

Apprenticeship Qualification in Building Services Engineering

Safety Critical Tasks (Electrical)

DRAFT

1 Introduction

This document contains the safety critical test for the electrical four-year apprenticeship qualification. The electrical safety critical test comprises of the following timed tasks which must all be successfully achieved for the safety critical test to be passed.

Safety critical area	Task	Time
Safe isolation	01	15 minutes
Connection and termination	05A	3 hours
	05B	9 hours
	05C	1 hour
	05D	2 hours
Inspection and testing	06	4 hours
Fault finding	07	2 hours

(Note that the task numbering is to reflect the relationship to the qualification's units).

The purpose of these defined electrical safety critical tasks is to enable the safe working of the apprentice in the workplace. It will also facilitate the safety of the learner's work after handover – particularly in relation to connection and termination and inspection and testing, affording compliance with BS 7671.

These tasks can be taken over the period of the apprenticeship qualification. Time on each task is finite and cannot be shared between tasks.

Task environment:

The tasks must be taken at the centre under Assessor supervision.

Centre Preparation:

- centres must ensure the appropriate teaching delivery has been satisfied (or undertaken) and that the learner is suitably prepared to undertake each task
- refer to the practical task diagram to establish materials required; tasks 01, 06, and 07 can utilise premade task rigs, part of 05 can utilise a part pre-assembled bay.
- the learner will require a suitable location to carry out the task free from distraction and interruption and under task conditions
- appropriate tools, equipment and materials must be made available to the learner
- for the connection and termination tasks (05 A-D) the learner should only be provided with enough materials and cable to complete the task, however limited additional materials are available on request as per the accompanying notes for each task
- learner instructions will be provided in a learner pack.

Are the tasks graded?

No, they are pass or refer only. They will not contribute to the grade in the qualification.

What are the marking criteria?

These are given with each task marking sheet.

How is the task achieved?

The learner must achieve all the marking criteria on the Assessor's marking sheet.

Can the learner retake the task/s?

Yes, post task feedback and after any appropriate re-training has taken place.

Can the tasks be adapted?

The practical tasks may be adapted in order to accommodate local bay layouts/facilities. Your EQA will be able to assist you with any questions you may have in adapting tasks.

Learners preparation

Learners can refer to the task information in a reasonable timeframe prior to each task to enable them to carry out preparations where required. This can include materials lists and diagrams for the connection and termination tasks. This is to ensure they are prepared for the assessment.

Permitted material

Other than for safe isolation tasks in tasks 01 and 06, learners can utilise their notes/books, such as the IET On-Site Guide, BS 7671 as applicable to reference during the task, and verify test results etc.

DRAFT

01: Safe Isolation

01: Safe Isolation

What does this task cover?

The learner's ability to perform the safe isolation procedure.

Time Allowed: 15 Minutes

Preparation Required:

- Resources required are a safe and appropriate isolation simulator with a socket outlet, a plug-in voltage indicator, warning notice and a circuit breaker lock.
- Learner instructions are provided.

Task Information:

The assessor **MUST** oversee this activity and **MUST** ensure it complies with the centres risk assessment.

The learner must safely isolate the supply to the socket outlet using the lock notice and plug in voltage indicator. The learner is to select the correct voltage indicator from a selection of inappropriate devices, including a neon screwdriver. Refer to the sequence given by Electrical Safety First.

The learner is not allowed reference material for this task.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

01: Safe Isolation

Learner name:			
Date:		Attempt N°:	
<i>Did the learner correctly complete the task covering:</i>		Decision	
		Pass	Refer
Correctly selects approved plug in voltage indicator, and checks for good working order			
Proves indicator function on known live supply			
Isolates main switch and locks off			
Removes and retains key			
Displays warning sign			
Verifies installation de-energised			
Re-proves voltage indicator function on known live supply			
Completes task within allowed time			
Assessor comments:			
Overall result: Pass <input type="checkbox"/> / Refer <input type="checkbox"/> <i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i>			

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

05A: MICC

05A: MICC

What does this task cover?

It assesses the learner's ability to interpret and apply the techniques and methods for the safe and effective termination and connection of cables (MICC).

Time Allowed: 3 hours.

