Training to Succeed Manual for SkillElectric

The SkillElectric competition is delivered by the registered charity NET (National Electrotechnical Training) who on behalf of the industry own, manage and develop the industry's assessment of occupational competence, the AM2.

This year SkillElectric is generously sponsored by the following industry partners; ECS (Electrotechnical Certification Scheme), Edmundson, Scolmore Group and Di-LOG.

Introduction

This document is a guide for SkillElectric competitors to be used in conjunction with the competition training and development they are receiving from their supporting provider and / or employer for all stages of the competition. It contains technical tips and advice to enable competitors to achieve their full potential and be competition ready.

This manual contains top tips in **bold blue text** and covers two main sections:

Section 1: General Tips – covering areas such as preparation, time management and the competition specification.

Section 2: Technical Guidance – with top tips on the specifics relating to the competition, such as positioning, installation quality, wiring and terminations and inspection and testing.

Section 3: **Pre Competition Activity** – a task outline to prepare learners for what a competition task could look like, in addition to guidance on how marks are awarded and the competition cycle.

Using this document should make a difference by helping you to:

- focus on the basics at a higher level of accuracy
- plan before carrying out any work
- learn to step back occasionally to see if it looks right as per the specification.

You are competing against a high set standard designed to challenge you but it is achievable with the right competition preparation. Remember to pace yourself and enjoy your competition journey.

Section 1 – General Tips

1a. Preparation

Preparation is required in any competition and this includes; technical skill, body and mental training. To succeed at a higher level in any competition, be it Electrical, Formula 1, Football or the Olympics, all have one thing in common – consistent training to be successful:

- keep yourself fit as competition can be physically demanding
- prepare mentally to accept only the best quality work and become a self-critic, understanding your own strengths and weaknesses
- prepare physically to maintain your high level of skill and concentration throughout the competition
- prepare your tool kit and check you have the correct tools for each job. check they are accurate and fit to carry out the task – check levels are correct, measures are clear and saw blades are sharp etc. make sure you know how to use the tools correctly and safely.
- prepare yourself for a noisy and distracting environment – could you do an electrical job in front of the crowd at Wembley on cup final day? at the finals you will have as many people watching you throughout the week
- make sure you keep hydrated and drink at least 2 litres of water per day, starting weeks before the competition to allow your body to get used to that amount of liquid
- eat regularly and wisely throughout the day.

During the competition try not to drink energy drinks or eat energy bars as they give a short burst of energy then this drops dramatically. Go for water and snack on bananas which give a slow, lasting energy release rather

1b. Practice

Practice is required to improve your performance and take your skill to the next level:

- practice all elements of the competition, concentrating on not only your identified weaknesses but also your strengths to help improve your overall performance
- use every opportunity to use your skills and visualise success
- when clearing up on site, providing you have permission to do so keep off-cuts etc to practice with

- get into the competition mind-set and get used to accepting only the highest standard of work from yourself
- practice keeping focused on your work and planned outcome
- practice trusting your decisions and do not be tempted to alter your work after seeing another competitor's work as it may be wrong and yours is correct
- practice laying out your tools and keeping them close to hand. repeatedly walking to and from your toolbox to get what you need costs time that could be critical to your overall score.
- practice creating a time line to complete every job: how long will each task take, after one hour how far should i have progressed etc?
- prepare for a change in your plan especially when you make an error. resolve it if you can and then move on leaving the problem behind and focusing on the task ahead.
- whilst training set up a video camera to record your work so that you can watch it back and see where you can save time and improve your performance further
- make sure that you use the rest room before starting the competition and again during the next break. extra time may not be given so again avoid this if you can as it is time wasted.

