T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Building Services Engineering for Construction

Electrotechnical Engineering

Guide standard exemplification material

Threshold competence – Sample 2021

City & Guilds | eal

Version and date	Change detail	Section
June 2021 v1.0	Initial document.	All.
July 2021 v1.1	Transfer of existing content into updated document template.	All.

Contents

Introduction

The sample assessment materials within this document refers to the electrotechnical engineering sample occupational specialism assignment. The aim of these materials is to provide centres with examples of knowledge, skills and understanding that attests to minimal threshold competence. In this document all exemplar evidence attests as examples of minimal threshold competence. The examples provided do not reflect all evidence from the sample assignment as the focus of this material is the quality and standards that need to be achieved rather than the volume of exemplar evidence provided. However, the examples provided are representative of all tasks in the sample assignment. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and standard of performance will vary across tasks. Minimal threshold competence will be based on a synoptic mark across all tasks.

The materials in this GSEM are separated into three sections as described below. Materials are presented against a number of tasks from the assignment.

Task

This section details the tasks that the candidate has been asked to carry out. What needs to be submitted for marking and any additional evidence required including any photograph/video evidence. Also referenced in this section are the assessment themes the candidates will be marked against when completing the tasks within it. In addition, candidate evidence that has been included or not been included in this GSEM has been identified within this section.

In this GSEM there is candidate evidence from:

Task 1
Task 2
Task 3

Candidate evidence

This section includes exemplars of candidates work, photographs of the work in production (or completed) and practical observation records of the assessment completed by centre assessors. This will be exemplar evidence that was captured as part of the assessment and then internally marked by the centre assessor.

Commentary

This section includes detailed comments to demonstrate how the candidate evidence attests to the standard of minimal threshold competence by directly correlating to the grade descriptors for this occupational area. Centres can compare the evidence against the performance indicators in the marking grid descriptors within the assessor packs, to provide guidance on the standard of knowledge, skills and understanding that need to be met for minimal threshold competence.

It is important to note that the commentary section is not part of the evidence or assessment but are evaluative statements on how and why that piece of evidence meets a particular standard.

Grade descriptors

To achieve a pass (threshold competence), a candidate will be able to:

Demonstrate an acceptable performance that meets the requirement of the brief and that is required to enter the industry to begin to work in the occupational area.

Demonstrate the adequate technical skills for installing components that is in line with industry standards.

Interpret information, demonstrate planning, assess risk and follow safe working methods when applying practical skills to an acceptable standard as recognised by industry.

Demonstrate basic knowledge and understanding of the principles and processes required for Electrotechnical Engineering.

Work safely showing an understanding in the selection and use of tools and equipment and demonstrate a basic awareness of straightforward preparation and application processes.

Attempt some complex tasks and the level of performance mostly meets an acceptable level.

Identify causes of faults and have some knowledge and skills in how to locate and rectify them.

Uses industry terminology most of the time that is accurate in both written and verbal contexts.

Task 1 – Planning the installation

(Assessment themes: Health and safety, design and planning, reporting and information)

For task 1 candidates need to produce the following pieces of evidence:

- Completed assessment of general characteristics form
- Completed lighting design schedule
- Completed materials take-off sheet
- Completed design grid

For illustration, the guided exemplification materials (GSEM) for Task 1 contain examples of candidate evidence for the following assessment requirements only:

- Completed assessment of general characteristics form
- Completed lighting design schedule
- Completed materials take-off sheet
- Completed design grid

Candidate evidence

Completed assessment of general characteristics form

Chapter/regulation from BS 7671	What needs assessing specific to this installation	How this impact the installation
Chapter 31	Purpose of the installation	Is it suitable for the intended use
311.1	Maximum demand and diversity	Maximum demand and diversity and volt drop need checking
312.3	Earthing system	The earthing system needs assessed to ensure that it is suitable for the installation.
313.1	Supplies	The following need to be determined by calculation, measurement, enquiry, or inspection • Nominal voltage (s) • Current and frequency • PSCC at origin • Loop test at origin • Suitability for the requirements of the installation and maximum demand
314.1	Has the circuits been divided to provide for	• Inconvenience in case of a fault • Take into of hazards from failure of a single circuit. • Reduce unwanted tripping of RCD's due to high earth leakage, use RCBO on circuits or increasing the number of circuits.
Chapter 32 Appendix 5	Classification of external influences	Has the external influences: Environment, • Correct IP codes used. • Corrosion Utilisation, Has thought been given to those who may use the building: • BA1 Ordinary persons • BA3 handicapped. Buildings for buildings CA
		Need to ensure that equipment in the installation will not have harmful effects:

Chapter 33	Compatibility of characteristics	• Earth leakage current from equipment not being electrically tested may operate RCD's.
Chapter 34	Maintenance	To ensure the installation remains safe.
Chapter 35	Safety services	Has the designer considered the safety services of the following? • Emergency lighting • Fire detection
Chapter 36	Assessment of continuity of service	Any alterations of circuits need to be checked to ensure that: • The earthing system is safe. • Selection of devices to ensure selectivity, protective device closest to fault disconnects first. • Number of circuits.

Commentary

The candidate demonstrates sound knowledge and understanding in completing an assessment of general characteristics form with the key regulations, assessed items and impact covered. However, the form has some minor errors in terminology, such as loop test at the origin. The impact on the installation has been attempted but is brief in parts and contains only basic reasoning, for example chapter 34.

Candidate evidence

Lighting design schedule

Lighting design schedule

Area	Utilisation factor	Light loss factor	spacing	height	Required lux level	Calculation	Lumens required per luminaire
Workshop/print room	0.7	0.65	2.25 m	2.4 m	500 lux	L - 5.25 m W - 3.75 m $\frac{5.25 \times 3.75 \times 500}{6000 \times 0.70 \times 0.65}$ = 4 LIGHTS REQUIRED	6000
Office sales area	0.75	0.8	2.8 m	2.4 m	300 lux	L 8.75 W 3.75 $\frac{8.75 \times 8.25 \times 300}{6000 \times 0.75 \times .80}$ = LIGHTS REQUIRED	6000

Figure 4 lighting design schedule

ROOM INDEX CALCULATION = $\frac{\text{No of POINTS}}{\text{LDL} \times \text{UF} \times \text{MF}} = \frac{L \times W \times E}{}$

L = length
W = WIDTH
E = LUX
LDL = LIGHT OUT PUT
UF =
MF = maintence factor

Commentary

The candidate shows sound knowledge and understanding creating a lighting design schedule with reasonable accuracy and detail. The lighting design schedules shows some consideration has been given to locations. However, the candidate has been indecisive and made crossing out where errors occurred, such as in the spacing for the workshop and office area calculation and errors have been made using the scale ruler. There are some gaps, such as the spacing factor in the workshop. The candidate has though demonstrated that they understand the fundamental principle of lighting design and considered the requirements of BS7671. Calculations are accurate but there is minimal working shown to evidence that all factors have been considered.