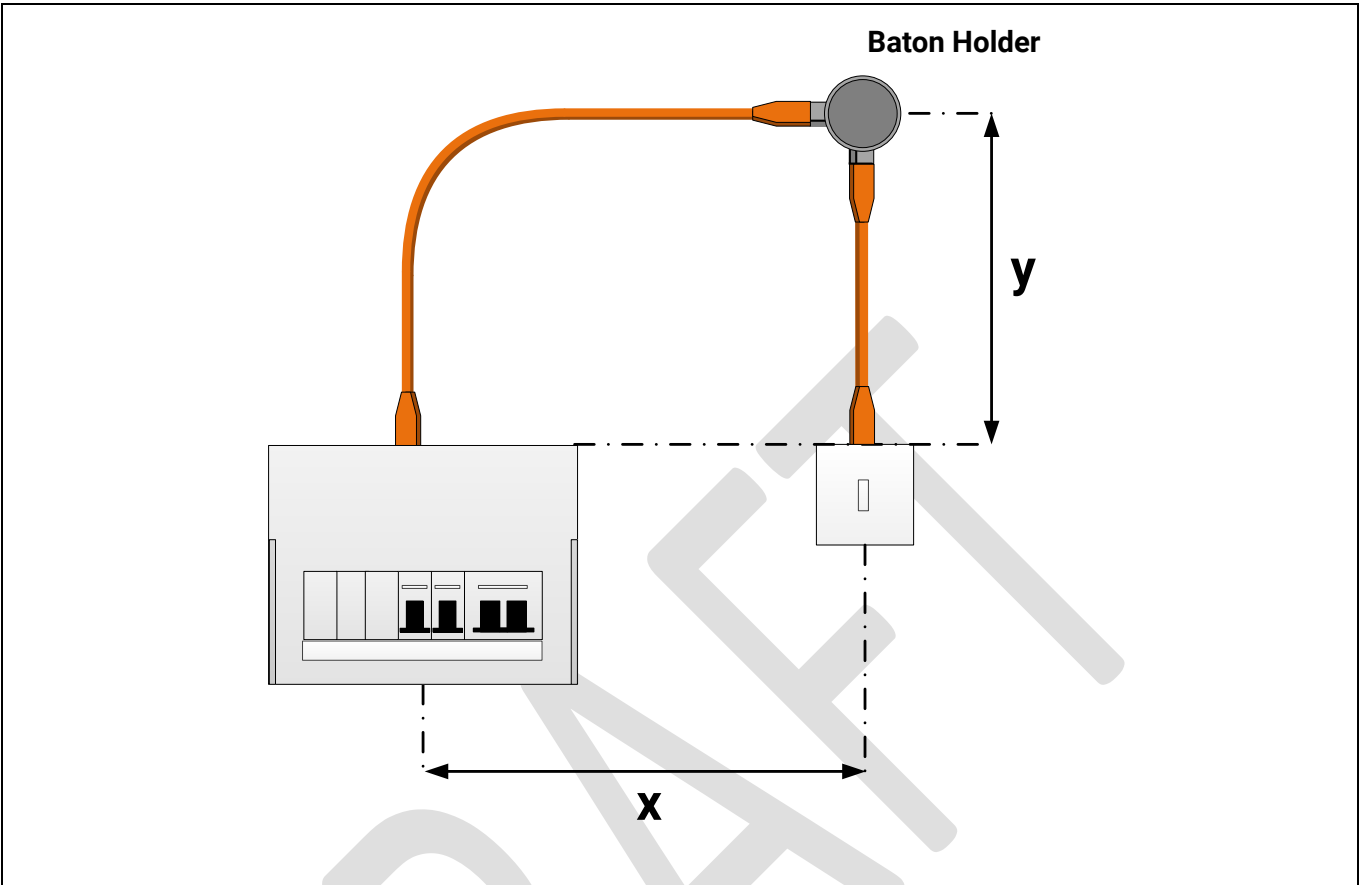
Task Information:

The learner is to refer to the layout diagram and complete a materials list prior to undertaking this task. This part of the pre-task planning is untimed.

The learner should correctly install, terminate, and connect the simple one-way lighting circuit as shown. They will also need to carry out the necessary tests of continuity and insulation resistance and record their results.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

05A: MICC - Drawing



Specification:

Complete a materials list prior to undertaking this task.

1-way lighting circuit. Distance x and y determined by your assessor. Install to a commercially acceptable standard (e.g.: clip positioning, bend formation, glands are fitted correctly, termination pots are correctly sealed). Install in accordance with the IET On-Site Guide and BS 7671. Complete tests to ensure integrity of the installation. Check circuit functions correctly. Tidy up on completion of your work. (Total completion time: 2 hours).

You must work safely at all times.

(Note: Installation may be adapted/modified by your assessor).

Circuit	CPC Continuity Ω	Insulation resistance M Ω			Polarity \checkmark x
		P/N	P/E	N/E	

05A: MICC - Task Marking Sheet

Learner name:		
Date:	Attempt N ^o :	
<i>Did the learner correctly complete the task covering:</i>	Decision	
	Pass	Refer
Materials list detailed and quantified		
Work carried out in a safe manner		
Correct materials selected and used		
All accessories fixed securely		
Cable bends formed to an acceptable standard		
Cable fixed securely		
Cable sheath undamaged		
Glands fitted correctly and securely		
All cable termination pot seals correct		
All circuit conductors sleeved correctly		
Sufficient spare left at terminations		
All terminations electrically and mechanically sound		
All conductors installed neatly at consumer unit		
Correct selection of phase, neutral and CPC terminals at the consumer unit		
Completes insulation resistance and polarity tests and records results		
Completes task within allowed time		
Assessor comments:		
<p>Overall result: (delete as appropriate) Pass / Refer</p> <p><i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i></p>		

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

05B: Composite

05B: Composite

What does this task cover?