Preparation + Practice = High Performance

1c. Specification, Drawing and Time Management

- read the specification and drawing carefully until you have fully understood them and what is required to achieve high marks in the competition
- combine the two documents and create a time line to complete the task within the specified time
- break the task into sections and allocate a time to each. practice this during every task within your normal working day and monitor your accuracy to improve your time estimation.
- monitor your progress throughout the day against your section times
- research with your provider, employer or the competition organising partner questions if you are not sure of something
- make sure that you understand the marking criterion and where the most marks can be gained and what can be forfeited
- plan and do not waste valuable time e.g. why fit the accessories back, when you have to take them off to carry out your test?
- **time is the most important tool you have so use it wisely**
- **read the drawing carefully, noting any special requirements**
- **keep your tools close to hand, so as not to waste time.**

1d. Marking Criteria

SkillElectric is assessed against a set of assessment criteria and in might involves:

Assessment criteria	Maximum marks available
Measuring and marking out	**20**
Cable connections	**25**
Function	**5**
Angles of bends sets and clearances	**12**
Fault Finding	**10**
Testing and inspecting	**10**
Cable clipping	**8**
Health and safety	**10**
Total	**100**

Ensure that you understand the marks weighted against each task for your stage of the competition so that you can plan how to best approach the order of tasks. The standards by which the competition is assessed is also shared with you in the Task Information so ensure that you have read this as minor errors can lead to marks not being gained. The opposite is also true where you can achieve marginal gains from competition preparation and planning.

Section 2 – Technical Tips

In this section we show you the average scores achieved from previous years of competition. The lower the average, the more important it is to pay close attention to what's required to avoid you losing marks. We will outline what's required for each criterion and share some top tips with you so that you can do as best as you can on the day.

2.1 Positioning of Equipment

In the past competitors have lost marks in this category mainly due to not reading the specification correctly and placing accessories in the incorrect position with poor alignment

What's Required:

- correct measurements within allowed tolerance
- correct position of accessories and equipment
- correct levels of accessories horizontal and vertical.

Solutions for Success:

- ensure your measure is accurate and do not use the '0' end of a tape measure (use '10' as your start or preferably use a steel rule).
- read the specification and drawing thoroughly.
- check your tools, measurements and fixings are accurate.
- when you cut, make sure that you leave the line visible on the part you are using rather than cutting on the line (the thickness of the blade may be enough to put you outside the tolerance allowed).
- **have spare batteries for any permitted battery-operated tools**
- **read the measurements on the drawing to know where to place datum lines**
- **don't use a tape measure as the end that's loose may well exceed the tolerance you're working to, use a steel rule**
- **measure twice, cut once.**

2.2 Installation Quality

In the past competitors have lost marks in this category mainly due to poor quality sets and bends in conduit and poor joints in trunking.