Candidate evidence

Materials take off sheet

Equipment/Materials	Quantity
6/4-way distribution board (100/80 amp)	1
32amp mcb/rcbo type B	1
16amp mcb/rcbo type B	1
6amp mcb/rcbo type B	1
20mm PVC conduit	
20mm PVC saddles	2
20mm PVC adaptors/bush	
20mm PVC tee-box	1
20mm PVC angle-box	1
PVC surface mounted switch boxes	2
100mm metallic tray	
100mm metallic tray bend	1
50x50mm steel trunking	
20mm steel conduit	
20mm steel conduit couplers	10
20mm steel conduit saddles	6

20mm brass bushes	12
Lighting LED Fluorescent	2
2-way PVC lighting switches	2
16amp isolator BSEN 60309 (Metal clad)	1
Metal clad switched double sockets	4
Single core cable 2.5mm (Brown)	15 metres
Single core cable 2.5mm (Blue)	15 metres
Single core cable 2.5mm (Green/Yellow)	15 metres
Single core cable 1.5mm (Brown)	10 metres
Single core cable 1.5mm (Blue)	2 metres
Single core cable 1.5mm (Green/Yellow)	4 metres
SWA (Steel wire armoured) cable 2-core 2.5mm	2 metres
SWA (Steel wire armoured) gland pack	1
Tools and Plant	
Marking tool/Pencil	1
Tape measure	1
Conduit bending spring (20mm)	1
Conduit bending machine	1
Stock and die set (20mm)	1
Bush spanner 20mm	1
Power Drill (Battery/Mains)	1
Selection of drilling bits (Steel/Masonry) 6mm etc	1
20mm Hole cutter/saw	1
Hacksaw	1
Pipe Grips/footprints	2
Adjustable spanner	2
Selection of metal files (reamer)	2/3
Electricians Knife	1

Side cutters	1
Pliers	1
VDE Screwdriver Philips/Pozi small	1
VDE Screwdriver Philips/Pozi medium	1
VDE Screwdriver Philips/Pozi large	1
VDE Screwdriver flat head small	1
VDE Screwdriver flat head medium	1
VDE Screwdriver flat head large	1
Cable/wire strippers	1
Hammer	1
Spirt levels	2
PPE	
Overalls/protective clothing	
Steel toe capped boots	
Goggles/glasses	

Commentary

The candidate has demonstrated sound knowledge and understanding identifying the basic resources, components and PPE to carry out the tasks and the meet the requirements of the assignment brief. There are some minor inaccuracies in quantities which may cause a delay to the installation process.

Terminology is not always clear, for example, the term MCB has been used rather than C.B (circuit breaker), DB would be detailed as 6+4way consumer unit and screwdrivers should state the actual size e.g. Pozi-drive number 1, 2 or 3. However this does not impact on safety to carry out the installation but it can impact on the effectiveness and aesthetics of the completed installation.

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Candidate evidence

Design grid

Consumer unit located in workshop VOLTAGE DROP TO COMPLY WITH BS 7671		Nominal Voltage (U) 230 V		Earthing Arrangement TN-C-S		External Earth Fault Loop Impedance (Z_e) 0.3 Ω		
Circuit	1	2	3	4	5	6	7	8
Description	Ring-final office	Radial-final sockets worksh op	Radial-sockets kitchen x2 twin	Boiler supply	Outbuildi ng DB	4.5 kW printing machine	Lighting office	Lighting worksh op/kitch en/ toilets
No. outlets	6 x 2-gang	4 x 2-gang	2 x 2-gang	1	1	1	7	5
Type of wiring	70 °C thermopl astic single-core non-sheathed	70 °C thermo plastic single-core non-sheathe d	70 °C thermo plastic single-core non-sheathe d	70 °C thermo plastic multi-core flat profile	70 °C thermopl astic 3-core PVC SWA	70 °C thermop lastic 3-core PVC SWA	70 °C thermo plastic single-core non-sheathe d	70 °C thermop lastic single-core non-sheathe d
Design Current (I_b)	22 A	15 A	9 A	4 A	16 A	[illegible]	1.6 A	0.7 A

FIGURE 2

19.56A

Page 1

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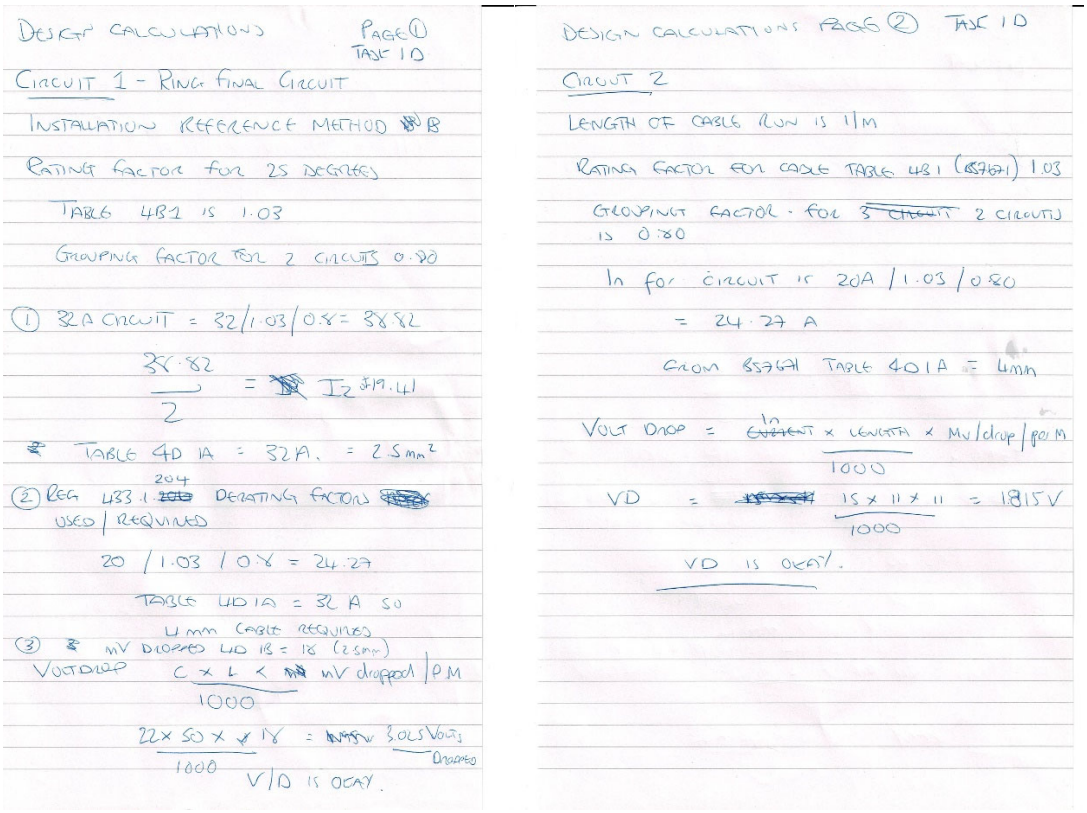
Type and Nominal rating (I_n)	32 A B	20 A B	20 A B	16 A B	16 A C	20 B	6 A C	6 A C
Length (metres)	50 m loop	11 m	10 m	8 m	27 m	6 m	65 m	20 m
Installation method	B	B	B	B	C	C	B	B
Ambient temperature ^{0}C	25 ^{0}C	25 ^{0}C	25 ^{0}C	30 ^{0}C	30 ^{0}C	30 ^{0}C	30 ^{0}C	30 ^{0}C
Rating Factor Ambient air temp. C_a	1.03	1.03	1.03	1	1	1	1	1
Total circuits in group	2	2	2	1	1	1	2	2
Rating factor grouping C_g	0.80	0.80	0.80	1	1	1	0.80	
Minimum current capacity (<I_t) *	38.83/2 19.41 24.27 EACH	24.27	24.27	16	16	20A	7.5	7.5
mV/A/m	18	11	11	29	18	29	29	29
Actual Voltage drop	4.95	1.815	0.99	~~0.648~~ 0.928	7.776	3.40	3.016	0.4016
Minimum conductor csa mm^2	2.5	4	4	1.5	2.5	1.5	1.5	1.5

Figure 2

* BOTH LEGS OF RING FINAL CIRCUIT

Page 2

Design grid calculations



DESIGN CALCULATIONS PAGE ① TASK 10

CIRCUIT 1 - RING FINAL CIRCUIT

INSTALLATION REFERENCE METHOD B

RATING FACTOR FOR 25 DEGREES

TABLE 4B1 IS 1.03

GROUPING FACTOR FOR 2 CIRCUITS 0.80

① 32A CIRCUIT = 32/1.03/0.8 = 38.82

38.82 / 2 = I_z 19.41

TABLE 4D 1A = 32A. = 2.5 mm²

② REG 433.1 204 DERATING FACTOR USED / REQUIRED

20 / 1.03 / 0.8 = 24.27

TABLE 4D1A = 32 A SO

4 mm CABLE REQUIRED

③ mV DROPPED 4D 1B = 18 (2.5mm)

VOLTDROP C x L x mV dropped / PM / 1000

22 x 50 x 18 / 1000 = 3.05 Volts Dropped

V/D IS OKAY.