It assesses the learner's ability to:

- Interpret and apply the techniques and methods for the safe and effective termination and connection of cables, including the techniques and methods for effective support of cables.

Time allocation: 9 hours. Learners may undertake this assessment over consecutive days. Where this is the case the assessment time is recorded to enable correct allocation of time.

Task Information:

The learner is to refer to the layout diagram and produce a wiring diagram for the lighting circuit only. They should also complete a materials list. This part of the pre-task planning is untimed.

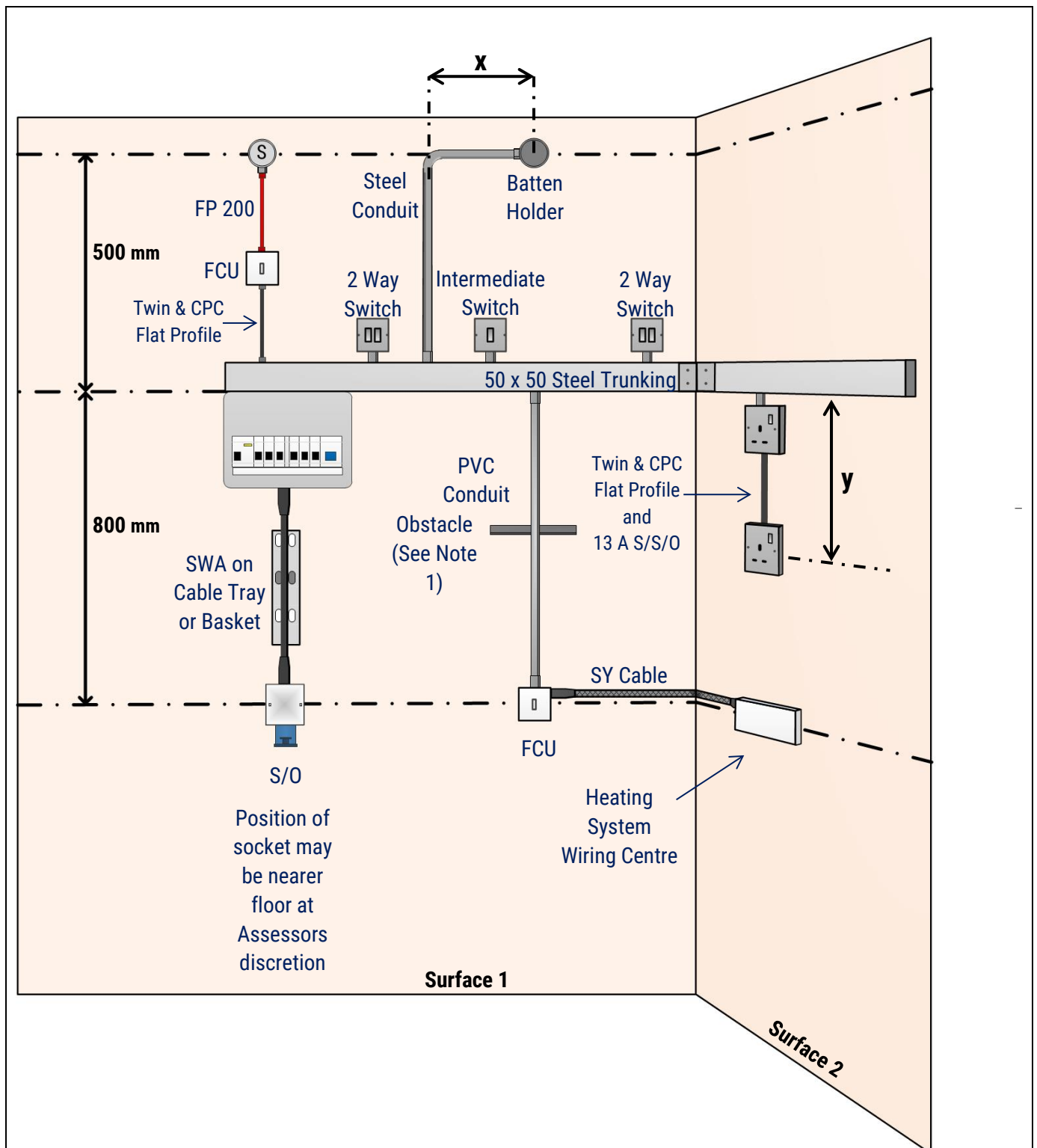
They will have to (within 9 hours) correctly install, terminate, connect, and test the installation as shown in the diagram.

The de-energised tests are for continuity, insulation resistance and polarity. Learners can use their notes/books etc to help them. Some of the items are pre-fixed please refer to the specification provided.

As per note 1 the target distance is 20 mm (+/- 5 mm) clearance of the obstacle. Feedback on this set can be given in the assessor comment section.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

05B: Composite – Drawing



Note 1: Target distance is 20 mm (+/- 5 mm) clearance of the obstacle.

Specification: (Note: Installation may be adapted or modified to fit bays and facilities).

Time allocation: 9 hours.