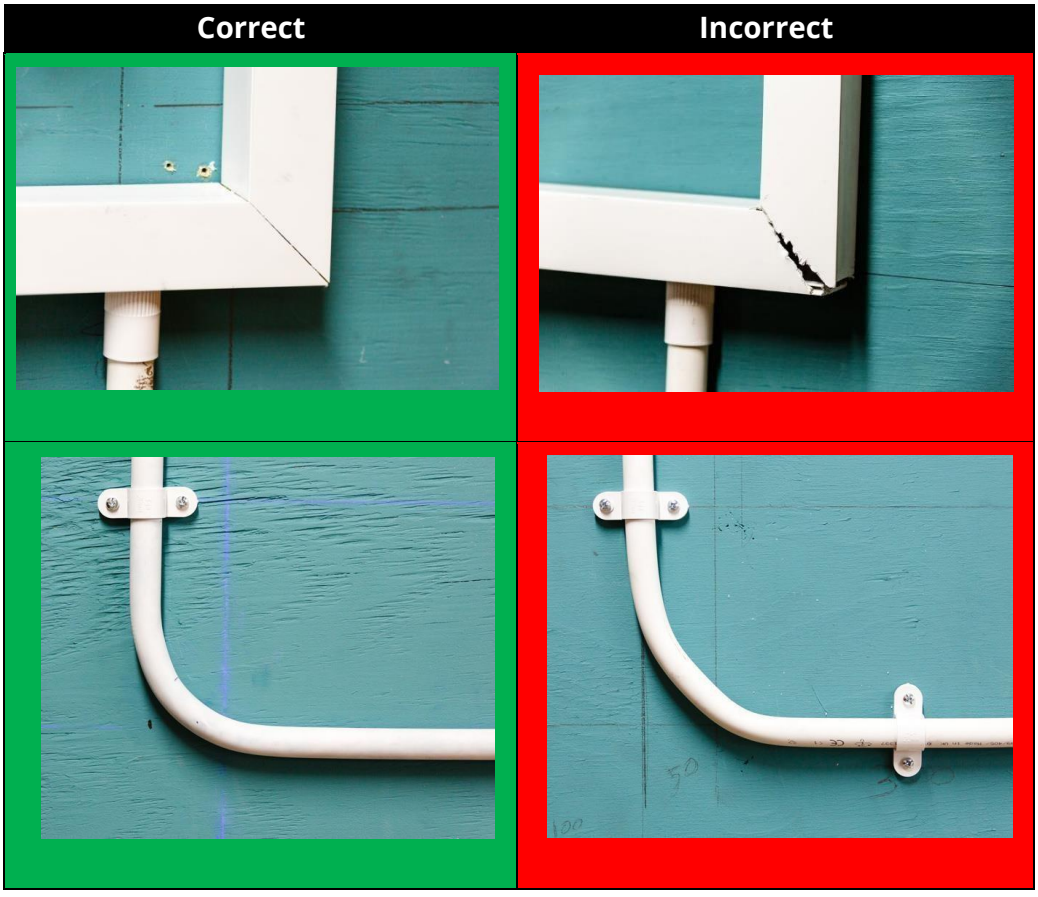
What's Required:

- gaps of less than 1mm on trunking joints and lids
- internal radii of cables and encasement within limitations

- work produced as specified
- conduit sets produced with correct clearance/ angles and no distortion • correct levels of encasement horizontal and vertical.

Solutions for Success:

- practice cutting mitre joints on odd scraps to perfect your joints
- check the on-site guide (osg) (bs 7671) to calculate radius of bends and fixing spacing. draw the radii out, so you get to know what it should look like.
- you should be using recognised standards (bs 7670 2011, electricity at work regulations and health and safety at work act) in your everyday work so you just need to ensure that your work is compliant
- practice using a template for conduit and trunking bends and sets in order to perfect your accuracy with small off-cuts
- check your levels continuously, along with the angle of your bends, to ensure that once installed both horizontal and vertical are correct
- take the greatest of pride in your workmanship before you attend the competition and do not accept second best.



2.3 Wiring and Terminations

In the past competitors have lost marks in this category mainly due to bare conductors visible at terminals and loose connections.

What's Required:

- correct selection and use of cables
- conductors securely terminated withstanding pull test, and no bare conductor showing at any termination when viewed at 90 degrees
- no reduction in cross-sectional area of conductor (scoring by knife etc) and insulation undamaged
- all terminations fitted correctly.

Solutions for Success:

- ensure you use the correct cables as required – see appendix 3 of the on-site guide
- ensure that all connections are tight and terminated correctly, as above
- be careful when stripping cable to ensure you do not cut into the conductor, and be sure that you take precautions not to damage the insulation within the installation.
- ensure that you fit terminations (glands) correctly and tight using all materials provided.

- **pull, test and inspect ever connection**
- **zero test your instrument in front of the judge every time you use it**
- **operate all switches when testing.**

2.4 Inspecting, Testing and Fault Finding

This category is split into two sections:

1. basic safety tests of the project, prior to energising by a judge or authorized person who will witness the tests.
2. a part Electrical Installation Condition Report (EICR) on a purpose built rig with a number of faults inserted, (UK final competition only).

Test instruments will be available, but if you are using your own, which you are advised to do, then make sure they are calibrated prior to the competition.

1. Testing

In the past competitors have lost marks in this category mainly due to not completing the piece within the allocated time and being unfamiliar with Inspection and Testing paperwork

What's required:

- each circuit inspected and tested with results recorded
- continuity of all earth continuity conductors
- insulation resistance
- polarity
- single pole switching in line conductor only (lighting circuits).