DESIGN CALCULATIONS PAGE ② TASK 10

CIRCUT 2

LENGTH OF CABLE RUN IS 11M

RATING FACTOR FOR CABLE TABLE 4B1 (BS7671) 1.03

GROUPING FACTOR FOR 2 CIRCUITS IS 0.80

In for CIRCUIT IS 20A / 1.03 / 0.80

= 24.27 A

FROM BS7671 TABLE 4D1A = 4mm

VOLT DROP = In CURRENT x LENGTH x MV/drop/per M / 1000

VD = 15 x 11 x 11 / 1000 = 1.815 V

VD IS OKAY.

Commentary

The candidate shows sound knowledge and understanding of producing a design grid with calculations and has considered most aspects required to meet the assignment. A good working knowledge and understanding of designing electrical systems has been demonstrated.

There are some gaps in knowledge such as grouping factor for circuit 8 which have been missed off the design grid. The presentation is not fully clear, but the candidate does however understand the design procedure.

Task 2 – Installation, commissioning and decommissioning

(Assessment themes: Health and Safety, Design and planning, Systems and components, Inspecting and testing systems and components, Reports and information)

For task 2 candidates need to produce the following pieces of evidence:

- Assessor observation of installation:
  - Safe isolation
  - Installation of cables and wiring systems
  - Inspection and testing
- Completed Electrical Installation Certificate
- Schedule of inspections
- Schedule of test results
- Copy of the Guidance for recipients

For illustration, the guided exemplification materials (GSEM) for Task 2 contain examples of candidate evidence for the following assessment requirements only:

- Assessor observation of installation:
  - Safe isolation
  - Installation of cables and wiring systems
  - Inspection and testing
- Completed Electrical Installation Certificate
- Schedule of inspections
- Schedule of test results

The following task 2 candidate assessment requirements have not been included as example candidate evidence for this version of the guided exemplification materials.

- Copy of the Guidance for recipients

Photographic evidence:

Installation of cables and wiring systems

- Measuring and marking out **(photograph 1a and 1b)**
- Containment being installed and saddles **(photograph 2, 3, 4)**
- Installation of SWA and glanding **(photograph 5)**
- Cables being installed into the containment **(photograph 6)**
- Cutting conduit **(photograph 7)**
- Terminations being prepared and completed **(photograph 8, 9)**
- Final installation **(photograph 10)**

Inspection and testing

- Testing equipment being nulled/zeroed **(photograph 11)**
- R1+R2 and polarity being confirmed **(photograph 12 – 13)**
- Testing of final ring circuit **(photograph 14 – 18)**
- Insulation resistance tests **(photograph 19)**
- Reenergised installation **(photograph 20 – 24)**

Candidate evidence

Practical Observation Form – Safe isolation process

Assessment ID	Qualification number
8710-353	8710-33
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Safe Isolation	The candidate took some time to consider the safe isolation process of the distribution board. They referred to their method statement frequently throughout and wrote it out prior to commencing with the task. Correct voltage indicators were selected and the candidate carried out a visual inspection of the voltage indicators and they knew that there should be less than 3mm tip showing and finger guards but did not however identify that this was from the requirements of GS38. The voltage indicators were correctly proved on the proving unit. Permission was asked to safely isolate the circuit. The circuit was switched off and locked off. The candidate retained the key. The assessor had to prompt the candidate by asking what they were going to do with the key now the circuit was locked off, the candidate then placed the key in their pocket. Test were performed in the correct manner to ensure the installation was not energised. Signage was posted next to the locked off device. The voltage indicator was then reproved on the proving unit.

Commentary

Candidate demonstrates a sound understanding of the safe isolation process and carried out all the necessary steps in the safe isolation and lock off correctly.

The safe isolation process was correct in method and the candidate was able to describe in detail the reasoning behind each the step in the process. For example, the candidate used all the correct terminology for the testing equipment and explained what each check was proving before moving to next stage.

Candidate evidence

Practical Observation Form – Installation of cables and wiring systems

Assessment ID	**Qualification number**
8710-353	8710-33
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety, systems and component

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Installation	The candidate prepared the workspace with consideration to health and safety and good housekeeping, correct PPE was selected for use such as hard hat, boots, safety googles and Hi-Viz waistcoat. The candidate used their equipment & materials list during collection to ensure they had all the materials they needed. However, this was lacking in some detail in terms of quantities and this caused some delays as the candidate had to ask the store person for the extra materials required. All tools were used in a and effective safe manner. The installation was safely isolated and locked off prior to the installation commencing.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	The workspace was reasonably maintained in terms of tidiness of tools materials and equipment throughout the task. Candidate did not make any reference to pre-existing marks or damage to the wall prior to marking out for their installation, tape measure and level were used appropriately, the candidate made an error and had to remark the wall prior to fixing some components. The candidate required some prompts to progress. For example, when deciding the spacing distances of the saddles and making off the SWA ends, which took a second attempt due to the SWA armoring not being cut straight this was rectified easily once the armoring was re-terminated. Sequencing was not always logical, for example, conduit and trunking were cut before components were installed resulting in incorrect lengths due to some inaccuracies in the component positioning. All equipment was installed within a permitted tolerance. However, working to the extremes of these tolerances resulted in some gaps in places. Good use was made of the spirit level to check that containment and component installation is level/plumb, but in some cases, installation was not true. For example, the saddles on the conduit feeding the sockets outlets were off center. All components were installed in the locations detailed in the dimensioned drawing. The final installation did not appear to be neat in terms of cable core routing, however the cable ends were prepared and terminated correctly with no exposed conductors and no damage to the insulation. All devices were installed and connected as per the system design specification. The candidate did not always work to a high level of tolerance throughout the installation which impacted on the final aesthetics of the installation.

Assessor signature	**Date**
Assessor	26.02.21

Photographic evidence

1a

Photograph 1a and 1b

Marking out & measurements being carried out multiple times

or alternatively

This photo could show a tape measure being used to measure the conduit which is outside the required tolerance.

1b.

2.

Photograph 2

Some measurements of the conduit are inaccurate, again the use of a tape measure shows this is outside the required tolerance.

3.

Photograph 3 & 4

Back box / Containment being installed which shows that it has not been levelled correctly on the first attempt and them a follow up photo showing it is has been rectified and now level.

4.

5.

Photograph 5

SWA gland with armouring which are not straight or not terminated correctly within the gland.

6.

Photograph 6

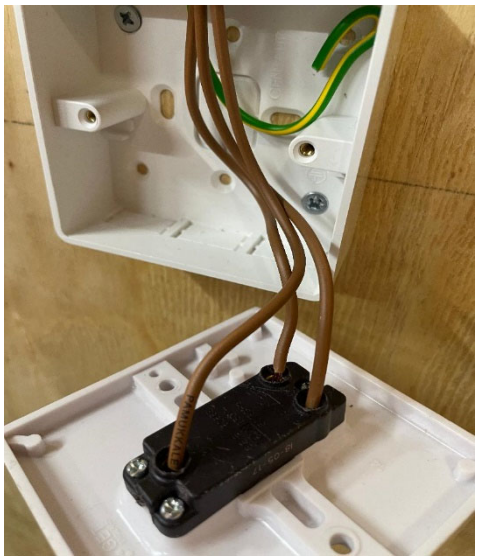
Cables being installed into the containment where there is evidence of trapped cable chaffing. This does not however expose the cables conductors

7.

Photograph 7

The candidate cutting PVC conduit safely with the conduit secured.
The finished cut has slight inaccuracies.
The candidate de-burred the conduit end.

8.



