H&MV ENGINEERING
City & Guilds Accredited High Voltage Switching and Operations Course
Course Description and Summary

City & Guilds Accredited

H&MV ENGINEERING

Engineers Ireland cpd REGISTERED TRAINING PROVIDER 2016

1. Why the Need for High Voltage Switching & Operations Training

High Voltage Systems comprise of a significant and critical element of the overall electrical system worldwide. These high voltage systems are usually the interface between the HV Grid Supply and the Step-down or Step-up voltage systems between the demand or generator power systems and the grid owner. As a result this is an area of electrical engineering which requires specific knowledge, expertise and competency in which to operate in a safe and competent manner. Many people are required to deal with this high voltage element of their electrical systems, sometimes not often due to the fact that switching, operations and configuration changes of these systems may be infrequent. In many instances those responsible for these installations are unaware of the risk and implications particularly in the areas of Safety, Maintenance and Continuity of Supply of having such equipment located on their sites. H&MV Engineering have recognised that a significant gap exists in this specialist area of High Voltage Switching & Operations and the risk associated with it. We have put significant resources, experience and development into this course to address that shortfall. This course is designed to provide an awareness of the risks associated with these systems and the methods used to control and minimise them. This course is City & Guilds Accredited and is the first of its type for Ireland.

2. Training Philosophy and Course Content

The course itself is broadly divided into classroom and practical sessions on an equal basis. The intention is to introduce the various concepts in the classroom environment and then implement them through practical activities. The classroom sessions will also accommodate discussion on the topics being introduced as well as interaction with the trainees. The following subject areas are covered in detail in the classroom sessions:

1. Principles of Electrical Safety
2. Lock-Out & Tag-Out (LOTO) & Testing of Isolations
3. Electrical Drawings and Switching Plans
4. Electrical Safety Legislation and Standards
5. Principles of Arc-Flash and Arc-Blast
6. Personal Protective Equipment (PPE) and High Voltage Test Equipment
7. High Voltage Switchgear and Transformers
8. General Electrical Theory and Concepts
9. Electrical Circuits and Protection
10. Principles of Risk Assessment

The Module 'General Electrical Theory and Concepts' serves to give all participants an electrical basis for the concepts being presented.

3. Course Delivery

The course presentation format is both theoretical and practical. Continuous assessment will be applied throughout the duration of the course and a theory and practical exam will be required to be passed on the final day. The theoretical elements will be delivered by means of a series of modules. These modules will, in general, be presented in the form of slides and case studies. Each module will contain an Examination Questionnaire which must be completed at the end of the presentation session. The marks obtained in these assessments will be taken into account in the overall marking of the course. The practical activities will take place in a specially designed High Voltage training center and students will be involved in carrying out particular operations on actual equipment.

Contact Niamh at **hvtraining@hmveng.ie** if you would like a schedule of course dates or a quotation.

4. Participant Profile

This course is designed to be suitable for varied groups including:

- Facilities and Maintenance Managers
- Facility Engineers and Technicians
- High Voltage System Operators
- Plant Electricians
- Maintenance Technicians

It is recommended that candidates have 4 years of electrical experience.

5. Course Duration

The course is run over five (5) days. In general, the theoretical elements will be presented during the morning sessions and the practical elements will take place each afternoon.

In order to cater for improvements in technology and changes in legislation, a two (2) day Refresher Course is offered. It is recommended that this refresher training should be carried out within three (3) years of completing the course.

6. Award Achieved

Successful candidates will receive a City & Guilds Accredited Certificate in High Voltage Switching & Operations.

7. Summary

The purpose of this course is to equip personnel working, or associated with, High Voltage Systems, with the knowledge they require to carry out their functions in a safe and competent manner. The course is applicable to both those carrying out High Voltage Operations, be that Switching, Installation or Maintenance Works, and persons who deal with these systems from a Managerial or Supervisory perspective.

The course offers a structured approach to High Voltage training, in that all relevant aspects of the subject area are addressed in detail and followed by Practical Exercises. It will provide participants with a solid foundation in both the theoretical and practical aspects of the operation of High Voltage Systems and Equipment.

Module 1 – Principles of Electrical Safety

OBJECTIVE

The Objective of this module is to introduce the 'Electrical Hazard' to the students. The mechanism of electric shock is described, as are the effects on the human body. Accident statistics are introduced and data is presented, with an emphasis on High Voltage incidents. Safe Work Practices and Protection Methods are described in detail.

RESULT / OUTCOME

On completion of this module, students will be aware of how a person can receive an Electric Shock and what type of injuries can occur. In addition, they will understand the relevance of Accident Statistics. Students will also be made aware of the various Safe Work Practices and Protection Methods that are employed to minimise the risk involved with HV operations.

Module 2 – Lock-Out / Tag-Out (LOTO) & Testing of Isolations

OBJECTIVE

The Objective of this module is to introduce the topic of proper, definitive and safe Isolation Techniques to the students. The basis of LOTO systems are outlined, including the requirement to test isolations in a correct manner.

RESULT / OUTCOME

On completion of this Module, students will have a knowledge of the importance of correct and comprehensive Isolation Systems, testing of isolations and making HV Systems safe for work.

Module 3 – Electrical Drawings and Switching Plans

OBJECTIVE

The objective of this module is to introduce students to the subject of Electrical Drawings, with particular emphasis being placed on Single Line (one Line) Diagrams. Various types of drawings, including Block Wiring Diagrams and Schematic Drawings are introduced and explained. The symbology associated with Electrical Drawings is also presented. The concept of switching plans, which are closely related to Single Line Drawings, are also introduced.

RESULT / OUTCOME

On completion of this module, students will be in a position to interpret Single Line Diagrams and compile Switching Plans for High Voltage Switching Operations.

Module 4 – Electrical Safety Legislation & Standards

OBJECTIVE

The objective of this Module is to provide the students with an overall appreciation for the legislation relevant to Electrical Work, with the emphasis being placed on High Voltage Work. The module also introduces the concept of competency and the 'Authorised Person'. Both the Safety, Health and Welfare at Work Act and the associated General Application Regulations will be presented.

RESULT / OUTCOME

On completion of this Module, Students will have a firm understanding of the Safety and Health Legislation pertinent to High Voltage Electrical Work. The Participants will also have an appreciation for the Guidelines associated with the Legislation.

Module 5 – Principles of Arc-Flash and Arc-Blast

OBJECTIVE

The objective of this module is to introduce the concepts of Electrical Arc-Flash and Arc- Blast. This is a phenomenon which has potentially extreme effects on both people

and equipment, particularly in the case of High Voltage Systems. This module will outline the mechanisms and hazards related to Arc-Flash and explain the data generated during a study. The data contained on Arc-Flash Warning labels will also be addressed.

RESULT / OUTCOME
On completion of this module, students will have a greater understanding of the concept of Arc-Flash and it's potential effects on both Equipment and Personnel. They will achieve a better understanding of the Risks involved and the mechanisms available to deal with these Risks.

Module 6 – Personal Protective Equipment (PPE) and Test Equipment

OBJECTIVE
The Objective of this module is to describe to the class the requirements of Personal Protective Equipment (PPE), taking account of 'Cal' Ratings in relation to Arc-Flash and Arc- Blast. The importance of care and testing of PPE is also presented. Examples of test equipment, in particular test equipment used on High Voltage Equipment, are presented.

RESULT / OUTCOME
On completion of this module, students will have an appreciation for the type of PPE required when working on High Voltage Equipment. Maintenance and Testing of PPE is also covered as part of this module. High Voltage Test Equipment, and it's correct use, is also introduced. Students will have a working knowledge of all of these topics on completion of the module.

Module 7 – High Voltage Switchgear and Transformers

OBJECTIVE
The objective of this module is to introduce the building blocks of High Voltage Systems, i.e. Switchgear, Transformers, Ring Main Units, etc. The various Distribution Systems are outlined and examples are presented. The principle of operation of a transformer is explained and both Oil-Filled and Cast Resin Transformers are covered in detail. Nameplate data is explained and the issue of Transformer Inrush Current is addressed.

RESULT / OUTCOME
On completion of this module, students will have a good understanding of the operation and configurations of High Voltage System components. They will also understand the meaning of the parameters given on Transformer Nameplates. They will

have an appreciation for Transformer Maintenance as well as the phenomenon of 'Inrush'.

Module 8 – General Electrical Theory & Concepts

OBJECTIVE

The objective of this module is to provide revision of the main concepts of Electrical Engineering for the students. The module covers all aspects of Electrical Theory which affect Power Systems and Equipment, with an emphasis on High Voltage Systems.

RESULT / OUTCOME

On completion of this module, students will have a knowledge of the main elements of Electrical Engineering, particularly those applicable to High Voltage Equipment and Installations.

Module 9 – Electrical Circuits and Protection

OBJECTIVE

The objective of this module is to outline the various Fault Mechanisms in Electrical Systems and the methods and equipment used to detect them. The module introduces the protection of both Personnel and Equipment from Electrical Faults. Particular emphasis is placed on Protection of Personnel from Electrical Faults, in particular Earth Faults.

RESULT / OUTCOME

On completion of this module, students will have a knowledge of High Voltage Protection Devices as well as the concept of Protective Earthing Systems.

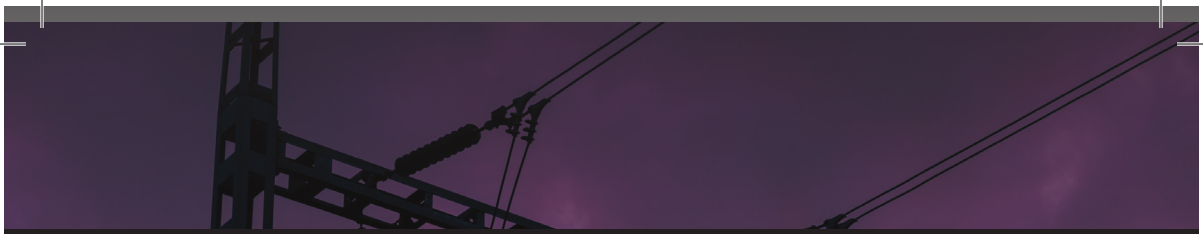
Module 10 – Principles of Risk Assessment

OBJECTIVE

The objective of this module is to illustrate the concept of Risk Assessment and how it is employed in High Voltage Operations. The module outlines the hazards and risks associated with HV work and presents templates of documentation used in the process of generating Risk Assessments. Also presented is a practical quantitative methodology which allows a risk matrix to be developed by numerical means. The matrix can then be used to determine the necessary control measures.

RESULT / OUTCOME

On completion of this module, students will have the requisite knowledge to enable them to evaluate the risks and hazards associated with High Voltage Tasks and to carry out a risk assessment based on their observations. They will also be able to determine the control measure.



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Contact hvtraining@hmveng.ie for more information
Offices in Ireland, UK, Netherlands, Sweden and Norway