Solutions for success:

- always zero your tester before commencing, ensuring the judge is aware
- use test method 2 for continuity, polarity and single pole line switching to avoid any insecure readings
- ensure you test all circuits including the supply inlet.

Only the basic tests, and not a full 18th edition test, are required for this section. Do not waste your time carrying out a full test it gains nothing.

2. Electrical Installation Condition Report (EICR)

In the past competitors have lost marks in this category mainly due to a lack of understanding and failure to record details

This is carried out on a purpose-built test rig which simulates a common domestic installation. The test rig will not be livened, so only dead testing will be required. (UK Final Competition only)

What's required:

- a full visual inspection of the complete test rig installation
- a part eicr dead test of the rig
- a fault-finding inspection and test
- a documented account of the results, including faults found. all test sheets are supplied.

Solutions for success:

- get used to visually inspecting installations whenever you can and identify the faults. keep practicing and it will soon become second nature.
- log every detail as you proceed through the test to ensure that you record everything.
- do not attempt to repair any faults you may find - leave the rig as you find it. you are to report your findings only.

Only two test procedures are used, due to no energising testing:

- continuity resistance
- insulation resistance

- **work through the circuits systematically**

- **keep it in your mind what the test instrument is doing**
- **be aware of any sensitive equipment and disconnect it**
- **make a point of leaning exactly what the test equipment is doing for each test**
- **write it down so you can see what is happening**
- **visualise it in your mind**

2.5 Function

In the past competitors have lost marks in this category mainly due to not completing the task in the allocated time.

What's required:

- the installation is to function, when energised by a judge or authorized person, in compliance with the specification
- there will be nothing in the project that you have not done before within your training, so just relax and think it through.

Solutions for success:

- read and absorb the specification and drawing to ensure compliance
- draw up your time line and monitor it continuously to ensure completion
- check, check and check again to make sure it is correct
- remain focused and do not get distracted

- **use your own test time to ensure correct function**
- **remember to operate all switches to ensure all strappers are tested.**

2.6 Health and Safety

In the past competitors have lost marks in this category mainly due to not complying with competition special requirements

What's required:

- correct personal protective equipment (ppe) used
- safe working methods practiced
- work area kept clean and free of hazards
- correct tools used safely for the job in hand
- complying with the health and safety at work act.

Solutions for success:

- you will be required to wear safety boots/shoes and work trousers whilst you are in the competition area
- you will be required to wear safety goggles/glasses **at all times** (non-tinted)
- the best solution is to get used to wearing them all the time you are in competition (this does not mean on the top of your head, forgotten)
- all of the remainder of health and safety is what you should be practicing every day in the working environment

At all times we will ask competitors:

- to work safely always and take appropriate precautions when working with any tools that have a potential safety hazard
- to wear appropriate personal protective equipment (ppe)
- not carry out any live working
- not to use power tools except a battery-operated drill (preferably not impact)
- to comply with additional competition rules for safety
- **focus on your work but remain aware if your surroundings**
- **electricians clasp knives only. 'stanley' type knives are not allowed**

Conclusion

In a competition one-point can make the difference between achieving a medal position or not. By getting into the correct mind set and putting productive, positive thinking into practice you can improve your performance. Be clear and set goals to achieve within the allocated time. Preparation and practice are the two factors that will make all the difference to your overall performance and score.

In summary:

- prepare your mind and body
- prepare your working practices
- prepare your tool kit
- prepare your approach
- practice your timing
- practice your weaknesses and enhance your strengths
- understand the marking schemes fully and where you can gain more marks or afford to lose minor marks
- never get complacent
- be proud of your work

References

References made in this document can be found at the following sources:

HM Stationery Office – www.legislation.gov.uk

Health and Safety at Work Act
Electricity at Work Regulations

Institution of Engineering and Technology – www.theiet.org

Wiring Regulations BS 7671
Inspection and Testing GN3 BS 7671
On Site Guide BS 7671

I hope that this document supports you to be as prepared as you can be for your competition performance.