Photograph 8

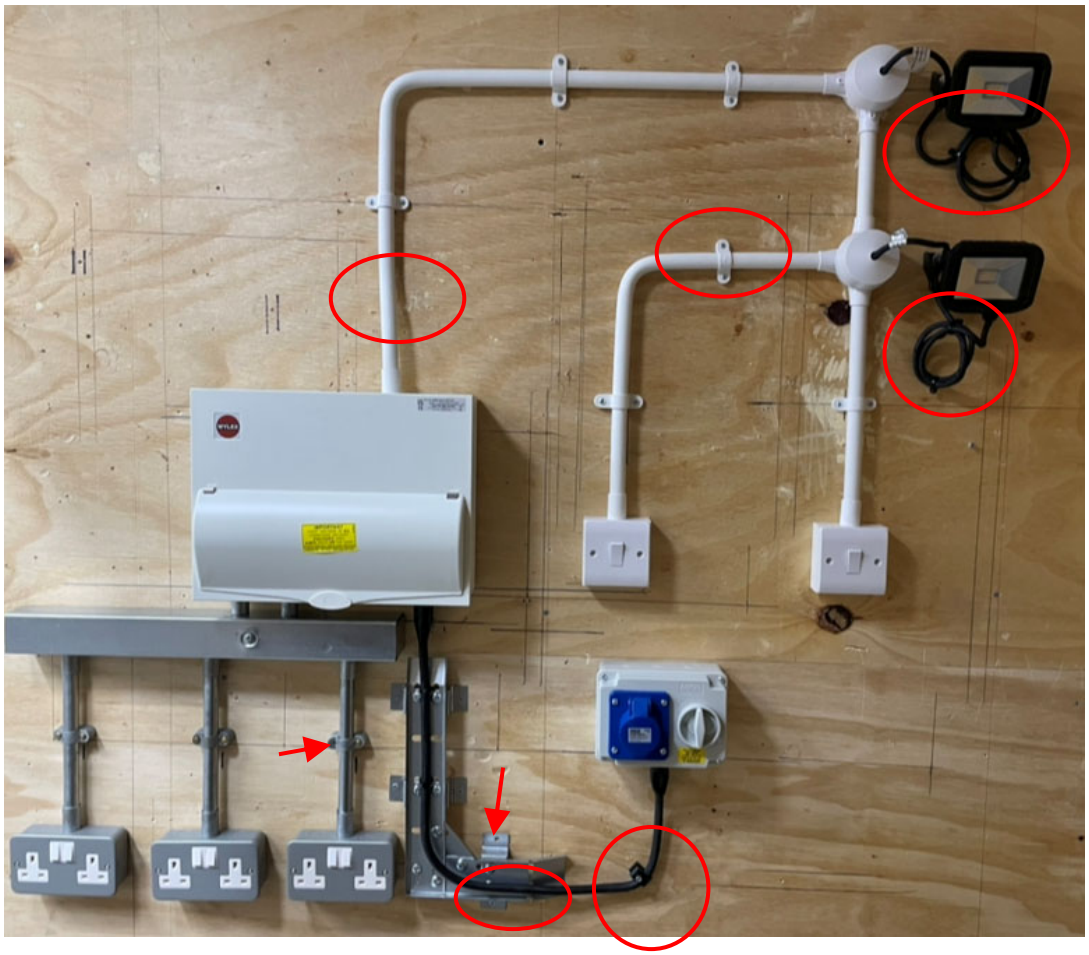
Terminated conductors being slightly different lengths showing the dressing of the cables that is not aesthetically pleasing.

9.

Photograph 9

Photo of SWA not being installed neatly on the tray.

10.



Photograph 10

Final installation capturing an acceptable standard with some non-safety critical errors that impact competed installations aesthetics. E.g. Conduits and saddles are not level or square, screw missing from the saddle above socket 3, cleat on SWA cable is on the 90-degree bend and the last cable tie on the tray is missing. Cables are untidy on the LED flood lights, and the stand-off bracket on the horizontal leg of the tray has a screw missing.

Commentary

The candidate demonstrated sound knowledge and understanding of the installation process and it was conducted safely. The approach to the installation was logical in process however on occasions some work needed to be re-done, such as remarking the wall which was measured incorrectly. The conduit and trunking were cut before components were installed which resulted in incorrect lengths as a result of inaccuracies in the component positioning, causing subsequent delays.

The stores person had to ask for clarification of some items in the materials list, however the candidate was able to provide this verbally. Method and equipment for the marking out was appropriate to the task. However, there was some minimal wastage due to the candidate cutting the conduit prior to fixing the components.

Short cable tails on SWA and glanding indicated some gaps in forward planning when terminating SWA. On occasions the candidate worked outside tolerances expected for this type of installation and it was not always aesthetically pleasing. Overall, the installation was acceptable to an acceptable standard and safe.

Candidate evidence

Practical Observation Form – Inspection and testing

Assessment ID	Qualification number
8710-353	8710-33
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety, Inspection & Testing

Task	***Notes –*** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Inspection & Testing	***Inspection & Testing*** Safety aspects considered. Safe isolation procedures undertaken, for example the correct safe isolation procedures were undertaken prior to the inspection and testing being carried out. The candidate has demonstrated a good standard of work whilst considering the inspection and testing and applied, consistent skills, which meets industry standards. The candidate has followed the correct process for completing the inspection of the installed circuits but was at points hesitant in relating it to the electrical installation certificate and reflected that within the electrical installation certificate. They have demonstrated an ability to sequence tasks logically in a focused manner. The test instruments were correctly prepared by carrying out a visual inspection prior to starting testing, a prompt was required whilst inspecting the test leads. They took some time to think about the use of the equipment in relation to zeroing the test instrument for continuity tests, this however did not impact on safety. The candidate followed the correct testing sequence with no prompting for R1+R2, insulation resistance. Prompting was required for the ring final circuit figure of eight test in relation to the R1+R2 for the circuit. The circuit was correctly re energised after gaining permission, polarity was taken correctly whilst carrying out the live testing after seeking permission reenergizing the circuit.

Task	***Notes –*** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	Good skills and consistent skills were demonstrated for the Zs and RCD testing which met industry standards.

Assessor signature	**Date**
Assessor	26.02.21

Photographic Evidence

Photograph 11 and 12

Testing equipment being nulled/zeroed first shows incorrect process and second should show the tester showing the leads are zeroed.

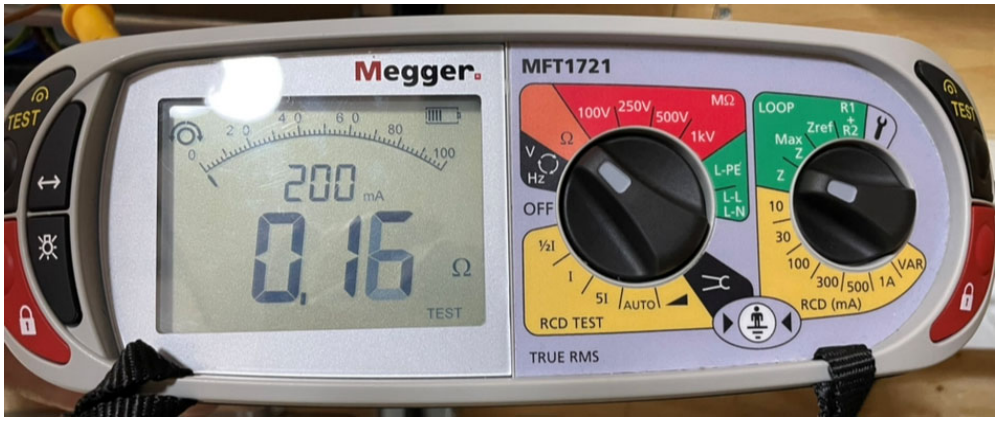
13.

Photograph 13, 14 a & b.