Circuit	
1	16 A 230 V industrial S/O (BS EN 60309) wired in 1.5mm ² SWA cable
2	6 A Heating system circuit wired in PVC singles in trunking and conduit. Final connection between FCU and wiring system in SY cable
3	20 A Radial circuit to socket outlets. Connection between socket outlets wired in flat profile twin and CPC cable
4	6 A smoke detector circuit wired in flat profile twin and CPC cable (or can use singles in conduit at Assessor's discretion). Final connections from FCU to detector in FP 200
5	6 A circuit to wall mounted luminaire wired in PVC singles in trunking and conduit. Lighting circuit – to be completed as per your circuit design

Install to a commercially acceptable standard. Install in accordance with the IET On-Site Guide and BS 7671. Complete tests to ensure integrity of the installation. Check circuit functions correctly. Use saddles, cleats, and clips as appropriate.

Tidy up on completion of your work.

- All components on surface 1 will be installed into pre-drilled holes in the trunking.
- The following components will be pre-fixed:
 - CCU,
 - trunking on surface 1,
 - obstacle on surface 1,
 - 90° bend in trunking between surfaces 1 and 2.
- Distance x and y to be stated by the Assessor
- Position of 16 A socket outlet may be nearer floor at Assessors discretion – this is to allow enough space for the SWA cable and tray
- Position of heating system wiring centre to be stated by the Assessor
- Other adaptations/modifications may be given by the Assessor in line with local bays and facilities.
- As per note 1 the target distance is 20 mm (+/- 5 mm) clearance of the obstacle.

You must work safely at all times.

05B: Composite – Schedule Test Results for ‘Dead’ Tests

[illegible]

05B: Composite – Task Marking Sheet

Learner name:		
Date:	Attempt N ^o :	
<i>Did the learner correctly complete the task covering:</i>	Decision	
	Pass	Refer
Materials list detailed and quantified		
Produces accurate wiring diagram for the lighting circuit		
Correct materials selected and used		
Work carried out in a safe manner		
All enclosures correctly fabricated (where necessary) and installed		
All circuit protective conductors sleeved		
Minimum insulation removed and conductors undamaged		
Acceptable amount of spare left at terminations		
All terminations electrically and mechanically sound		
All conductors installed neatly in consumer unit		
Correct selection of phase, neutral and CPC terminals at the consumer unit		
Completes CPC, insulation resistance and polarity tests and records results		
Completes task within allowed time		
Assessor comments:		
<p>Overall result: (delete as appropriate) Pass / Refer</p> <p><i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i></p>		

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

05C: Earthing and Protective Bonding

05C: Earthing and Protective Bonding

What does this task cover?

It assesses the learner's ability to:

- Interpret and apply the techniques and methods for the safe and effective termination and connection of cables (single core earthing/protective bonding conductors).
- select suitably sized protective conductors in accordance with BS 7671.

Time Allowed: 1 hour

Task Information:

The learner is to refer to the layout diagram and complete a materials list prior to undertaking this task. This part of the pre-task planning is untimed.

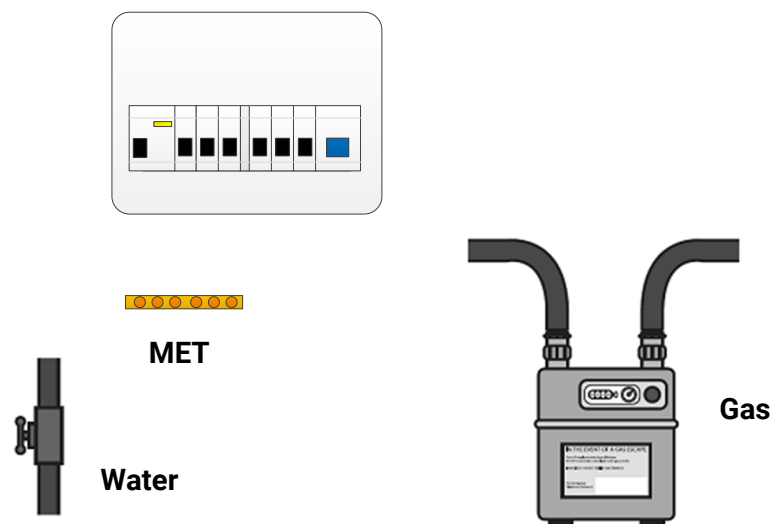
They will then have to select and install cables and clamps and terminate cables correctly. They also must carry out tests for continuity of the protective conductor and record their results.

Learners can use their notes/books etc to help them.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

05C: Earthing and Protective Bonding - Drawing

Actual component position can vary to fit centre requirements.



Test Results	
Bonded service	Continuity of protective conductor test result Ω :
Gas pipe	
Water pipe	

Specification:

Refer to the layout diagram and complete a materials list. You then have 1 hour to carry out the protective bonding of the services. Select and install cables and clamps and terminate cables correctly. Test for continuity of the protective conductor and record your result.

You must work safely at all times.