Kind regards,

Jennie Phung
Project Manager for SkillElectric

Section 3 – Pre Competition Activity

SkillElectric Pre-Competition Activity

The SkillElectric competition is delivered by the registered charity NET (National Electrotechnical Training) who on behalf of the industry own, manage and develop the industry's assessment of occupational competence, the AM2.

SkillElectric has been designed to reflect the role of an Electrical Technician and the standards that are expected within the electrical industry. Each year SkillElectric is the search for the UK's best young electrician and the premier skills competition for the UK's electrical industry. The best electrical

apprentices and newly qualified electricians from across the UK take part in the National Qualifiers to win a place in the competition's grand UK Final.

SkillElectric is generously sponsored by the following industry partners; ECS (Electrotechnical Certification Scheme), Edmundson and Scolmore Group.

Overview

This guidance document will help you to identify your most suitable individual(s) to register for the regional competition using the simple steps below:

Step	Suggested task
1	From December to Spring 2021 use the **Talent Spotting Checklist** to identify those who have the potential and attributes to meet the competition standards as set out in the **Core Competencies** for each relevant stage of the competition
2	It is also strongly encouraged that you use the **Pre-Competition Activity Task** and **Marking Guide** to run your own in-house competition and introduce the group to competition activity as part of their professional development. Register your identified competitor on the **WorldSkills UK** website (Spring 2021)
3	Prepare your competitor by using the **Training to Succeed Manual** alongside your own development techniques
4	Compete in one of the National Qualifiers taking place at your local college, training centre of employer premises, or, online, you will work on a test piece for a maximum of 4 hours
5	If you are successful you will be invited to compete at the UK Final
6	Prepare your competitor by using the **Training to Succeed Manual** alongside your own development techniques
7	Compete at the live UK Final at Birmingham NEC, November 2021

Talent Spotting Checklist

This list identifies the ideal personal attributes we are looking for in a potential competitor. Please use this to identify your most appropriate candidate to enter the competition. It would be ideal if they have as many of these personal attributes as possible.

Competitor name..... **Date.....**

College and campus.....

	Please tick
Has achieved S/ NVQ level 2 and is either working towards or has completed level 3	☐
Has a supportive employer	☐
Can work well under pressure	☐
Has a high level of ability and flexibility	☐
Good communication and interpersonal skills	☐
Self-motivated and can self-reflect	☐
Has a good level of practical skills and knowledge	☐
Uses theoretical knowledge to its full potential	☐
Consistent high performer in the work place and/ or at college	☐
Can adapt to different working environments	☐
Is accurate in measurements	☐
Possesses mental and physical stamina	☐
Able to assess task and plan before they act	☐
Good time management and can work to a tight time schedule	☐
Self confident, but not over confident	☐

Core Competencies

The table below clearly lists the core competencies and the expected standards at each stage of the competition journey for the SkillElectric competition, starting from the Regional Qualifiers through to world class international standards.

	Passive / Qualifiers	National Final	WSI/ Team UK
Health and Safety			
Tidy work area	Yes	Yes	Yes
Correct PPE being used for task	Yes	Yes	Yes
Safe working practices being observed	Yes	Yes	Yes
Safe isolation of electrical supply	Yes	Yes	Yes
Theory knowledge	No	Yes	Yes
Positioning			
Mark horizontal and vertical datum lines	Yes	Yes	Yes
Correctly position electrical components in relation to the given drawings	Yes	Yes	Yes
Ensure all equipment is fitted level	Yes	Yes	Yes
Wiring and Terminations			
Correctly select the type and size of cable	Yes	Yes	Yes
Correctly fit and secure cable glands	Yes	Yes	Yes
Correctly and securely terminate conductors	Yes	Yes	Yes
Quality			
Install cable containment to industry standards	Yes	Yes	Yes
Correctly support cables with clips or cleats where required	Yes	Yes	Yes
Correctly install cables within containment	Yes	Yes	Yes
Inspection and Testing			
Correctly carry out the following tests:			
1. Continuity	Yes	Yes	Yes
2. Insulation resistance	Yes	Yes	Yes
3. Earth fault loop impedance	No	Yes	Yes
4. RCD operation	No	Yes	Yes
5. Continuity	Yes	Yes	Yes
Function			
Installation operates as specified	Yes	Yes	Yes

Pre-Competition Activity Task

This task is designed to be used as an in-house competition from which you can identify your most suitable learners/ employees to register for the SkillElectric competition.

The competitors are expected to:

- comply with all health and safety legislation and requirements for the competition
- install the competition piece to industry standards in a safe and orderly manner
- eye protection must be worn for all drilling and cutting
- complete the exercise with the materials provided
- work to the dimensions included on the diagram with a tolerance of +/- 4mm
- determine all necessary wiring for the correct installation and operation of equipment as described in the specification
- carry out dead electrical safety tests and record your readings on the test results sheet to prove the installation is safe to energise prior to requesting live testing.

Materials

Please supply all the tools and equipment for which to complete this task including; hand tools, test equipment, bending springs, cutting blocks, handsaws, draw tapes, spare blades etc. Competitors can use their own tools if they prefer. Below is the suggested materials list you will require per competitor:

Material	Quantity
Metal clad 4-way DB	1
6A MCB	1
16A MCB	2
MCB Blank	1
2 gang 2-way switch	1
2-way switch	1
Switch pattress PVC with 20mm knockout	2
13A fused connection unit	1
Pattress for above with 20mm knock out	1
Metal clad socket outlet with backbox	1
20mm PVC conduit tee box	2
20mm PVC conduit angle box	1
20mm PVC conduit end box	1
Batten lamp holder	2

20mm PVC conduit	3 metres
20mm conduit saddles	6
2.5mm T&E PVC/ PVC	3 metres
2.5 clips	10
2.5mm 3core SWA	3 metres
20mm SWA glands	2
SWA cleats	8
PVC conduit box lids	2

We suggest that you set a time limit by which to complete the task by which is a PVC conduit, PVC/ PVA and a SWA installation with the following 2 circuits:

Circuit 1: 20A radial circuit feeding a switched fused connection unit (CU1) wired in PVC/ PVC insulated cable.

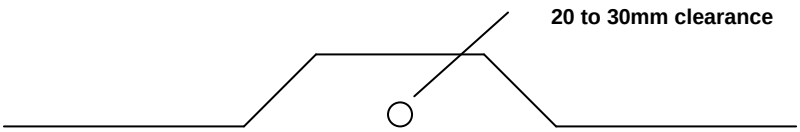
Circuit 2: 20A general power circuit feeding one single metal clad switch socket outlet (S01) wired in 2core SWA cable.

Key for diagrams

DB1 Metal clad consumer unit
LT1 BC baton lamp holder
LT2 BC baton lamp holder
SW1 1 gang 2-way light switch
SW2 2 gang 2-way light switch
SO1 13A single metal clad switched socket outlet
CU1 13A switched fused connection unit

Note 1

The PVC conduit must bridge an obstruction (20mm PVC conduit) using a double set with a minimum clearance of 20mm and a maximum clearance of 30mm.

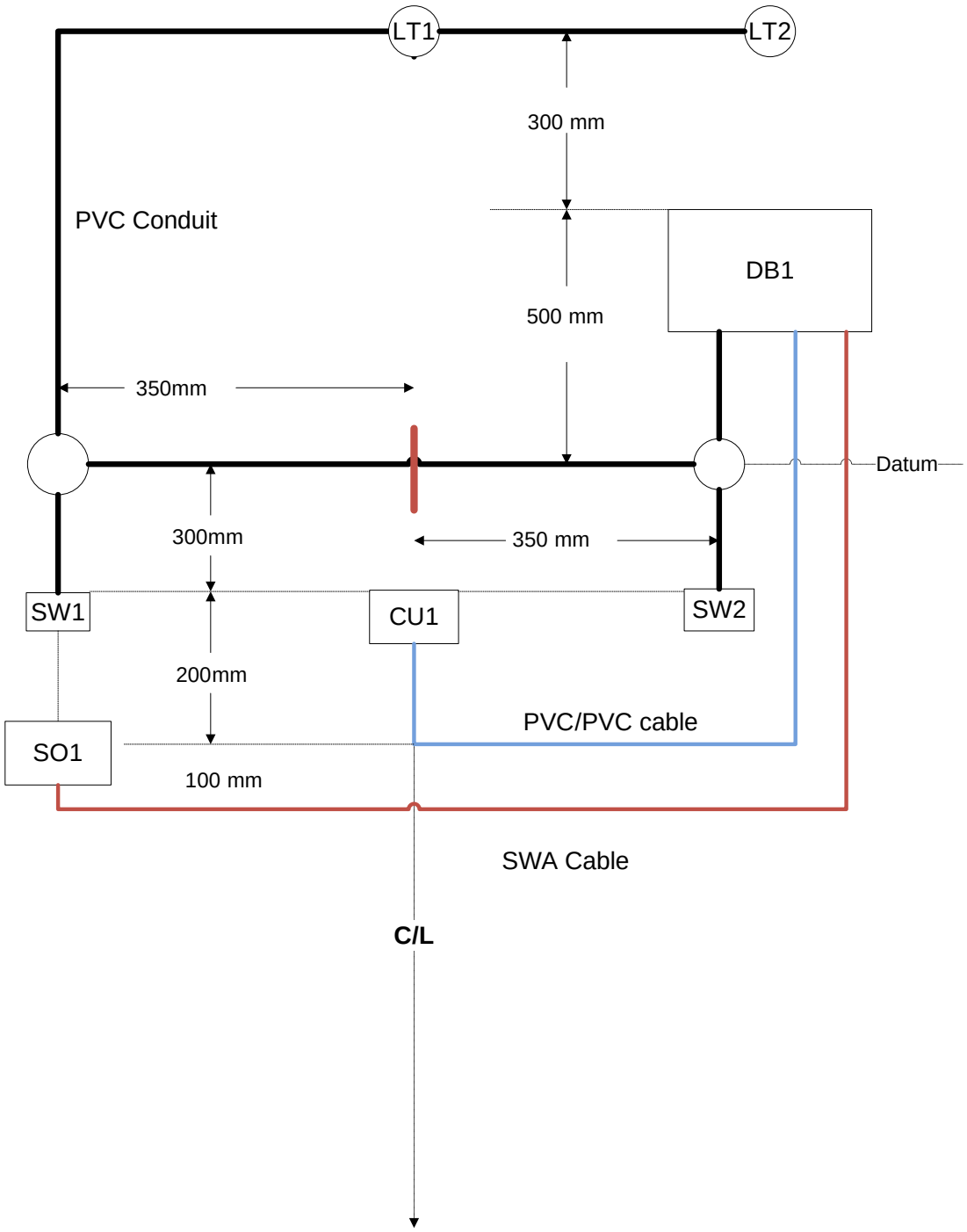


Note 2

3 core flex and 13A plugtop to be supplied by college for connection to supply using trailing socket.

Electrical Installation Practical Assessment

2018


LT1
LT2
300 mm
PVC Conduit
DB1
500 mm
350mm
Datum
300mm
350 mm
SW1
CU1
SW2
200mm
PVC/PVC cable
SO1
100 mm
SWA Cable
C/L

Marking Guide for Pre-Competition Activity

Competitor name..... **Date.....**

College and campus.....

Aspect ID	Description	Maximum mark allocated	Mark awarded
A1	CU1 circuit completed in the correct cable as per the specification	**1**	
A2	SO1 circuit completed in the correct cable as per the specification	**1**	
A3	LT1 and LT2 circuit completed in the correct cable as per the specification	**1**	
A4	Conductors securely terminated at DB1 with no exposed copper when viewed at 90 degrees. Pull test on all terminations. No damage to insulation or reduction in conductor CSA (1 mark per circuit to include supply)	**3**	
A5	SWA gland terminated correctly (1 mark per gland)	**2**	
A6	Conductors securely terminated at CU1 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	
A7	Conductors securely terminated at SW1 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	
A8	Conductors securely terminated at SW2 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	
A9	Conductors securely terminated at SO1 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	
A10	Conductors securely terminated at LT1 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	

A11	Conductors securely terminated at LT2 with no exposed copper when viewed at 90 degrees. No damage to insulation or reduction in conductor CSA. Pull test on all terminations	**2**	
A12	CPCs and Neutral conductors connected in correct sequence at DB1 for all circuits (1 mark per circuit and 1 mark for Earthing conductor)	**3**	
	Total marks for A	**23**	

Aspect ID	Description	Maximum mark allocated	Mark awarded
B1	PVC conduit bridge set and offset acceptable as per specification and drawing	**3**	
B2	PVC conduit bend acceptable and inner radius at least 2.5 times outside diameter of the conduit	**3**	
B3	PVC/ PVC cable securely clipped horizontally and vertically. Bending radii satisfactory	**3**	
B4	SWA cable securely clipped horizontally and vertically. Bending radii satisfactory	**3**	
B5	Additional material used **(-1 mark for each item issued)**	**0**	
	Total marks for B	**12**	

Aspect ID	Description	Maximum mark allocated	Mark awarded
C1	DB1 level, centred horizontally and vertically within 2mm of measurements taken from datum lines (500mm)	**1**	
C2	LT1 centred, horizontally and vertically within 2mm of measurements taken from datum lines (350mm and 1000mm)	**1**	
C3	LT2 centred horizontally and vertically within 2mm of measurements taken from datum lines (1000mm)	**1**	
C4	SW1 level, centred horizontally and vertically within 2mm of measurements taken from datum lines (350mm and 300mm)	**1**	
C5	SW2 level, centred horizontally and vertically within 2mm of measurements taken from datum lines (350mm and 300mm)	**1**	

C6	centre of set within 2mm of measurements taken from datum (500mm)	**1**	
C7	SO1 level, centred horizontally and vertically within 2mm of measurements taken from datum lines (350mm and 800mm)	**1**	
C8	CU1 level, centred horizontally and vertically within 2mm of measurements taken from datum lines (300mm)	**1**	
C9	PVC/ PVC cable horizontal and vertically within 2mm of measurements taken from datum line (500mm)	**1**	
C10	SWA cable horizontal and vertically below datum lines within 2mm of measurements (1000mm)	**1**	
	Total marks for C	**10**	

Aspect ID	Description	Maximum mark allocated	Mark awarded
D1	Personal protective equipment used at all times	**1**	
D2	Work area kept free from hazards at all times	**1**	
D3	Safe working practices employed when using hand tools	**1**	
D4	No faults or dangers found when work tested	**1**	
D5	Due consideration to others safety demonstrated	**1**	
	Total marks for D	**5**	

Aspect ID	Description	Maximum mark allocated	Mark awarded
E1	Correctly carries out continuity testing on each circuit	**3**	
E2	Correctly carries out insulation resistance testing on each circuit	**3**	
E3	Correctly carries out polarity testing on each circuit	**3**	
E4	Correctly completes schedule of test results for each circuit	**3**	
	Total marks for E	**12**	

Aspect ID	Description	Maximum mark allocated	Mark awarded
F1	CU1 functions correctly	1	
F2	SO1 functions correctly	1	
F3	LT1 functions correctly	1	
F4	LT2 functions correctly	1	
	Total marks for F	4	

Total marks awarded for Pre-Competition Activity	

Pre-Competition Activity assessed by:

Name:..... **Date:**.....

I hope that this document supports you to identify your most suitable candidate to register for the Regional Qualifiers and to be as prepared as they can be for live competition activity. If you have any further queries relating to the competition please do not hesitate to contact me.

Kind regards,

Jennie Phung
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