TRAINING TO SUCCEED

Training Manual for SkilleLECTRIC UK Finalists

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TRAINING TO SUCCEED
Training Manual for SkillELECTRIC UK Competitors

Introduction

The aim of this manual is to help competitors prepare for the SkillELECTRIC UK Competitions and perform to the best of their ability during the event. It contains technical tips and advice to enable competitors to achieve their full potential. By working through this manual, alongside the ‘WSUK Preparation Toolkit’, you can ensure you’re competition-ready from Day 1 of the competition.

This manual contains 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 & testing.

Using the tips and advice in this Training Manual should make a difference by helping you to:

- Focus on the basics at a higher level of accuracy.
- Look more at thinking before doing.
- Step back occasionally to see if it looks right – if it does look right it will be pretty close.
- Look at the drawing then your layout – do they look the same?

Remember it’s not a race – you are competing against a standard a very high standard, but a standard that is achievable.

1) General non – technical tips

1.1 Preparation

Preparation is required in any competition and this includes 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: training, training and training to be successful.

- Keep yourself fit.
- Prepare mentally to accept only the best quality work and become a self-critic, highlighting your own strengths and weaknesses.
- Prepare physically to maintain your high level of skill and concentration throughout the competition.
- Prepare your tool kit to check you have the correct tools for the job. Check they are accurate and fit to carry out the task (check levels are correct, measures are clear and saw blades are sharp). 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 – 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 – and have a good breakfast.
• Arrive at the event in plenty of time to avoid rushing around.

1.2 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 - be it sitting in a waiting room (visual inspection of installation) or cleaning up on site. Keep off-cuts etc. to practice with, providing you have permission to do so.
• Get into the competition mind-set and get used to accepting only perfect work from yourself.
• Practice keeping focused on your work, without allowing your mind to stray.
• Practice trusting your decisions and do not be tempted to alter your work after seeing other people’s work. Theirs may be wrong and yours is correct (it has happened in the past).
• Practice keeping your tools close to hand and not having to walk backwards and forwards to get them (this costs vital time that could be critical).
• Practice creating a time line to complete every job: how long will it take? After one hour how far should I have progressed?
• Prepare for a change in plan – especially when you make an error. Re-plan quickly and move on, leaving the problem behind.
• Whilst training set up a video camera to record your work – watch it back and see where you can save time and improve your performance.
• Make sure you have completed tasks before breaks – stopping and starting in mid-task causes bigger problems.
• Make sure that you use the rest room before starting work and visit again during next break. No time allowance is given for an unplanned toilet visit so avoid it, as it’s vital time wasted.

PRACTICE! PRACTICE! PRACTICE!

PREPARATION + PRACTICE = PREMIER PERFORMANCE

Top Tips

• Don’t drink energy drinks – they give a short energy burst then you’ll drop dramatically
• Eat bananas rather than energy bars – they give a slow, lasting energy release rather than a quick boost.
1.3 **Specification, Drawing and Time Management:**

- Read the specification and drawing carefully until you have absorbed them fully.
- 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 estimation.
- Monitor your progress throughout the day against your section times.
- Ask questions if you are not sure.
- Make sure that you understand the marking criterion.
- Use marking criterion when planning/problem solving to minimise point loss.
- Do not waste valuable time. For example, why fit the accessories back, when you have to take them off to carry out your test?

Reading and fully understanding what is required is vital if you want to achieve high marks in the competition.

**TIME IS THE MOST IMPORTANT TOOL YOU HAVE, SO USE IT WISELY AND DO NOT WASTE A SINGLE SECOND - OR IT MAY COST YOU A MEDAL!!**

1.4 **Marking Criteria for Electrical Installation**

Every competition is judged by a marking criteria, and yours is as follows:

- Positioning of Equipment
- Installation Quality
- Wiring and Terminations
- Inspecting and Testing/Fault finding
- Function
- Health and Safety

**What is expected?**

You will be required to install single insulated cables contained within trunking and conduit, with various sets and bends that you will be required to make. Surface mounted cables of various types may also be used to supply:

- Domestic and commercial power circuits
- Domestic and commercial lighting circuits
- A simulated three phase motor circuit with remote stop/start buttons

The following could be included:

- Central heating system control
- Door entry system
- Lighting control systems

Whatever the requirements, you will be made fully aware of the task prior to the competition.
2) Technical Guidance

In this section we show you the average scores from previous years for each competition marking area, so you can see how highly past competitors have scored. The lower the average, the more you can see it’s really important to pay close attention to what’s required, to avoid you losing vital marks.

Here we outline what’s required for each area and also Top Tips to ensure you do as best as you can.

2.1 Positioning of Equipment

<table>
<thead>
<tr>
<th>Average scores in past competitions</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% 80% 58% 78%</td>
<td></td>
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</tr>
</tbody>
</table>

100% of finalists lost marks in this category (mainly due to not reading the specification correctly and placing accessories in the incorrect position)

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).

2.2 Installation Quality

<table>
<thead>
<tr>
<th>Average scores in past competitions</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>73% 58% 66% 64%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

97% of finalists 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

<table>
<thead>
<tr>
<th>Average scores in past competitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>87%</td>
</tr>
</tbody>
</table>

75% of finalists lost marks in this category
(mainly due to bare conductors visible at terminals)

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.

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.

Project Test

<table>
<thead>
<tr>
<th>Average scores in past competitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>97%</td>
</tr>
</tbody>
</table>

73% of finalists lost marks in this category
(mainly due to not completing the piece within the allocated time)
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 17th edition test, are required for this section. Do not waste your time carrying out a full test - it gains nothing.

**Electrical Installation Condition Report (EICR)**

<table>
<thead>
<tr>
<th>Average scores in past competitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
</tr>
<tr>
<td>36%</td>
</tr>
</tbody>
</table>

95% of finalists 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 - see Appendix B.

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.
- You are again advised to use test method 2 (See ‘Inspection & Testing’ Guidance Notes 3 – page 10 tells you where to access this document).
Only two test procedures are used, due to no energising testing:

- **Continuity resistance** (test method 2)
- **Insulation Resistance**

### 2.5 Function

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>89%</td>
<td>40%</td>
<td>91%</td>
<td>67%</td>
</tr>
</tbody>
</table>

44% of finalists 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.

### 2.6 Health and Safety

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>98%</td>
<td>89%</td>
<td>100%</td>
<td>89%</td>
</tr>
</tbody>
</table>

19% of finalists 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 (non-tinted) whilst you are cutting, filing, drilling, stripping Steel Wire Armoured (SWA) cable and whenever you are using the battery drill, for whatever purpose.
• 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.

Bad health & safety not only costs points, it could cost a life

3 Conclusion

In conclusion you can see that by getting into the correct way of thinking and putting that productive, positive thinking into practice, you can improve your performance by setting goals and setting your time line to achieve them.

Do not accept second best from your work effort and you will not have to accept second best in competition. Preparation and practice are the two factors that will make all the difference to your performance.

Tip: One point can make the difference between achieving a medal position or not. We know it is hard work and time consuming, but with your dedication to training the sky really is the limit it is just how far you want to go. Whatever your dreams, by doing this competition, you will improve your skills to a better level than you were at before taking part.

• PREPARE YOUR MIND AND BODY
• PREPARE YOUR WORKING PRACTICES
• PREPARE YOUR TOOLKIT
• PREPARE YOUR APPROACH
• PRACTICE YOUR TIMING
• PRACTICE YOUR WEAKNESSES
• PRACTICE YOUR STRENGTHS
• NEVER GET COMPLACENT
• GET PROUD OF YOUR WORK

With the competition on your CV it could make the difference between you or another applicant getting your dream job!

Good luck on your journey through competition and life. With your approach to perfecting your skill and trained focus, you will no doubt achieve more than if you had not participated and you will be a credit to your trade and yourself.

Good luck!
References
References made in this training manual 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 7670 (2011)
Inspection and Testing GN3 BS 7670
On Site Guide BS 7671
Appendix A: Data used to support Guidance

The data from previous national competitions shows that overall improvement took place in 2012, but fell back in 2013. The evidence clearly shows that all areas require improvement. 2014 featured new fault finding test rigs that highlighted a weakness in competitor fault finding techniques

Competitors are able to install the project but are not:

- Planning their time line to complete the work
- Checking that containments are plumb and level
- Carrying out the works to the higher standard in conjunction with time management.

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<table>
<thead>
<tr>
<th>Areas of Assessment</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - Function</td>
<td>67%</td>
<td>40%</td>
<td>89%</td>
<td>91%</td>
</tr>
<tr>
<td>B - Wiring Installation</td>
<td>78%</td>
<td>79%</td>
<td>69%</td>
<td>87%</td>
</tr>
<tr>
<td>C - Testing</td>
<td>96%</td>
<td>90%</td>
<td>64%</td>
<td>97%</td>
</tr>
<tr>
<td>D - Quality</td>
<td>64%</td>
<td>66%</td>
<td>73%</td>
<td>58%</td>
</tr>
<tr>
<td>E - Positioning</td>
<td>76%</td>
<td>80%</td>
<td>84%</td>
<td>58%</td>
</tr>
<tr>
<td>F - Health &amp; Safety</td>
<td>93%</td>
<td>100%</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>G - Inspection &amp; Test</td>
<td>72%</td>
<td>62%</td>
<td>55%</td>
<td>36%</td>
</tr>
<tr>
<td>Overall</td>
<td>74%</td>
<td>76%</td>
<td>74%</td>
<td>81%</td>
</tr>
</tbody>
</table>
Appendix B: Test Sheet

### SCHEDULE OF TEST RESULTS

<table>
<thead>
<tr>
<th>Competitor</th>
<th>Type of Supply: TNS / TNCS (Delete as necessary)</th>
<th>Test Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date</td>
<td>Ze at origin: 0.41 ohms</td>
<td>Continuity and Insulation</td>
</tr>
<tr>
<td>Signature</td>
<td>PFC: 0.585 kA</td>
<td>Serial Number</td>
</tr>
</tbody>
</table>

#### Description of work - Initial inspection

<table>
<thead>
<tr>
<th>Circuit Description</th>
<th>Overcurrent Protection</th>
<th>Wiring Conductors</th>
<th>TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BS Type Rating line cpc</td>
<td>R1 + R2 R2 R1 - Rn R1 - R2</td>
<td></td>
</tr>
</tbody>
</table>

#### Description of work - Recording findings

<table>
<thead>
<tr>
<th>TEST RESULTS</th>
<th>REMARKS AND FAULTS FOUND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location circuit No</td>
<td>Description</td>
</tr>
</tbody>
</table>

Judges comments:

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