



National Unit Specification: general information

UNIT Installation of Cable Tray and MI Systems (SCQF level 6)

CODE F5FW 12

SUMMARY

This Unit is intended for candidates with little or no prior knowledge of cable tray and mineral insulated (MI) cable systems but who wish to gain an understanding of them and develop their skills in the fabrication and installation of such systems.

The aim of this Unit is to develop candidate's knowledge and understanding of cable tray systems as a means of providing a route for electrical wiring, and to develop also their fabrication and assembly skills. The Unit will develop the candidate's skills and techniques in the installation of Mineral Insulated (MI) cables and the requirements of the Wiring Regulations BS7671 in relation to cable tray and MI systems. It will also give candidates an understanding of circuit and wiring diagrams and develop their ability to wire circuits using MI cables. Candidates will also be introduced to circuit testing and be provided with opportunities to carry out basic circuit testing procedures.

This Unit may form part of a National Qualification Group Award or may be offered on a free-standing basis.

OUTCOMES

- 1 Interpret the requirements of the Wiring Regulations BS7671 for cable tray and MI wiring systems and state advantages and limitations of cable tray and MI Wiring Systems.
- 2 Demonstrate the skills and techniques used in the fabrication, assembly and installation of cable tray systems.
- 3 Demonstrate the skills and techniques used in the installation of MI cables.
- 4 Interpret wiring requirements from circuit diagrams.
- 5 Demonstrate the skills and techniques used when installing, inspecting and testing MI wiring mounted on a cable tray system.

Administrative Information

Superclass: XJ

Publication date: March 2009

Source: Scottish Qualifications Authority

Version: 01

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ Standard Grade Mathematics — Credit Level
- ◆ Standard Grade Technological Studies — Credit Level
- ◆ Standard Grade Physics — Credit Level
- ◆ NQ Unit *Installation of Cable Tray and MI Systems* at SCQF level 5
- ◆ NQ Unit *Inspection and Testing of Electrical Installations* at SCQF level 5

CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Problem Solving (SCQF level 6)
- ◆ Numeracy (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Installation of Cable Tray and MI Systems (SCQF level 6)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Interpret the requirements of the Wiring Regulations BS7671 for cable tray systems and MI wiring systems and state the advantages and limitations of cable tray and MI wiring systems.

Performance Criteria

- (a) Identify and interpret correctly the BS7671 requirements for cable tray systems.
- (b) Identify and interpret correctly the BS7671 requirements for mineral insulated wiring.
- (c) State correctly the advantages and limitations of cable tray and MI wiring systems.

OUTCOME 2

Demonstrate the skills and techniques used in the fabrication, assembly and installation of cable tray systems.

Performance Criteria

- (a) Measure and cut cable tray to given dimensions.
- (b) Form a 90° flat bend and a 90° internal radius bend, and a 45° set in cable tray to given dimensions.
- (c) Demonstrate the assembly and installation of cable tray sections to given specification requirements and dimensions.

OUTCOME 3

Demonstrate the skills and techniques used in the installation of MI cables.

Performance Criteria

- (a) Identify correctly mineral insulated cables of various sizes and numbers of core.
- (b) Measure and cut MI cable to given dimensions.
- (c) Form a 90° bend and a 45° set in MI cable to given dimensions.
- (d) Complete correctly the sealing of an end of MI cable using a pot and gland assembly.
- (f) Test correctly the sealed ends of an MI cable to ensure its integrity.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Interpret wiring requirements from circuit diagrams.

Performance Criteria

- (a) Identify correctly the circuit diagrams for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point.
- (b) Describe accurately the operation of the circuits for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point.
- (c) Draw correctly from given circuit diagrams, the wiring diagrams for both a two-way, and a two-way and intermediate switching arrangement, each controlling two lighting points.
- (d) State correctly the number and cross sectional area of MI cable cores in both lighting circuits to comply with the requirements of BS7671.
- (e) State clearly how the colour coding of MI cores is achieved to comply with the requirements of BS7671.

OUTCOME 5

Demonstrate the skills and techniques used when installing, inspecting and testing MI wiring mounted on a cable tray system.