05C: Earthing and Protective Bonding - Task Marking Sheet

Learner name:		
Date:		Attempt N ^o :
<i>Did the learner correctly complete the task covering:</i>		Decision
		Pass Refer
Materials list detailed and quantified		
Correct materials selected and used		
Work in a safe manner		
Clean pipe at point of bond (if required)		
Bond gas and water services in an appropriate position		
Install earth clamps and labels correctly		
Install cables correctly and terminated conductors electrically and mechanically sound		
Complete tests and record results		
Completes task within allowed time		
Assessor comments:		
<p>Overall result: (delete as appropriate) Pass / Refer</p> <p><i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i></p>		

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

05D: Mini Trunking & Data Cable

05D: Mini Trunking & Data Cable

What does this task cover?

It assesses the learner's ability to:

- Interpret and apply the techniques and methods for the safe and effective termination and connection of cables (data cable) and apply techniques and methods for effective support of cables.

Time Allowed: 2 hours

Task Information:

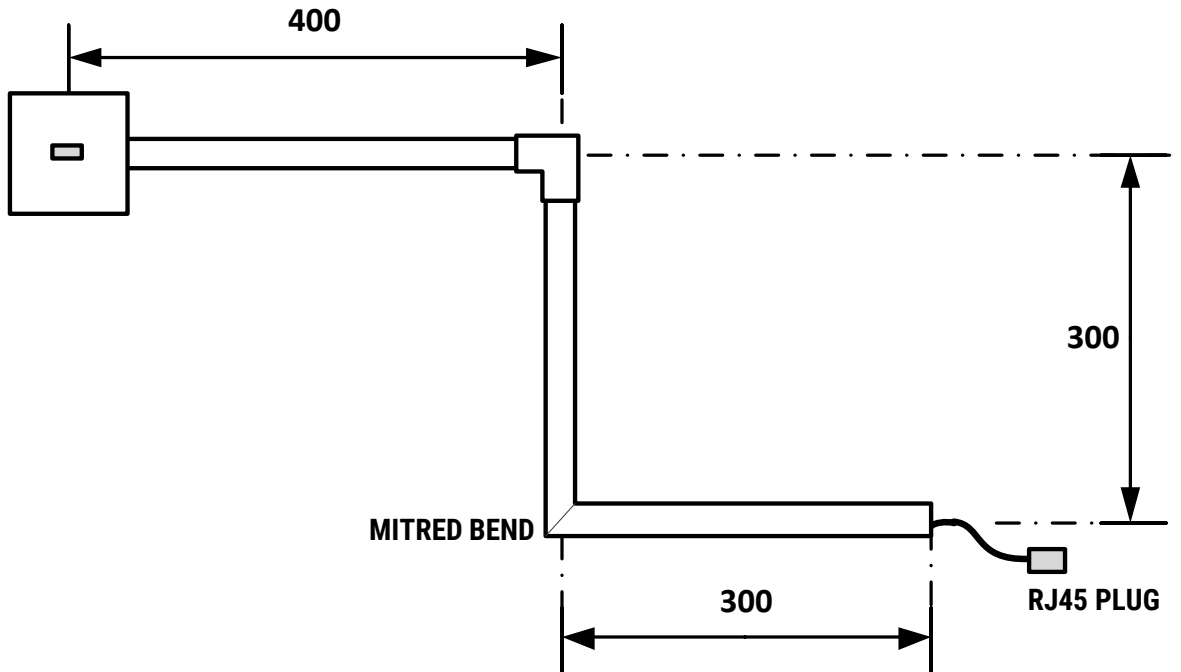
The learner must produce a materials list, and then must install and terminate the data cable installed in mini trunking.

The Assessor will determine if the learner has successfully completed the assignment using the Task Marking Sheet provided.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

05D: Mini Trunking & Data Cable - Drawing

Actual component position can vary to fit centre requirements.



Specification:

Refer to the layout diagram and complete a materials list. You then have 2 hours to carry out the installation. This involves data cable in MT2 mini trunking. Install in accordance with industry practice, BS 7671 and the IET On-Site Guide. Terminate both ends of the data cable into the appropriate terminals. Trunking lid must be fitted.

You must work safely at all times.

05D: Mini Trunking & Data Cable - Task Marking Sheet

Learner name:		
Date:		Attempt N ^o :
<i>Did the learner correctly complete the task covering:</i>		Decision
		Pass Refer
Materials list detailed and quantified		
Correct materials selected and used		
Work in a safe manner		
Install the wiring system and equipment accurately to the specification		
Apply techniques and methods for effective support of cables. <i>Consisting of: all installation secure, installation and bends formed correctly, lid fitted correctly (any gaps to an acceptable limit).</i>		
Apply the techniques and methods for the safe and effective termination and connection of cables <i>Consisting of: cable terminated correctly, sufficient cable length (spare) in enclosures, cable installation mechanically and electrically sound.</i>		
Maintain a tidy and safe work area.		
Completes task within allowed time		
Assessor comments:		
Overall result: (delete as appropriate) Pass / Refer <i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i>		

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

06: Inspect, Test and Commission

06: Inspect, Test and Commission

What does this task cover?

It assesses inspection, testing, and commissioning.