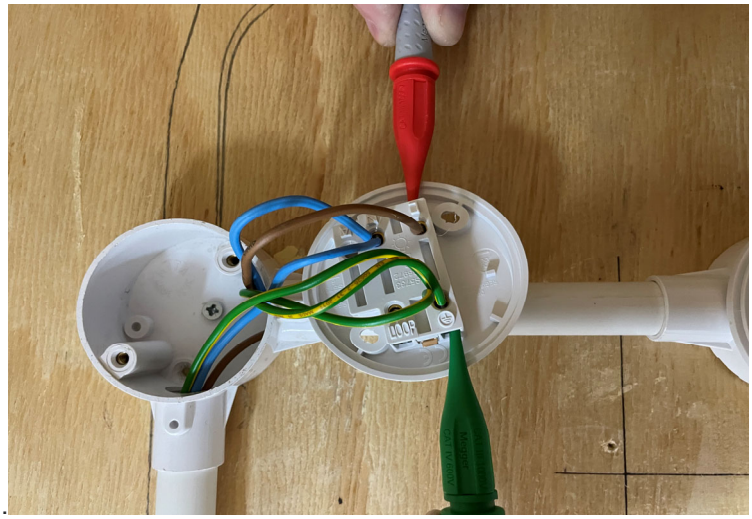
Method 1 continuity (R1+R2) and polarity being confirmed with the test leads inserted in the wrong port on the test equipment.

Second and third photo shows correct port being used and the test being taken and the result.

14.a



14.b



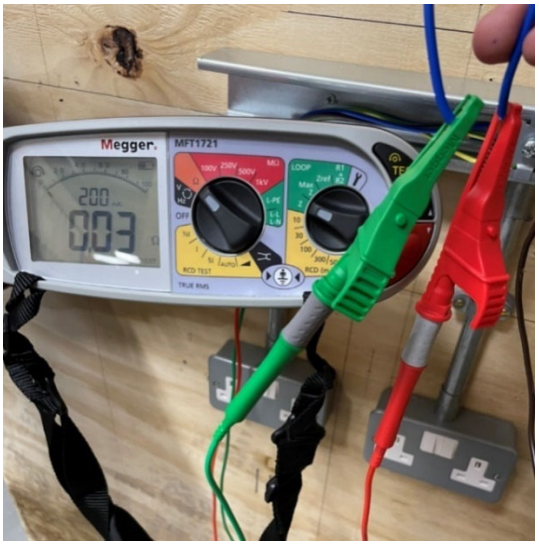
15.

Photograph 15-18

The ring final circuit being tested and shows the correct readings on the end to end to ends of the circuit. and then reading once rectification had taken place.

16.

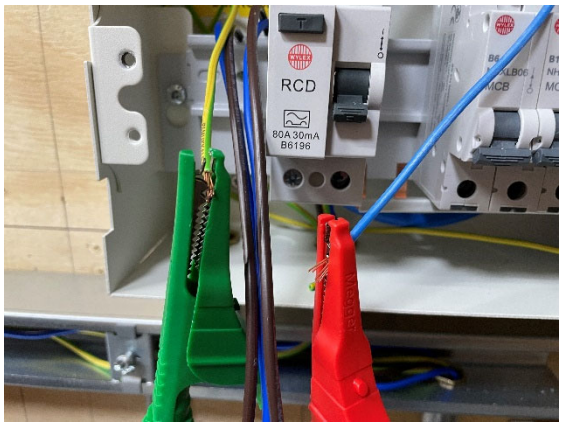
17.



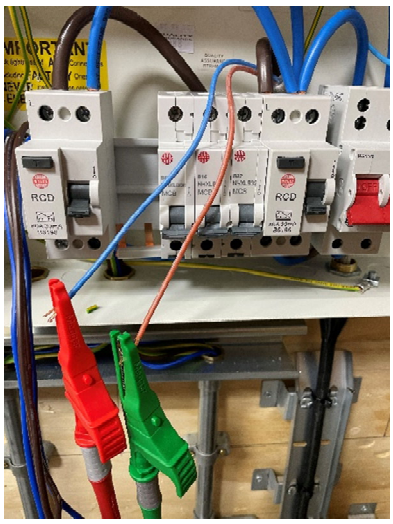
Photograph 19

Insulation resistance tests being carried out. This is a safety critical test and must be carried out in a safe manner due to the test voltage of 500 volts DC

19.a



19.b

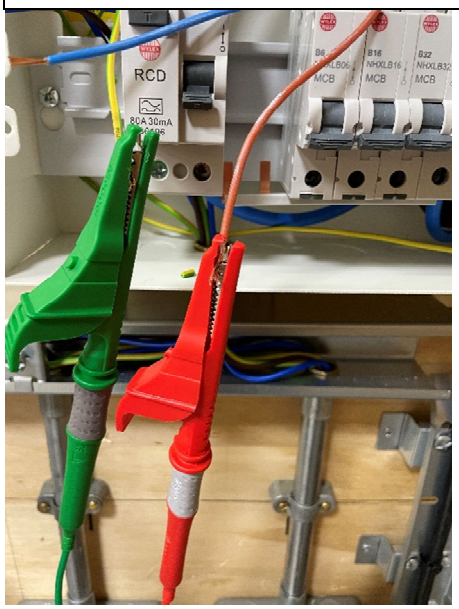


19.c

Photograph 20 - 25

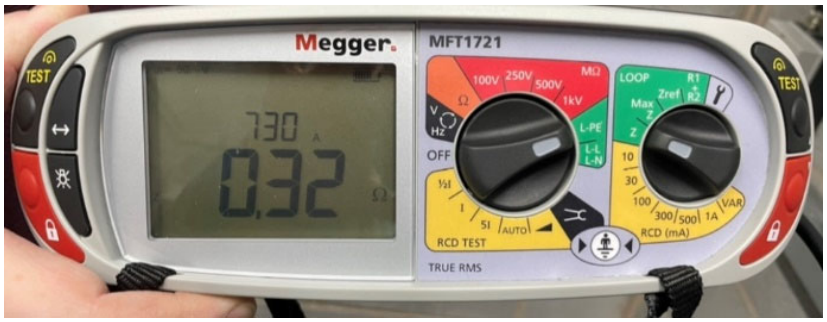
Re-energised installation being testing. Photo shows the Ze being taken, this was first carried out with the main earth connected creating a parallel path, a second photo shows the test being performed correctly with the MET disconnected.

Photos required of PFC being taken, earth fault loop impedance and RCD tests being carried out.



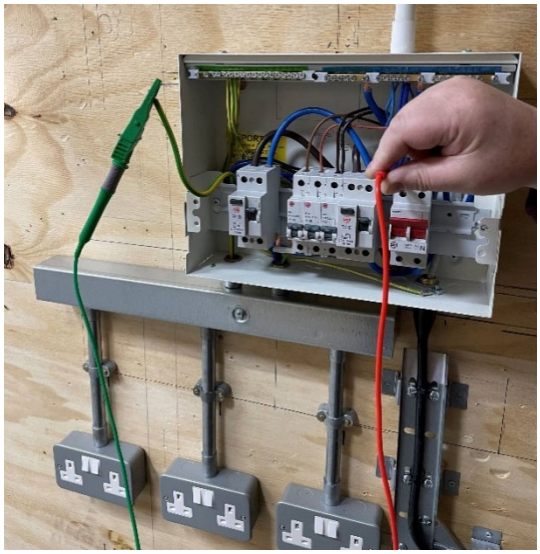
19.d

20.

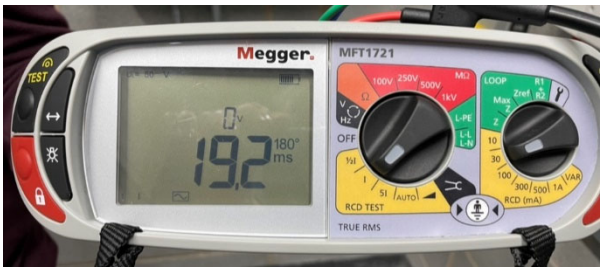


21.

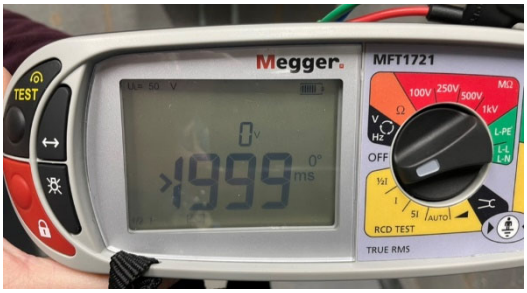
22.



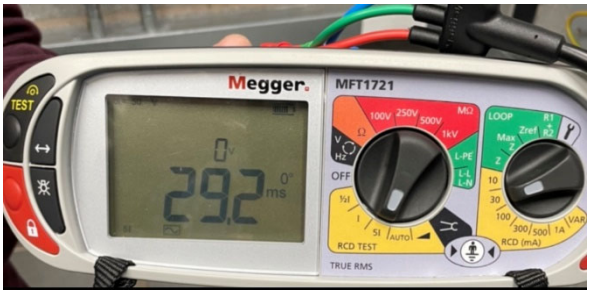
23.



24.



25.



The candidate demonstrated a good understanding of the inspection process. The test instruments were used on the correct scale to a good standard, but the candidate did however need to take time to think about the use of the equipment in relation to zeroing the test instrument for continuity tests, this however did not impact on safety. Prompting was required for the ring final circuit figure of eight test in relation to the R1+R2 for the circuit. The application of knowledge demonstrated for the Zs and RCD testing was of a good standard. The evidence provided suggests that procedures were fairly logical, and most results were understood.

Candidate evidence

– Electrical Installation Certificate and schedule of inspections

(REQUIREMENTS FOR ELECTRICAL INSTALLATIONS - BS 7671 [IET WIRING REGULATIONS])

DETAILS OF THE CLIENT **Mr John James** **22, Johnston Street, Seaton. AC30 1DC**	
INSTALLATION ADDRESS **22, Johnston Street, Seaton. AC30 1DC**	
DESCRIPTION AND EXTENT OF THE INSTALLATION Description of installation**: Domestic/Commercial workshop, lighting and small power**	New installation ☑
Extent of installation covered by this Certificate**: All circuits installed as per the schedule of results. As well as the associated containment as per figure 2.** (Use continuation sheet if necessary) see continuation sheet No:	Addition to an existing installation ☐ Alteration to an existing installation ☐
FOR DESIGN I/We being the person(s) responsible for the design of the electrical installation (as indicated by my/our signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design and additionally where this certificate applies to an addition or alteration, the safety of the existing installation is not impaired, hereby CERTIFY that the design work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with BS 7671:2018, amended to ..**N/A**..... (date) except for the departures, if any, detailed as follows:	
Details of departures from BS 7671 (Regulations 120.3, 133.1.3 and 133.5): **None** Details of permitted exceptions (Regulation 411.3.3). Where applicable, a suitable risk assessment(s) must be attached to this Certificate. **None** Risk assessment attached	
The extent of liability of the signatory or signatories is limited to the work described above as the subject of this Certificate.	
For the DESIGN of the installation: **(Where there is mutual responsibility for the design) Signature: .**PC Jenkin** Date: **07/09/20** Name (IN BLOCK LETTERS): .**CLIVE JENKIN** Designer No 1 Signature: ..... Date: ..... Name (IN BLOCK LETTERS): ..... Designer No 2**	
FOR CONSTRUCTION I being the person responsible for the construction of the electrical installation (as indicated by my signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the construction hereby CERTIFY that the work for which I have been responsible is to the best of my knowledge and belief in accordance with BS 7671:2018, amended to **....N/A.....(**date) except for the departures, if any, detailed as follows:	
Details of departures from BS 7671 (Regulations 120.3 and 133.5): **None**	
The extent of liability of the signatory is limited to the work described above as the subject of this Certificate. For CONSTRUCTION of the installation: Signature: .**PC Jenkin** Date: **07/09/20** Name (IN BLOCK LETTERS): **CLIVE JENKIN** Constructor	
FOR INSPECTION & TESTING I being the person responsible for the inspection & testing of the electrical installation (as indicated by my signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the inspection & testing hereby CERTIFY that the work for which I have been responsible is to the best of my knowledge and belief in accordance with BS 7671:2018, amended to ....**N/A.....(**date) except for the departures, if any, detailed as follows:	
Details of departures from BS 7671 (Regulations 120.3 and 133.5): **None**	
The extent of liability of the signatory is limited to the work described above as the subject of this Certificate. For INSPECTION AND TESTING of the installation: Signature: **PC Jenkin** Date: **07/09/20** Name (IN BLOCK LETTERS): **CLIVE JENKIN** Inspector	
NEXT INSPECTION I/We the designer(s), recommend that this installation is further inspected and tested after an interval of not more than .5. years/~~months.~~	

PARTICULARS OF SIGNATORIES TO THE ELECTRICAL INSTALLATION CERTIFICATE

Designer (No 1)

Name: **PC Jenkin** Company: **Honister Installation Ltd**
Address: **1 Grassmoor, Cockermouth**
..... Postcode: **CA99 1ER**. Tel No: **01234 567890**

Designer (No 2)
(if applicable)

Name: .....**N/A**..... Company:.....
Address: .....
..... Postcode: ..... Tel No: .....

Constructor

Name: **PC Jenkin** Company: **Honister Installation Ltd**
Address: **1 Grassmoor, Cockermouth**
..... Postcode: **CA99 1ER** Tel No: **01234 567890**

Inspector

Name: **PC Jenkin** Company: **Honister Installation Ltd**
Address: **1 Grassmoor, Cockermouth**
..... Postcode: **CA99 1ER** Tel No: **01234 567890**

SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

Earthing arrangements	Number and Type of Live Conductors		Nature of Supply Parameters	Supply Protective Device
TN-C TN-S TN-C-S ✓ TT IT	AC 1-phase, 2-wire ✓ 2-phase, 3-wire 3-phase, 3-wire 3-phase, 4-wire	DC 2-wire 3-wire Other	Nominal voltage, U / U_0 (1) .400/230 V Nominal frequency, f (1) 50 Hz Prospective fault current, I_{pf} (2) 1.6 kA External loop impedance, Z_e (2) 0.14 Ω *(Note: (1) by enquiry* *(2) by enquiry or by measurement)*	BS (EN) ...88..... Type .....2..... Rated current ....100.. A
	Confirmation of supply polarity ☑			

Other sources of supply (as detailed on attached schedule**) N/A**

PARTICULARS OF INSTALLATION REFERRED TO IN THE CERTIFICATE

Means of Earthing	**Maximum Demand**
Distributor's facility	Maximum demand (load) .....60..... kVA / Amps Delete as appropriate
Installation earth electrode	**Details of Installation Earth Electrode** *(where applicable)* Type **N/A** (e.g. rod(s), tape etc) ..... Location ..... Electrode resistance to Earth ..... Ω

Main Protective Conductors

Earthing conductor	Material .....**CU**..... csa ...**16**..... mm^2	Connection / continuity verified ☑
Main protective bonding conductors (to extraneous-conductive-parts)	Material .....**CU**..... csa ....**10**..... mm^2	Connection / continuity verified ☑

To water installation pipes ☑	To gas installation pipes ☑	To oil installation pipes **N/A**	To structural steel **N/A**
To lightning protection **N/A**	To other Specify **N/A**		

Main Switch / Switch-Fuse / Circuit-Breaker / RCD

Location **Workshop**. ..... BS(EN) **60947-5** No of poles ***2***	Current rating **100.** A Fuse / device rating or setting **.N/A.** A Voltage rating **230.** V	**If RCD main switch** Rated residual operating current ($I_{\Delta n}$) **N/A...** mA Rated time delay ..... ms Measured operating time .... ms

COMMENTS ON EXISTING INSTALLATION (in the case of an addition or alteration see Regulation 644.1.2):
.....
.....**N/A.**.....
.....
.....
.....
.....
.....
.....

SCHEDULES
The attached Schedules are part of this document and this Certificate is valid only when they are attached to it. .1.....
Schedules of Inspections and ....1..... Schedules of Test Results are attached.
(Enter quantities of schedules attached).

SCHEDULE OF INSPECTIONS (for new installation work only) for

DOMESTIC AND SIMILAR PREMISES WITH UP TO 100 A SUPPLY

NOTE 1: This form is suitable for many types of smaller installation, not exclusively domestic.

All items inspected in order to confirm, as appropriate, compliance with the relevant clauses in BS 7671. The list of items and associated examples where given are not exhaustive.

NOTE 2: Insert ✓ to indicate an inspection has been carried out and the result is satisfactory, or N/A to indicate that the inspection is not applicable to a particular item.

Item No	DESCRIPTION	Outcome See Note 2
1.0	**EXTERNAL CONDITION OF INTAKE EQUIPMENT (VISUAL INSPECTION ONLY)**	
1.1	Service cable	☑
1.2	Service head	☑
1.3	Earthing arrangement	☑
1.4	Meter tails	☑
1.5	Metering equipment	
1.6	Isolator (where present)	N/A
2.0	**PARALLEL OR SWITCHED ALTERNATIVE SOURCES OF SUPPLY**	
2.1	Adequate arrangements where a generating set operates as a switched alternative to the public supply (551.6)	
2.2	Adequate arrangements where a generating set operates in parallel with the public supply (551.7)	N/A
3.0	**AUTOMATIC DISCONNECTION OF SUPPLY**	
3.1	**Presence and adequacy of earthing and protective bonding arrangements:**	
	• Distributor's earthing arrangement (542.1.2.1; 542.1.2.2)	☑
	• Installation earth electrode (where applicable) (542.1.2.3)	N/A
	• Earthing conductor and connections, including accessibility (542.3; 543.3.2)	☑
	• Main protective bonding conductors and connections, including accessibility (411.3.1.2; 543.3.2; 544.1)	☑
	• Provision of safety electrical earthing/bonding labels at all appropriate locations (514.13)	☑
	• RCD(s) provided for fault protection (411.4.204; 411.5.3)	N/A
4.0	**BASIC PROTECTION**	
4.1	**Presence and adequacy of measures to provide basic protection (prevention of contact with live parts) within the installation:**	
	• Insulation of live parts e.g. conductors completely covered with durable insulating material (416.1)	☑
	• Barriers or enclosures e.g. correct IP rating (416.2)	☑
5.0	**ADDITIONAL PROTECTION**	
5.1	**Presence and effectiveness of additional protection methods:**	
	• RCD(s) not exceeding 30 mA operating current (415.1; Part 7), see Item 8.14 of this schedule	☑
	• Supplementary bonding (415.2; Part 7)	N/A
6.0	**OTHER METHODS OF PROTECTION**	
6.1	**Presence and effectiveness of methods which give both basic and fault protection:**	
	• SELV system, including the source and associated circuits (Section 414)	N/A
	• PELV system, including the source and associated circuits (Section 414)	N/A
	• Double or reinforced insulation i.e. Class II or equivalent equipment and associated circuits (Section 412)	N/A
	• Electrical separation for one item of equipment e.g. shaver supply unit (Section 413)	N/A
7.0	**CONSUMER UNIT(S) / DISTRIBUTION BOARD(S):**	
7.1	Adequacy of access and working space for items of electrical equipment including switchgear (132.12)	
7.2	Components are suitable according to assembly manufacturer's instructions or literature (536.4.203)	☑

7.3	Presence of linked main switch(es) (462.1.201)	☑
7.4	Isolators, for every circuit or group of circuits and all items of equipment (462.2)	☑
7.5	Suitability of enclosure(s) for IP and fire ratings (416.2; 421.1.6; 421.1.201; 526.5)	☑

Item No	DESCRIPTION	Outcome See Note 2
	CONSUMER UNIT(S) / DISTRIBUTION BOARD(S) continued	
7.6	Protection against mechanical damage where cables enter equipment (522.8.1; 522.8.5; 522.8.11)	☑
7.7	Confirmation that ALL conductor connections are correctly located in terminals and are tight and secure (526.1)	☑
7.8	Avoidance of heating effects where cables enter ferromagnetic enclosures e.g. steel (521.5)	
7.9	Selection of correct type and ratings of circuit protective devices for overcurrent and fault protection (411.3.2; 411.4, 411.5, 411.6; Sections 432, 433; 537.3.1.1)	☑
7.10	**Presence of appropriate circuit charts, warning and other notices:**	
	• Provision of circuit charts/schedules or equivalent forms of information (514.9)	☑
	• Warning notice of method of isolation where live parts not capable of being isolated by a single device (514.11)	N/A
	• Periodic inspection and testing notice (514.12.1)	☑
	• RCD six-monthly test notice; where required (514.12.2)	☑
	• AFDD six-monthly test notice; where required	N/A
	• Warning notice of non-standard (mixed) colours of conductors present (514.14)	N/A
7.11	Presence of labels to indicate the purpose of switchgear and protective devices (514.1.1; 514.8)	☑
8.0	**CIRCUITS**	
8.1	Adequacy of conductors for current-carrying capacity with regard to type and nature of the installation (Section 523)	☑
8.2	Cable installation methods suitable for the location(s) and external influences (Section 522)	☑
8.3	Segregation/separation of Band I (ELV) and Band II (LV) circuits, and electrical and non-electrical services (528)	☑
8.4	Cables correctly erected and supported throughout, with protection against abrasion (Sections 521, 522)	☑
8.5	Provision of fire barriers, sealing arrangements where necessary (527.2)	☑
8.6	Non-sheathed cables enclosed throughout in conduit, ducting or trunking (521.10.1; 526.8)	☑
8.7	Cables concealed under floors, above ceilings or in walls/partitions, adequately protected against damage (522.6.201, 522.6.202, 522.6.203; 522.6.204)	☑
8.8	Conductors correctly identified by colour, lettering or numbering (Section 514)	☑
8.9	Presence, adequacy and correct termination of protective conductors (411.3.1.1; 543.1)	☑
8.10	Cables and conductors correctly connected, enclosed and with no undue mechanical strain (Section 526)	☑
8.11	No basic insulation of a conductor visible outside enclosure (526.8)	☑
8.12	Single-pole devices for switching or protection in line conductors only (132.14.1; 530.3.3; 643.6)	☑
8.13	Accessories not damaged, securely fixed, correctly connected, suitable for external influences (134.1.1; 512.2; Section 526)	☑
8.14	Provision of additional protection/requirements by RCD not exceeding 30mA:	
	• Socket-outlets rated at 32 A or less, unless exempt (411.3.3)	☑
	• Supplies for mobile equipment with a current rating not exceeding 32 A for use outdoors (411.3.3)	N/A
	• Cables concealed in walls at a depth of less than 50 mm (522.6.202; 522.6.203)	N/A
	• Cables concealed in walls/partitions containing metal parts regardless of depth (522.6.202; 522.6.203)	N/A
	• Final circuits supplying luminaires within domestic (household) premises (411.3.4)	☑
8.15	**Presence of appropriate devices for isolation and switching correctly located including:**	
	• Means of switching off for mechanical maintenance (Section 464; 537.3.2)	☑
	• Emergency switching (465.1; 537.3.3)	N/A

	• Functional switching, for control of parts of the installation and current-using equipment (463.1; 537.3.1)	☑
	• Firefighter's switches (537.4)	N/A
9.0	**CURRENT-USING EQUIPMENT (PERMANENTLY CONNECTED)**	
9.1	Equipment not damaged, securely fixed and suitable for external influences (134.1.1; 416.2; 512.2)	☑
9.2	Provision of overload and/or undervoltage protection e.g. for rotating machines, if required (Sections 445, 552)	☑
9.3	Installed to minimize the build-up of heat and restrict the spread of fire (421.1.4; 559.4.1)	☑
9.4	Adequacy of working space. Accessibility to equipment (132.12; 513.1)	☑
10.0	**LOCATION(S) CONTAINING A BATH OR SHOWER (SECTION 701)**	
10.1	30 mA RCD protection for all LV circuits, equipment suitable for the zones, supplementary bonding (where required) etc.	N/A

11.0	**OTHER PART 7 SPECIAL INSTALLATIONS OR LOCATIONS**	
11.1	List all other special installations or locations present, if any. (Record separately the results of particular inspections applied)	N/A

Inspected by:

Name (Capitals) .CLIVE JENKINS.....Signature ....PC Jenkins.....Date 07/09/20

Draft.

Pass – Gaps Not Completed.

GENERIC SCHEDULE OF TEST RESULTS

DB reference no CU1
Location Workshop
Z_s at DB (Ω) 0.14Ω
I_{pf} at DB (kA)
Correct supply polarity confirmed ☑
Phase sequence confirmed (where appropriate) ☐

Details of circuits and/or installed equipment vulnerable to damage when testing: Loads Plugged In.

Details of test instruments used (state serial and/or asset numbers)
Continuity 116384-75
Insulation resistance —
Earth fault loop impedance —
RCD
Earth electrode resistance

Tested by:
Name (Capitals) PC JENKIN
Signature C JENKIN Date

Circuit details												Test results															
		Protective device						Conductor details				Ring final circuit continuity (Ω)			Continuity (Ω) ($R_1 + R_2$) or R_2		Insulation Resistance Test Voltage	Insulation Resistance (MΩ)		Polarity	Z_s (Ω)	RCD		AFDD	Remarks (continue on a separate sheet if necessary)
Circuit number 1	Circuit Description 2	BS (EN) 3	type 4	rating (A) 5	breaking capacity (kA) 6	RCD $I_{\Delta n}$ (mA) 7	Maximum permitted Z_s (Ω*) 8	Reference Method 9	Live (mm²) 10	cpc (mm²) 11		r_1 (line) 12	r_n (neutral) 13	r_2 (cpc) 14	($R_1 + R_2$) 15	R_2 16	V 17	Live - Live 18	Live - Earth 19	20	Maximum measured 21	Disconnection time (ms) 22	RCD test button operation 23	Manual AFDD test button operation 24	25
1	Ring Final	—	B	32	6	30	1.37	B	2.5	1.5		0.6	0.6	0.97	0.38	—	500	>1000	>1000	✓	0.57	25	✓		
2	Radial Circuit	60898	B	16	6	—	2.37		2.5	1.5					0.29			>1000	>1000		0.4				
3	Lighting		B	6	6	—	7.28	B	1.5	1.0					0.51			>1000	>1000		0.71				

61009-

* Where the maximum permitted earth fault loop impedance value stated in column 8 is taken from a source other than the tabulated values given in Chapter 41 of this Standard, state the source of the data in the appropriate cell for the circuit in the 'Remarks' column (column 25) of the schedule.

Commentary

The candidate demonstrates a good knowledge and understanding of the requirements for completing the Electrical Installation Certificate and the EIC documents produced show a good level of detail, although there are some gaps. The earthing system has not been identified in the supply characteristics section of the electrical installation certificate. Items 1.5, 2.1, 7.1, 7.8 of the schedules of inspections (for new installation work only) have not been completed.

The maximum demand has not been noted on page 2 of the Electrical Installation Certificate.

RCD test results are fully complete in the schedule of test results.

Reference method omitted from circuit 2 of the schedule of test results.

The Electrical Installation Certificate was completed overall to an acceptable standard with only minor errors.

Task 3 – Carrying out maintenance

(Assessment themes: Health and safety, systems components, working with faults)

For task 3 candidates need to produce the following pieces of evidence:

- Six completed report cards
- Assessor observations:
  - Fault diagnosis
  - Fault rectification

For illustration, the guided exemplification materials (GSEM) for Task 3 contain examples of candidate evidence for the following assessment requirements only:

- A sample completed report card
- Assessor observations:
  - Fault diagnosis
  - Fault rectification

The following task 1 candidate assessment requirements have not been included as example candidate evidence for this version of the guided exemplification materials.

- Six completed report cards

Candidate evidence

Job card

Report sheet One	
Job card reference number: **RF 1 (Ring final)** (Needs to reflect the relevant fault reference, as stated in the award standards)	
Candidate name: **John James**	**Date of assessment:** **07.09.2020**
Description of work done/ tests carried out to locate fault (if any) Carried out investigation work on the ring final circuit, as the client had informed me that the circuit protective device was not holding in the on position. Having safely isolated the circuit, I carried out the appropriate inspection and testing procedures. Due to the nature of the fault condition, I presumed that the circuit had a short-circuit fault condition. I therefore carried out an insulation resistance test on the circuit. The following results were obtained. L-N 0.00MΩ L-CPC ≥1000MΩ N-CPC ≥1000MΩ **The nature of the fault** Short-circuit condition between line and neutral conductors. **Brief description including material if required to fix the fault.** Part of the ring final circuit had to be re-wired. **Action required to ensure rectification is suitable.** Re-test	

Commentary

The candidate demonstrates a good knowledge and understanding of the requirements for completing a job card, with the main details intact, accurate but the report is brief. The process is correct but with only limited reasoning for their approach in rectifying the fault. Although ‘re test’ is correct the candidate has not detailed the types of test that need to be conducted before reenergising the circuit. It is also clear that the candidate has not considered the materials required to rectify the fault.

Candidate evidence

Practical Observation Form – Diagnosis and rectification of faults

Assessment ID	Qualification number
8710-353	8710 – 33
Candidate name	**Candidate number**
Candidate A	2020A
Centre name	**Assessment themes**
City & Guilds	Health and safety, systems and components, working with faults

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Fault diagnosis	Initial interaction with the customer is slow, with limited eye contact, head down with arms folded although this improved as the candidate moved on with the fault diagnoses Candidate asked some questions that might help with the initial fault diagnosis such ascertaining the protective device was not holding in the on position. Health and Safety procedures were considered such as using the correct PPE, safe Isolation and locking off the circuit being worked on and tagging out prior to commencing work, the approach to be taken to commence the task was explained by the candidate. Tools and test equipment were used in a safe manner to industry standards, the candidate did however have to reprove their test leads were correctly inserted to the equipment as the reading first taken were not as the candidate expected, this was easily rectified without any prompting from the assessor. A logical sequence of electrical tests was applied to identify the faulty component, but the candidate lacked confidence and had to be prompted on occasions, overall, the candidate's fault-finding techniques were carried out with some success demonstrating appropriate knowledge of fault-finding techniques.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
	The candidate's selected repair method was acceptable, but this lacked details. Little consideration was given to possible damage to customer's property.
Fault rectification	Candidate implemented all the health and safety preparations required. The candidate identified that the part of the ring final circuit required rewiring. The approach to rectify the fault follows logical process and tool use was sound but with some errors that affected the quality of finish. The system is operational and checked, however not all replaced components and materials were disposed of correctly.

Commentary

The candidate applied a sound standard of knowledge and understanding when carrying out fault diagnosis and rectification. Initial interaction with the customer was laboured, not always making eye contact and standing with arms folded but this improved through the task. The candidate asked appropriate questions to help determine the cause of the fault, but they were minimal such as 'who was using the circuit'?

Health and safety procedures were considered prior to the task commencing.

Use of tools and test equipment were effective but on occasions it took more than one attempt. The candidate had to recheck the test leads were correctly inserted to the test equipment as the readings first taken were not as they expected. The rectification of faults follows a logical process and was completed to an acceptable standard with minor errors and with some care given to customers premises.

The T Level is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.