Performance Criteria

- (a) Install and terminate the wiring for two lighting circuits, each having two outlet points with one circuit controlled by a two-way switching arrangement, and the other by a two-way and intermediate switching arrangement, both using MI cable mounted on a cable tray system complying with the requirements of BS7671.
- (b) Carry out the inspection of both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit using MI cables mounted on a cable tray system, in accordance with the requirements of BS7671.
- (c) Carry out the appropriate testing of both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit using MI cables mounted on a cable tray system, in accordance with the requirements of BS7671.
- (d) Carry out the functional testing of both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit using MI cables mounted on a cable tray system, correctly.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Performance evidence supplemented with an assessor observation checklist and written and/or recorded oral evidence should be produced to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria. The evidence should be produced under supervised, controlled conditions in a practical environment throughout the duration of the Unit.

Candidates should be permitted to use the Wiring Regulations BS7671 as a reference document throughout the assessment.

An appropriate form of assessment could be a single, holistic practical assignment which incorporates all the Outcomes and Performance Criteria.

Candidates should be presented with a 'specification' giving the installation requirements and circuit diagrams for a mineral insulated wiring system mounted on a cable tray arrangement.

The wiring must provide for the supply and control of electrical energy to:

- ◆ a lighting circuit having two outlet points controlled by a two-way switching arrangement
- ◆ a lighting circuit having two outlet points controlled by a two-way and intermediate switching arrangement

The cable tray system should be mounted on pre-formed brackets and contain:

- ◆ one 90° flat bend
- ◆ one 90° internal radius bend
- ◆ one set

The wiring system should be connected to the energy supply through a consumer's Unit having appropriate circuit protection.

From the information contained in the 'specification' the candidate should produce a wiring system for in order to:

- ◆ demonstrate the techniques of measuring, cutting, bending (90° flat and internal radius), setting and joining cable tray to given dimensions
- ◆ demonstrate the assembly and installation of the cable tray system to given specification requirements and dimensions
- ◆ demonstrate the techniques of measuring, cutting, bending (90°), setting and sealing (pot and gland) MI cable ends to given dimensions
- ◆ identify correctly the circuit diagrams for both a two-way controlled lighting outlet point and a two-way and intermediate controlled lighting outlet point
- ◆ draw correctly from given circuit diagrams, the wiring diagrams of both the two-way and the two-way and intermediate switching arrangements each controlling two lighting points

National Unit Specification: statement of standards (cont)

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- ◆ determine correctly the number, cross sectional area and colour coding of cores in the MI cables for the two-way, and the two-way and intermediate lighting circuits, to comply with the requirements of BS7671
- ◆ install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way switching arrangement, using MI cable mounted on a cable tray system to comply with the requirements of BS7671
- ◆ Install and terminate the wiring for a lighting circuit having two outlet points controlled by a two-way and intermediate switching arrangement, using MI cable mounted on a cable tray system to comply with the requirements of BS7671
- ◆ inspect both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit mounted on cable tray, in accordance with the requirements of BS7671
- ◆ test both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit mounted on cable tray, in accordance with the requirements of BS7671
- ◆ carry out the functional testing of both the two-way controlled lighting circuit and the two-way and intermediate controlled lighting circuit mounted on cable tray to ensure they operate correctly

In addition to the production of the wiring systems as specified above, the candidates should also provide written and/or recorded oral evidence taken at a single assessment event lasting no more than 45 minutes, under controlled, supervised conditions which demonstrates an ability to:

- ◆ identify three types of MI cable including the size and number of cores
- ◆ state three advantages and three limitations of cable tray and MI wiring systems
- ◆ identifies four BS7671 requirements for cable tray systems and MI wiring
- ◆ interprets four BS7671 requirements for cable tray systems and MI wiring
- ◆ describes the operation of two-way and two-way and intermediate controlled lighting circuits

(Candidates should have access to the BS7671 Wiring Regulations publication during this assessment event).

National Unit Specification: support notes

UNIT Installation of Cable Tray and MI Systems (SCQF level 6)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This is an optional Unit within the National Qualification Group Award in Electrical Engineering at SCQF level 6 but may be offered on a free-standing basis.

The aim of this Unit is to develop candidate's knowledge and understanding of cable tray systems as a means of providing a route for electrical wiring and to develop also their fabrication and assembly skills. The Unit will develop the candidate's skills and techniques in the installation of Mineral Insulated (MI) cables and the requirements of the Wiring Regulations BS 7671 in relation to cable tray and MI systems.

It will also give candidates an understanding of circuit and wiring diagrams and develop their ability to wire circuits using MI cables. Candidates will also be introduced to circuit testing and be provided with opportunities to carry out basic circuit testing procedures.

The tutor **MUST** ensure that the candidate works safely at all times and that the wiring arrangements have been tested and are correct, prior to the circuits being energised.

This Unit has links with the technology Units in the National Qualification in the Electrical Engineering award and may be delivered as part of the suite of 'Wiring System' Units.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This Unit should be delivered in a practical environment and should encourage candidates to become familiar with the terminology of cable tray and MI systems, wiring techniques and testing procedures.

Opportunities should be provided to allow candidates to develop their practical skills in the fabrication and installation of cable tray systems and of MI installation techniques.

This practical approach should be continued to allow candidates to develop their interpretation of wiring and circuit diagrams and their ability to work between these. Basic installation testing procedures should also be carried out by candidates undertaking this Unit.

The requirements of the relevant Wiring Regulations BS7671 should be taught in conjunction with the development of the candidate's skills and understanding of cable tray and MI systems.

Candidates should be able to identify the hand tools used in the fabrication of cable tray and the specialist tools used in the installation of MI wiring systems and should be taught the correct use of hand tools in this context. They should also be familiar with testing instruments and their uses.

National Unit Specification: support notes (cont)

UNIT Installation of Cable Tray and MI Systems (SCQF level 6)

It is important that this Unit is delivered in a practical manner which develops the candidate's skills and understanding of tray and MI systems, circuit and wiring diagrams and inspection and testing procedures along with the appropriate requirements of BS7671.

The Outcomes should be delivered in the sequence given in the 'statement of standards'. The practical aspects of these Outcomes should be demonstrated to candidates with the reasons for particular techniques being fully explained. Candidates should then be given opportunities to practice these techniques.

Tutors **MUST** always ensure that candidates work in a safe manner and the Health and Safety workshop procedures of the centre should be continually emphasized and implemented.

Tutors MUST also satisfy themselves that ALL circuit wiring produced by candidates has been inspected and tested in accordance with the requirements of BS7671 and that NO circuit is connected to the supply voltage until these requirements have been fully met.

It is recommended that the supply voltage used to energise candidate circuits is of a suitable safe value.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

All elements of the Core Skill of *Problem Solving* will be naturally developed in this Unit, which requires the application of knowledge and understanding to a series of practical tasks. An installation specification is translated by candidates into a practical wiring system which is then assembled and fixed in the required position. Interpretation of requirements and consideration of a range of issues, including safety regulations, will underpin planning decisions on the use of tools and techniques. Inspection and testing includes analytical evaluation of decisions made during the practical work.

Candidates have to be able to work confidently with complex numerical and graphic concepts in order to interpret, calculate and apply relevant data. The emphasis of formative activities should be on numeracy as a tool used efficiently and critically in electrical engineering contexts.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

National Unit Specification: support notes (cont)

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The assessment of this Unit could take the form of a 'Practical Assignment' which extends over the duration of the Unit.

This assignment could contain the five elements specified in the Unit Outcomes ie:

- ◆ interpreting the requirements of the Wiring Regulations BS7671 for cable tray systems and MI wiring
- ◆ demonstrating the skills and techniques used in the fabrication, assembly and installation of cable tray systems
- ◆ demonstrating the skills and techniques used in the installation of MI cables
- ◆ interpreting wiring requirements from circuit diagrams
- ◆ installing, inspecting and testing circuit wiring

These five elements could be integrated into one practical assignment with the achievements of each element being clearly recorded for each candidate.

The practical assignment could be conducted in a workshop environment under supervised and controlled conditions.

The written and/or recorded oral evidence could be gathered by means of a short-answer and/or multi-choice question paper conducted under controlled, supervised conditions.

Candidates should be allowed access to the Wiring Regulations BS7671 for reference purposes.

The Health and Safety of candidates must be paramount at all times and the lecturer must be responsible for ensuring that all wiring carried out for assessment purposes is of a sufficiently high standard that it meets all the necessary BS7671 requirements prior to connection of the supply voltage.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).