Time Allowed: 4 hours after safe isolation of the rig. Completion of the certificate and schedules can be completed outside of the 4 hours.

Task Information:

The entire rig must be safely isolated upstream of the rig isolator by the Assessor before the assessment begins. Although the rig is de-energised the learner will have to still safely isolate the installation at the consumer unit main switch. **The learner is not allowed reference material for safe isolation and must be able to do this unaided.**

The learner **MUST** be supervised by a suitably instructed and skilled person whilst undertaking this assessment. The assessment must be completed in accordance with the centre's health and safety policy. The learner must not be able to energise the rig.

A rig specification is given on the following page (the same rig as used in Unit 07) which can be adapted locally as long as the range of inspection and tests can be covered.

Please note: the data outlets and the assessors fault switches are not required for this task – they are part of the task for Unit 07.

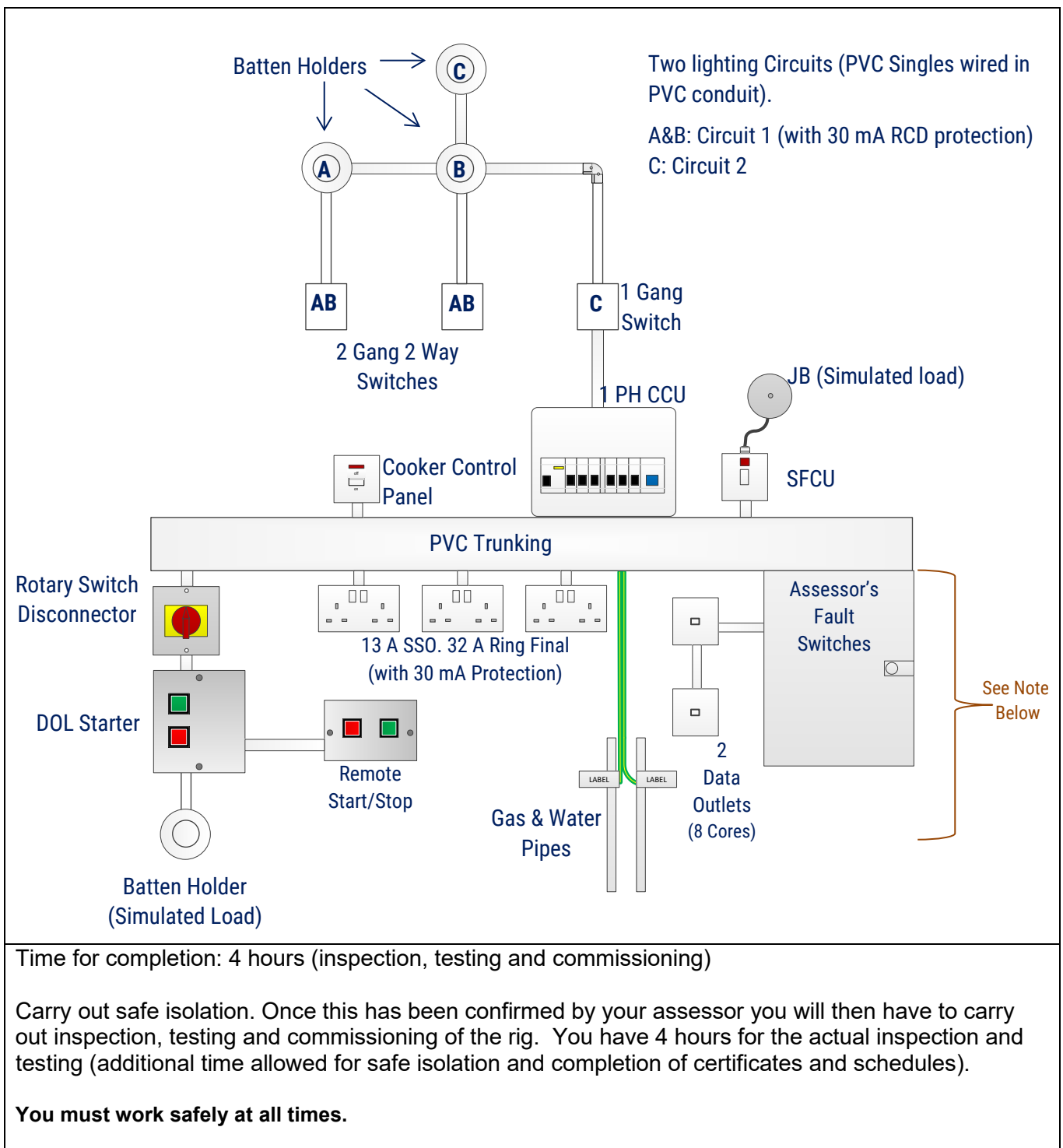
Ensure that simulator is in a prepared and operational state and please note that the starter/isolator should be fitted with a 230 V operating coil.

A circuit schedule should be displayed.

Note: the data outlets and the assessors fault switches are not required for this task – they are part of the task for Unit 07. They are shown on this drawing for convenience to enable a single dual-purpose rig to be built if required. Please let the learner know they are not part of this task.

