surge Test | Mechanical Testing | Online Testing

#### Bearing Failure Analysis

- Bearing Failures | Grease and Greasing | Belt Drive Aspects
- Balance | Storage Issues | Service Factor Loading
- Thermal Overload | Time Constraints
- Early Relays and New Digital Relays
- Starting and Stalling Conditions
- Over Current / Overload | Under-Voltage / Over-Voltage

#### Protection of Motors

- Under Frequency | Pole Slip / Out of Step | Loss of Excitation
- Inadvertent Energization | Over Fluxing
- Stall Protection / Acceleration Time / Start Up Supervision / Time Between Starts | Unbalanced Supply Voltages
- Negative Sequence Currents | De-Rating Factors
- Earth Faults – Core Balance, Residual Stabilizing Resistors
- Calculation of Protective Relay Settings

**Continue next page.....**

*Note:* Course Content subject to further review

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CALL US FOR DETAILS or VISIT OUR WEBSITE AT [WWW.ZOHLGROUP.COM](http://WWW.ZOHLGROUP.COM)



Sebarang pertanyaan sila hubungi Cik Niesa

ZOHL Consultancy Sdn Bhd (332967-D)(SST ID:W10-1810-32000429)

M2-15-02, Level 15, 8trium Tower 2, Jalan Cempaka SD 12/5

Bandar Sri Damansara, 52200 Kuala Lumpur

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# ELECTRICAL MOTOR SYSTEM MAINTENANCE & TROUBLESHOOTING

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## Motor Control

- Power Circuit | Control Circuit | Full Online Voltage Starting
- Reduced Voltage Starting: Delta-Star, Resistance, Reactor, Autotransformer, Soft Start
- Braking | Speed Control | Reversing

## Control System for AC Variable Speed Drives

- Overall Control System | Power Supply for the Control System
- Dc Bus Charging System | Vector Control
- VSD Control Loops (Open Loop/Closed Loop)
- Current Feedback in Ac Variable Speed Drives
- Speed Feedback from Motor

## Installation And Fault Finding

- General Installation and Environmental Requirements
- Power Supply Connections and Earthing
- Where to Install Contactors in Power Circuit
- Installation of Ac Converters into Metal Enclosures

## COURSE FEE

**RM1,272.00** per person incl. 6% SST  
(Fee inclusive of Course Material, Attendance Certificate, and Meals)

## CERTIFICATE

Participants will be issued a Certificate of Attendance/Accomplishment upon successful completion of this training program. Full attendance is a pre-requisite.

## HRDF SBL KHAS

Claimable under HRDF SBL KHAS Scheme (for Companies contributing to HRDF)

## REGISTRATION METHOD

1. **Online:** [http://zohlgroup.com/hrdf\\_registration/](http://zohlgroup.com/hrdf_registration/) **OR**
2. Download this brochure at: <http://zohlgroup.com/all-brochures/> and fill up the required information. Then please fax to: 03.6279.0663
3. Or contact our office at: 03.6279 9276 / 013.398.1038

## FACILITATOR

**Sathy Vel Naidu** - Sathy has more than 25 years of experience in the Mechanical and Electrical (M&E) industry. Over the span of his career he has gained significant knowledge in project management, electrical systems troubleshooting & maintenance, and systems design & engineering. In addition to managing projects he has also started sharing his knowledge through training services under ZOHL Technical Programs.

### Education:

- ◇ Electrical Chergeman License
- ◇ Certificate in Westinghouse Electrical Systems
- ◇ Power Systems Auditor for Procter & Gamble
- ◇ Radiation Safety Training for Honeywell TDC 3000

### Experience:

- ◇ Electrical Technician for Hitachi Electronics Devices Singapore
- ◇ Testing & commissioning supervisor for Toyo Engineering
- ◇ Asst Engineer for FPG Oleochemicals Sdn Bhd
- ◇ Maintenance Manager FPG Oleochemicals sdn Bhd
- ◇ Engineering Director at Pakat Perkasa Sdn Bhd
- ◇ Lightning & Earthing Protection Systems Trainer for Celcom
- ◇ Electrical Trainer for Leighton Offshore
- ◇ Technical Trainer @ZOHL

\*Note: Trainer availability is subject to change

## REGISTRATION FORM

Participant#1: \_\_\_\_\_

Position: \_\_\_\_\_

IC No: \_\_\_\_\_

Participant#2: \_\_\_\_\_

Position: \_\_\_\_\_

IC No: \_\_\_\_\_

Training Date: \_\_\_\_\_

Training Venue: \_\_\_\_\_

Organization: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Contact Person: \_\_\_\_\_

Position: \_\_\_\_\_

Tel: \_\_\_\_\_

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

Company Website: \_\_\_\_\_

## PAYMENT

CASH: RM \_\_\_\_\_ OR

CHEQUE No: \_\_\_\_\_

Please fax your bank-in slip to 03.6279.0663 or scan your bank-in slip and email to [plbk@zohlgroup.com](mailto:plbk@zohlgroup.com)

\*Please make your cheque payable to:

**ZOHL Consultancy Sdn Bhd**



Account No:  
**514392303373**

Signature & Company Stamp

### Note:

- Date & venue of seminar subject to changes
- Payment must be made 7 days before the training date
- Registration cancelled 7 days prior to the event is subject to RM100 service charge per participant
- No refunds for notice received less than 7 days prior to the event. A substitution may be made at any time at no extra charge.
- Program content may change subject to revision by our consultants from time to time.
- Full fee is required with your registration. 5% Group discount is available - min 3 pax.

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