The learner must observe and comply with health and safety procedures at all times. Failure to do so will result in the task being stopped.

06: Inspect, Test and Commission – Rig Specification



06: Inspect, Test and Commission

Learner name:		
Date:	Attempt N ^o :	
<i>Did the learner correctly complete the task covering:</i>	Decision	
	Pass	Refer
Correctly carry out safe isolation		
Correctly carry out an initial inspection of an electrical installation in accordance with the requirements of BS 7671 & Guidance Note 3.		
Correctly select the test instruments and their accessories for the tests.		
Correctly carry out the range of tests in accordance with BS 7671 and Guidance Note 3.		
Confirm compliance of the rig by verifying test results.		
Correctly carry out the commissioning of circuits, accessories and equipment to confirm functionality.		
Accurately complete a Schedule of Inspections in accordance with BS 7671 and IET Guidance Note 3.		
Accurately complete appropriate documentation in accordance with BS 7671 and IET Guidance Note 3 (Electrical Installation Certificate and Schedule of Test Results).		
Comply with the health and safety requirements of themselves and others within the work location during the initial verifications process.		
Completes the task within given time of 4 hours (additional time allowed for safe isolation and completion of documentation)		
Assessor comments:		
<p>Overall result: Pass <input type="checkbox"/> / Refer <input type="checkbox"/></p> <p><i>A pass will be awarded on the basis that the task criteria have been achieved to a satisfactory standard.</i></p>		

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled): _____

Date: _____

07: Fault Diagnosis and Rectification

07: Fault Diagnosis and Rectification

What does this task cover?

It assesses the learner's ability to: Perform fault diagnosis. Covering:

- Following safe working procedures
- Evaluating and applying appropriate fault diagnosis methods and techniques
- Diagnosing electrical faults using engineering decision making and evaluation of symptoms and findings
- Recommending the appropriate action/s to correct the fault

Time Allowed: 2 hours

Task Information:

A rig specification is given on the following page (the same as used in unit 06) which can be adapted locally if the range of faults can be covered.

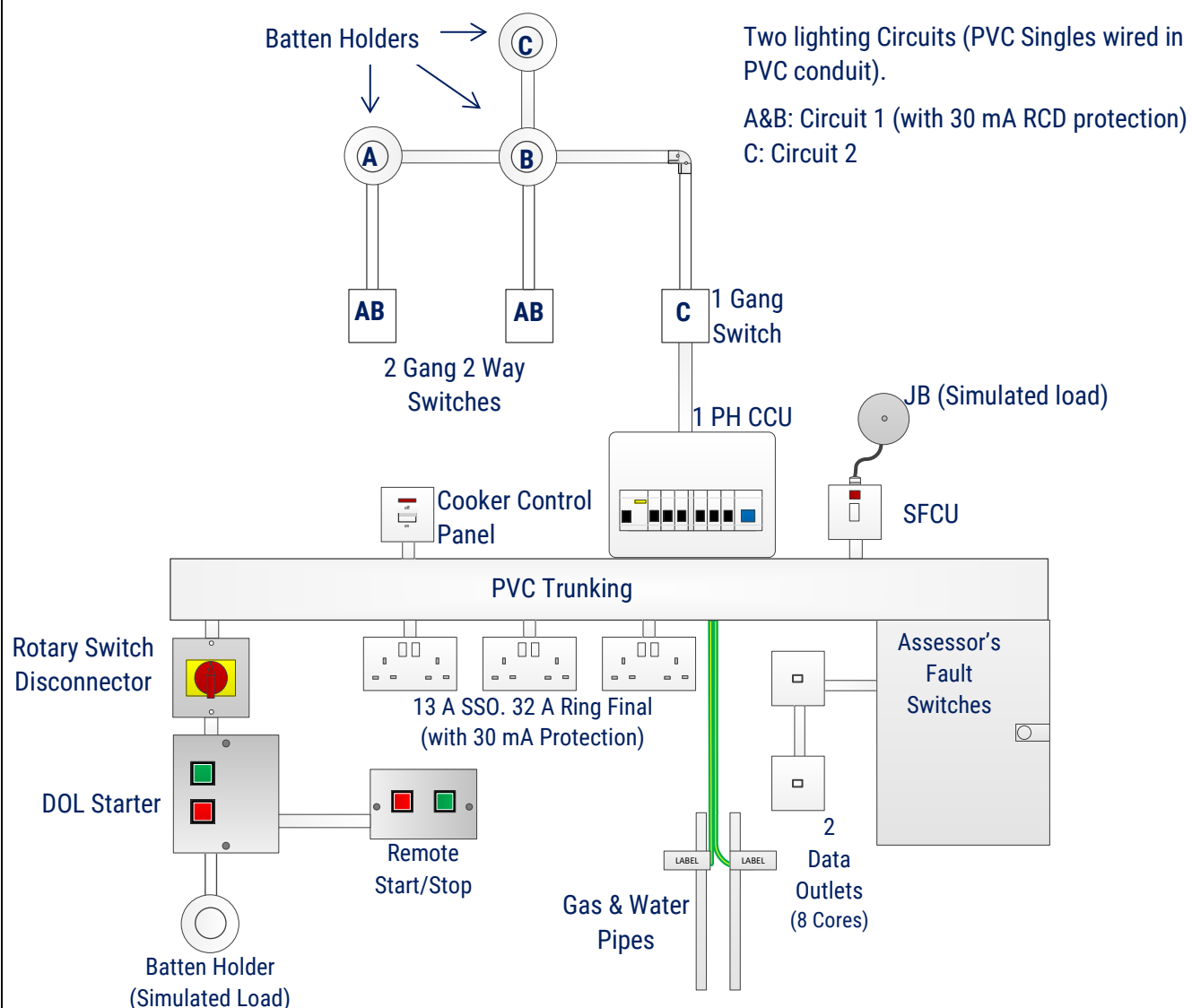
Requirements:

- The six circuit faults shall be selected by the assessor as given in Table 1 (next page).
- The assessor will demonstrate each of these faults clearly to the candidate on the simulation rig.
- The rig is then to be isolated and locked off by the assessor.
- The instruction to the learner is to correctly diagnose the fault and describe the corrective action required. The learner must only be allowed to remove the covers of the specified items of equipment.
- The assessor should record the fault numbers given to each candidate (e.g. A1) in the appropriate part of the learner marking record
- The learner will then have to investigate, diagnose and then recommend corrective action for the fault on the report form

Ensure that simulator is in a prepared and operational state and please note that the starter/isolator should be fitted with a 230 V operating coil.

A circuit schedule should be displayed.

07: Fault Diagnosis and Rectification



Time allowed: 2 hours.

- The simulator will have six defects set by the assessor
- The assessor will explain the types of faults clearly to you on the simulation rig.
- The rig is then to be isolated and locked off by the assessor.
- You must then correctly diagnose the fault and describe the corrective action required. You must only remove the covers of the specified items of equipment.
- You will then have to investigate, diagnose and then recommend corrective action for the fault on your report form.

07: Fault Diagnosis and Rectification

Group A: Open Circuit/Broken Conductor Faults (and Data Faults) – Assessor to Set 1		
Symptom		Cause
A1	The lamp in the batten lamp holder A does not light	Open circuit on switch wire
A2	The lamp in the batten holder does C does not light	‘Broken’ neutral conductor
A3	Client receives electric shock from utility supply pipes	Open circuit on protective bonding conductor
A4	The motor will not start	Broken neutral in the supply to the rotary switch disconnect
A5	Data socket not working	Incorrect wiring at socket / broken conductor
A6	Other open circuit/broken conductor or data cabling fault devised at centre	
Group B: Wiring Faults - Assessor to Set 2		
Symptom		Cause
B1	Other discretionary motor control wiring fault	Incorrect wiring
B2	The motor will run via the start buttons on both the starter and the remote stop/start. However, it will only stop via the stop button on the remote stop/start	The N connections at the stop button inside the starter have both been made to the same terminal, thus effectively bypassing the normally closed button
B3	The lamp in the batten holder A only operates in one position of the two-way switch	Incorrect wiring of the 2-way switching
B4	Other wiring fault devised at centre	
Group C: IR Faults - Assessor to Set 1		
Symptom		Cause
C1	RCD operates constantly for 20 A radial (SFCU) circuit	P-E fault
C2	RCD operates constantly operates constantly for the cooker circuit/lighting circuit/ SO circuit	
C3	Other phase to earth fault devised at centre	
AND: IR Faults - Assessor to Set 1		
Symptom		Cause
C4	Overcurrent protection operates constantly for 20 A radial (SFCU) circuit	Short circuit on circuit conductors
C5	Overcurrent protection operates constantly for the cooker circuit	
C6	Other phase to earth fault devised at centre	
Group D: High Resistance Faults - Assessor to Set 1		
Symptom		Cause
D1	Earth fault to extraneous metal work does not cause CB to operate in time requirements (BS 7671)	High resistance on protective bonding conductor
D2	Burning smell from S/O circuit (Assessor to describe fault symptom)	High resistance on a phase conductor (possibly poor connection/ cable damage)
D3	Other high resistance fault devised at centre	

07: Fault Diagnosis and Rectification - Learner's Report Form

Learner name:	
Date:	Attempt N ^o :
Circuit Defects Found (6 defects must be recorded)	
Nature of Defect	Remedial Action Required
Assessor Fault N ^o :	
Assessor Fault N ^o :	
Assessor Fault N ^o :	
Assessor Fault N ^o :	
Assessor Fault N ^o :	
Assessor Fault N ^o :	
Assessor comments:	
Overall result: Pass <input type="checkbox"/> / Refer <input type="checkbox"/> <i>A pass will be awarded on the basis that all faults are safely and successfully diagnosed in the allowed time of 2 hours.</i>	

Assessor signature: _____

Date: _____

Learner signature: _____

Date: _____

IQA signature (if sampled):

Date:
