

Candidate Handbook answers

ELTK 01: Understanding health and safety legislation, practices and procedures

Page 24: Progress check

1. List some of the key responsibilities that both employers and employees have placed upon them by the Health and Safety at Work Act 1974.

Answers may include:

Employer

- **Provision of Health and Safety Policy**
- **Carry out risk assessments**
- **Provide instruction and training**
- **Provide adequate and appropriate PPE**

Employee

- **Take reasonable care for health and safety of themselves and others affected by their actions**
- **Co-operate with employers on health and safety matters**
- **Bring to the employers attention any situation regarded as a serious and imminent danger**
- **Not interfere with or misuse anything provided for health and safety**

2. What are the main risks to operatives covered by the Electricity at Work Regulations 1989 and what is normally done on site to ensure those risks are minimised?

Answers should include:

- **Dangers associated with working near electricity, principally electric shock and/or burns.**
- **Supplies utilised at reduced voltages for safety.**
- **Safe isolation of circuits to be worked upon**

3. Manual Handling Operations Regulations 1992 guidance should be following when deciding whether a load should be handled or not. What are the three main steps the Regulations set out?

Answers should include:

- **Avoid manual handling likely to involve a risk of injury**
- **Assess all manual handling operations that cannot be avoided**
- **Take steps to reduce the risk of injury during manual handling to a minimum**

4. Which regulations are most appropriate in setting out the requirements for working at heights? What should duty holders do where work at heights is unavoidable?

The most appropriate regulations are the Working at Heights Regulations 2005 (amended 2007).

Duty holders should ensure working at height is:

- properly planned and organised
- taking account of weather conditions that could endanger health and safety
- carried out only by operatives who are trained and competent
- located safely
- only using appropriately inspected equipment
- controlling any risks from fragile surfaces
- controlling any risks from falling objects.

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1. Following a fatal accident on site, which agency would be involved with the investigation and what powers do they have? What range of penalties could be applied?

The agency that should be involved is the Health and Safety Executive (HSE). The powers they have include:

- Issuing an improvement notice – also contains a statement of the inspector's opinion that an offence has been committed.
- Issuing a prohibition notice – also explains why the action is necessary.
- Taking legal action – the inspector may also wish to start legal proceedings.
- 'Proportionality' – effectively this means the degree of enforcement to be taken will be in proportion to the degree of risks discovered.

The penalties that can be applied are:

- raising the maximum fine which may be imposed in the lower courts to £20,000 for most health and safety offences
- making imprisonment an option for more health and safety offences in both the lower and higher courts
- making certain offences, which are currently prosecutable only in the lower courts, prosecutable in either the lower or higher courts.

2. To maintain a safe working environment, companies often employ the services of a consultant to produce certain paperwork. Identify the items the consultant would be likely to supply.

Answers should include:

- **Risk Assessments**
- **COSHH assessments**
- **Health and Safety Policy**

3. While working on site one of your members of staff causes injuries to a member of the public who is taken to hospital. What are the legal requirements for reporting the accident and who is responsible to ensure the report is made?

The legal requirements are RIDDOR.

Employers are required to make reports. The report should be written to include the date and method of reporting, the date, time and place of the event, personal details of those involved and a brief description of the nature of the event along with any supporting evidence.

4. During work on site you notice water leaking from the toilet area, onto the floor where you are working. What should you do in this situation?

Answers should include:

- **Stop work and leave your work area.**
- **Report the matter to your site supervisor.**
- **Know the limits of your responsibility.**

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1. To maintain a safe working environment and avoid accidents, hazards and the risk of being harmed by that hazard need to be identified. Before work commences briefly outline what should be done.

Answers should include:

- **Carry out a risk assessment**
- **Step 1 Identify the hazards.**
- **Step 2 Decide who might be harmed and how.**
- **Step 3 Evaluate the risks and decide on precautions.**
- **Step 4 Record your findings and implement them.**
- **Step 5 Review your assessment and update it if necessary.**

2. You are requested to fix a series of hanging brackets onto a concrete wall. Identify what PPE you would expect to use to keep you safe. If one of the items of PPE were damaged and you were injured as a result who would be responsible?

Answers should include:

- **Hard hat**
- **Goggles**
- **Safety footwear**
- **Overalls**
- **Hearing protection**
- **Dust mask**

If the material was damaged and you were injured then responsibility would apply to employee for using defective equipment and/or the employer if the faulty equipment had been notified and not replaced.

3. As a site operative you are required to know all the safety signs. What do the following safety signs look like: Prohibition, Mandatory, Warning and Information?

Answer should include:

- **Prohibition – circular, red border and cross, black symbol on white background**
- **Mandatory – circular, white symbol on blue background**
- **Warning – triangular, yellow background with black border and symbol**
- **Information – square or rectangular, white symbols on a green background**

4. You hear a scream on site and upon investigation see your colleague clearly suffering from electric shock. What does the accident indicate? What would you do?

The accident indicates that there was a breakdown in procedure and the supply was on when work began.

You should:

- **Check for your safety to ensure that you would not put yourself at risk by helping the casualty.**
- **Break the electrical contact to the casualty by switching off the supply, removing the plug (if it is undamaged) or wrenching the cable free (only attempt this if the cable and plug etc. are undamaged). If this is not possible use a piece of non-conductive material, e.g. a piece of wood.**
- **If the casualty is conscious, guide them down to the ground making sure that further injuries are not sustained, e.g. banging their head on the way down. If the casualty is unconscious, get help straight away, then check the casualty's response. Talk to and gently shake the casualty to gauge their level of response. If the casualty appears unharmed they should be advised to rest and see a GP.**
- **If there is no movement or no sign of breathing, summon help immediately. If there is someone with you, tell them to get help; if you are on your own with the casualty you will have to leave them for a moment while you get help yourself.**
- **As soon as you return to the casualty you need to begin CPR (cardio-pulmonary resuscitation).**

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1. Why do we use reduced voltage equipment on building sites?

The reduced voltage supplies on construction sites are in recognition of the damp working environment and therefore an increased risk of electric shock. By reducing the electricity supply to 110 volts from a transformer that has on the secondary side a centre tapped connection to earth, the voltage to earth in the event of a fault is limited to 55 volts, therefore greatly reducing the chances of a fatal electric shock.

2. Describe how the safe isolation process works, and explain why this is so important.

The JIB issue guidance on safe isolation. A typical safe isolation procedure would be:

- **select an approved test lamp or voltage indicator – complying to GS 38**
- **prove that it is working on a known live supply or proving unit**
- **if it's not working then replace it with another and prove that it works**
- **if it's working, locate the equipment to be worked on and the means of isolation**
- **switch off the source of supply**
- **lock off with an appropriate locking device and padlock; put key in pocket**
- **prove circuit/equipment dead with test lamp or voltage indicator**
- **re-prove that the test equipment is working on a known live supply or proving unit**
- **fit warning labels**
- **begin work.**

3. What are the recommended points that you need to look for when choosing test probes.

When choosing test probes, compliance with GS 38 is mandatory. Therefore make sure that the probe:

- **has finger barriers**
- **has an insulated tip with not more than 2 mm of metal exposed (recommended 1 mm)**
- **contains an HBC fuse in the probe, not exceeding 500 mA.**

4. Describe the process used to lift a heavy object and explain what risk assessments you may need to carry out before you do it.

Before lifting any load it is necessary to assess the load.

- **Does it need more than one person or is there a need for a lifting aid?**
- **Is it bulky or difficult to grasp or unstable, with the contents likely to shift?**
- **Is it sharp or does it have surfaces that could be damaged?**
- **Is the route clear of debris? Is the floor surface slippery? Is there sufficient lighting?**

If it is possible for me to lift it, then I would:

- stand close to the load, with feet apart one slightly in front of the other
- lower myself to the load, keeping my back straight, bending my knees
- take a firm grip
- keep the load close into my body
- raise the load by straightening my legs and keeping my back straight
- make a straight lift, avoid twisting, turn to the left or right only after I've finished raising the load
- lower the load by keeping my back straight, the load tight into my body, bending at the knees.

5. What are the five different categories of fire, and what types of fire extinguisher should you use to combat each of them?

The five classes of fire are:

- Class A – solids, such as paper and wood [Water, Foam, Dry Powder]
- Class B – flammable liquids [Foam, Dry Powder, CO2]
- Class C – flammable gases [Dry Powder]
- Class D – metals
- Class F – cooking oils

Specialist extinguishers are used for the other classes.

6. What checks should you make before using a ladder and a stepladder?

Before using ladders or step ladders check the following:

- that the treads and styles are free of cracks or breaks
- that the treads are free from mud and grease
- that the ladder has not been painted
- that the hinges and screws holding them in place are sound
- that the ropes between the styles and the support legs are of equal length
- that the rope is knotted and is not frayed
- that, when opened, all four legs of the step ladder rest firmly on the floor.

7. Why might you choose to use trestles rather than a ladder?

Some jobs may require a basic platform to work from, such as installing a horizontal run of steel conduit along a wall. Working from steps would mean continually going up and down moving the steps one way then back again, whereas a trestle scaffold would enable work to be performed along a short length, perhaps up to 2.5 metres, before having to get down and relocate the trestles.

8. What are the main risks associated with working in excavations?

Some of the risks associated with working in excavations are:

- collapse of the sides
- objects, people or vehicles falling into the excavation
- fumes or gases
- underground services.

Page 118: Check your knowledge

1. Reduced voltage are normally utilised on site. Which of the following is the normal voltage used?
 - a) 25 V
 - b) 110 V**
 - c) 230 V
 - d) 400 V

2. When checking to ensure a circuit is isolated what should you do?
 - a) Test with a lampholder and flex
 - b) Use an approved voltage indicator**
 - c) Ask a colleague
 - d) Switch off only

3. Which of the following fire extinguishers **must not** be used if there was a fire involving electrical equipment?
 - a) Dry powder
 - b) Carbon Dioxide
 - c) Halon
 - d) Water**

4. When checking a person following an accident what is the ABC of resuscitation?
 - a) Accident, Breathing, Circulation
 - b) Accident, Bleeding, Casualty
 - c) Airways, Breathing, Circulation**
 - d) Airways, Bleeding, Casualty

5. CDM regulations **do not** apply to which of the following people?
 - a) Electricians
 - b) Designers
 - c) Apprentices**
 - d) Clients

6. Who is responsible for health and safety on construction sites?
 - a) Designer
 - b) Client
 - c) Main contractor
 - d) Employees and Employers**

7. What colours are mandatory signs on site?
 - a) Red and white
 - b) Blue and white**
 - c) Green and white
 - d) Black and yellow

8. Who should check and inspect ladders before use on site?
 - a) Manufacturer
 - b) User**
 - c) Site manager
 - d) Client

9. The flexible cord attached to an electric drill you wish to use has insulation damage with conductors showing. What should you do?
- a) Tape over the damage and report later
 - b) Put the drill away and use another
 - c) **Do not use and Inform your site supervisor**
 - d) Strip the faulty cable
10. Before lifting or moving any load, what should you always do?
- a) Ensure you have safety footwear on
 - b) Bend your knees
 - c) **Assess the weight of the load**
 - d) Maintain a straight back

ELTK 02: Understanding environmental legislation, working practices and the principles of environmental technology systems

Page 136: Progress check

1. Your site supervisor asks you to remove all the packaging from equipment and clear the work area. Most of the waste comprises of cardboard, paper, plastic sheet, wooden pallets and metal strapping. How should the waste be disposed of and whose responsibility is it?

Answers could include:

- **When leaving materials on site when your work is complete, you may be discarding them. If they are discarded they will be 'waste' and, as the producer of the waste, you will be responsible for it.**
 - **Waste needs to be assessed to see if it contains dangerous substances.**
 - **Most paper based products such as cardboard can all be processed via pulping and turned into new paper based products. Juice cartons and the like can go through a similar process.**
 - **Plastics can be recycled.**
 - **Wooden pallets should be returnable.**
2. Your company has been engaged to replace all the old fluorescent lighting in an office block with new. You are made responsible for the clear up and disposal of all the old fluorescent fittings. Which set of regulations covers the disposal of such material and how do you ensure you have complied with them?

You need to comply with The Waste Electrical and Electronic Equipment (WEEE) Regulations if you generate, handle or dispose of waste that falls under one of the following categories:

- **Lighting equipment.**
- **Monitoring and control equipment**

For all non household EEE either the producer or end user is responsible for the disposal of the products. You must obtain and keep proof that your WEEE was given to a waste management business, and was subsequently treated and disposed of in an environmentally sound way.

3. Noise in the workplace can cause workers some permanent problems.
 - a) Which regulations identify these risks? What are these risks?
 - b) What should be done to protect workers from the risks associated with noise?
 - c) What maximum levels should not be exceeded?

Answer could include:

- a) **The Control of Noise at Work Regulations 2005 and temporary deafness after leaving a noisy place; it could cause them to lose their hearing and/or to suffer from tinnitus (a permanent ringing in the ears).**
 - b) **Provide hearing protection**
 - c) **exposure limit values:**
 - **daily or weekly exposure of 87 dB;**
 - **peak sound pressure of 140 dB.**
4. An electrical company is hired to rewire a block of residential flats. The work includes the provision of fire alarm detection and low voltage energy efficient spotlights in the kitchen areas. It is the first contract to involve domestic work the company have undertaken.
 - a) What options have they to notify work?
 - b) What is the purpose of The Building Regulations 2000 as amended?
 - c) Which parts of the Building Regulations would need to be consulted for this project?

Answers could include:

- a) **Either register as competent persons and self certify work or notify building control before starting work**
- b) **They exist to ensure the health and safety of people in and around all types of buildings (i.e. domestic, commercial and industrial) and also provide for energy conservation, plus access to and use of buildings.**
- c) **The company would need to consult the following parts of the Building Regulations**

Part A	Structure	Depth of chases in walls and size of openings in joists or structural elements
Part B	Fire safety	Fire resistance of ceilings and walls including provision of fire alarm and detection systems
Part C	Site preparation and resistance to moisture	Moisture resistance of openings or penetrations for cables through external walls
Part E	Resistance to the passage of sound	Penetrations through ceilings and walls
Part F	Ventilation	Ventilation rates for areas within a dwelling
Part L	Conservation of fuel and power	Energy efficient lighting, effective controls including automatic controls
Part M	Access to and use of buildings	Heights of switches, socket outlets, etc.
Part P	Electrical safety	Fixed electrical installations in dwellings

Page 142: Progress check

1. Briefly describe six areas where potential energy savings could be made in buildings.

Answers could include:

- **By turning down the thermostat – less heat required**
- **Look for the labels – when buying products that use energy (this could be anything from light bulbs to fridge-freezers) help tackle climate change by looking for the Energy Saving Recommended label or European energy label rating of A or higher.**
- **Improve insulation – more than half the heat lost in your home escapes through the walls and roof.**
- **Install water efficient products – low flush volume toilets, water efficient showerheads and aerating heads on washbasin taps help to reduce your water use significantly.**
- **Fix dripping taps – this and fitting a ‘hippo’ in toilet cisterns are cheap ways of saving water. You can also collect rainwater in water butts and use it for watering your garden instead of a hose.**
- **Fix leaking pipes**

2. What three considerations should be made when planning working methods and procedures to reduce material wastage?

Answers should include:

- **report any hazards to the environment**
- **choose methods that can help to reduce material wastage**
- **use environmentally friendly materials, products and procedures that can be used in the installation and maintenance of electrotechnical systems.**

3. Which part of the Building Regulations covers energy efficiency? Give three examples of those requirements.

Answer could include:

- **Part L - ‘Responsible provision shall be made for the conservation of fuel and power in buildings’.**
- **Lighting controls should be provided.**
- **The type of lamps used in luminaries.**
- **The owner of a building must be provided with sufficient information.**

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1. Identify five environmental technology systems that may be used to reduce our energy requirements.

Answers could include:

- **Solar photovoltaic**
- **Solar Thermal**
- **Ground source heat pumps**
- **Wind energy**
- **Micro hydro**

2. Briefly describe how a solar photo voltaic system works.

Virtually all photovoltaic devices are types of photodiode and in most photovoltaic applications the radiation is sunlight and for this reason the devices are known as solar photovoltaic.

A photodiode is a p-n junction that responds to light. If we take a zero-biased p-n junction, sunlight falling on the material causes a voltage to develop across the device, leading to a current in the forward biased direction. We call this the 'photovoltaic effect'.

A standard power inverter then takes the direct current (d.c.) from the photovoltaic system and converts it to a.c. for use in the property.

In a grid connected system, power generated is first used within the property to reduce electricity consumption and any surplus is then exported to the grid. Feed in tariffs are available where customers exporting energy to the grid receive a payment.

3. You have a client looking at having a solar PV system installed. As the work will involve the building you check with your Local Authority Building Control regarding planning permission. What are the main functions of LABC? What may you have to submit for approval?

The main functions of the LABC are:

- **encourage innovation to produce energy efficient and sustainable buildings**
- **support local, regional and national businesses**
- **educate and inform building professionals, contractors and trades people**
- **defend vulnerable communities and householders**
- **drive out dangerous cheats and rogue traders**
- **safeguard the investments of individuals and companies**
- **enhance access for disabled, sick, young and old people**
- **protect the community from dangerous structures**
- **provide life-saving advice to the emergency services**
- **ensure sports grounds and public venues are safe for crowds.**

Applications for building approval through LABC, may require submission of a full plans application or give a building notice, depending on the scale of the work.

Page 158: Check your knowledge

1. Which of the following would **not** be covered by the WEEE Regulations?
 - a) Large household appliances
 - b) Medical devices
 - c) Wooden stepladders**
 - d) Lighting equipment

2. What is the maximum noise exposure level that must not be exceeded?
 - a) 100 dB
 - b) 120 dB
 - c) 140 dB**
 - d) 160 dB

3. Which of the following Parts of the Building Regulations 2000, amended, covers electrical safety?
 - a) Part A
 - b) Part B
 - c) Part M
 - d) Part P**

4. The Sustainable Homes Code uses a star rating to show the most efficient buildings in terms of sustainability. Which, of the following star codings, is the highest possible rating?
 - a) 1
 - b) 2
 - c) 4
 - d) 6**

5. You observe fumes that you consider will have a negative effect upon the environment from one of the site enclosures. Who should you inform?
 - a) Electrician
 - b) Site supervisor**
 - c) Site security
 - d) Client

6. Solar Photovoltaic systems use which of the following devices?
 - a) Photo diode and transformer
 - b) Diode and transformer
 - c) Photo diode and inverter**
 - d) Diode and inverter

7. Which of the following statements related to wind energy generation is regarded as a **disadvantage**?
 - a) Electricity generated can be sold back to the grid
 - b) Planning permission is required**
 - c) Plentiful source of energy
 - d) Wind energy generation does not release carbon dioxide

8. What is **not** included in grey water recycling?
- a) Dishwashers
 - b) Showers
 - c) Washing machine
 - d) **Rainwater**
9. A measurement of noise on site from one operation reveals a level of 150dB. What should be done?
- a) **Ensure the noise level is reduced or removed**
 - b) Reduce the time operatives are exposed to the noise
 - c) Issue all staff with ear plugs
 - d) Carry on with the work
10. You are concerned that the mounting height of switches, marked on the site drawing is incorrect. Which part of the Building Regulations would you check?
- a) Part B
 - b) Part L
 - c) **Part M**
 - d) Part P

ELTK 03: Understanding practices and procedures for overseeing and organising the work environment

Page 173: Progress check

1. You have a heater to connect on site and have concerns its position could present a hazard due to surface temperature. Where could you check the equipment's technical details and whether it is suitable for the position it is installed?

Answer could include:

Functional and technical information such as project specifications, site plans, client requirements and manufacturer's information etc.

2. Explain the difference between a wiring diagram and a circuit diagram.

In a wiring diagram the physical layout is taken into consideration. The components and connections show a pictorial version of those in the actual circuit.

A circuit diagram uses symbols to represent all the circuit components and shows how these are connected. The circuit diagram should be as clear as possible and should follow a logical progression route from supply to output.

3. List the main items a site visitor's book should record.

Answers should include:

- **Date**
- **Visitor's name**
- **Company**
- **Name of person to be visited**
- **Time in and out**
- **ID check**
- **Badge number**
- **Health and Safety brief**
- **Visitor's signature**

Page 193: Progress check

1. During a progress check with your supervisor, they advise you to consider joining the union and looking at the grading requirements for electricians. Where would you make those enquiries?

Answers could include UNITE the union and the Joint Industry Board (JIB)

2. What are the main functions of a design engineer?

Answers could include:

- **Act on behalf of the architect, advising on and designing specific services such as electrical installation, heating and ventilation, etc.**
 - **Create a design that satisfies the client and architect, the supply company and regulations.**
 - **Ensure that cable sizes have been calculated properly, that the capacities of any cable trunking and conduit are adequate, and that protective devices are rated correctly.**
 - **Produce drawings, schedules and specifications for the project that will be sent out to the companies tendering for the contract.**
 - **Answer any questions that may arise from this.**
 - **Once the contract has been placed, they will produce additional drawings to show any amendments.**
 - **Act as a link between the client, the main contractor and the electrical contractor.**
3. On completion of a contract, it is normal to have a handover meeting with a client. What are the usual areas to be covered?

Such meetings may typically involve:

- **Closing out any defects or amendments.**
- **Final inspection of the installation by the client.**
- **Demonstrating key features of the installation to the client to ensure it functions as specified.**
- **Issue of the handover manual(s).**
- **Establishment of contacts and procedures throughout the defect liability period (*a contracted period of time and coverage, whereby the installer is responsible for repair of defective items*).**

4. Identify four dos and don'ts relating to good customer relations, that all employees on site should be aware of particularly if visitors appear on site.

Answer could include:

DO

- be honest
- be neat and tidy in your personal appearance, and look after your personal hygiene
- learn how to put people at ease, and be pleasant and cheerful
- show enthusiasm for the job
- try to maintain friendly relationships with customers, but don't get over-familiar
- know your job and do it well – good knowledge of the installation and keeping to relevant standards gives the customer confidence in you and your company
- explain what you are going to do, and how long it will take
- if you are not sure about something – ask!

DON'T

- 'badmouth' your employer
- use company property and materials to do favours for others
- speak for your employer when you have no authority to do so
- use bad language
- smoke on customer premises
- gossip about the customer or anyone else
- tell lies – the customer will find out eventually if he or she is being misled or ripped off
- assume that you know what your employer wants without bothering to ask.

Page 213: Progress check

1. Your supervisor needs to complete a risk assessment before you start work on site. What should they consider including in the risk assessment?

Answer should include:

- Consider if there are any hazards you can avoid altogether.
- Decide which risks need to be controlled along with the best ways of controlling them.
- Having decided what needs to be done, make sure it happens.
- Ensure everyone is properly trained, competent and that they have the equipment they need.
- Ensure agreed work methods are put into practice.

2. Identify the four key principles in building a team.

Answer should include:

- **Forming**
- **Storming**
- **Norming**
- **Performing.**

3. Identify the key people you may need to communicate with during work on site.

Answer could include:

- **Customers**
- **Clients**
- **Site managers**
- **Major and sub-contractors**
- **Other services**
- **The public**

4. As materials begin to arrive on site you are tasked to check them into the storage area established on site. What should you check?

You should check the delivery note, which should give the following information:

- **the name of the supplier**
- **to whom the materials are being sent**
- **a list of the type, quantity and description of materials that are being delivered to the site in this particular load**
- **the time period allowed for claims for damage.**

Page 233: Progress check

1. The Employment Rights Act 1996 gives employees a number of rights. What are the main rights?

Answers could include:

- **right to statement of employment;**
- **right to pay statement;**
- **minimum pay;**
- **minimum holidays;**
- **maximum working hours;**
- **right to maternity/paternity leave.**

2. Explain briefly what a critical path network is and what we can ascertain from it.

Critical path networks (CPNs) are diagrams that represent each task and how they relate to one another. If we know the time needed for each activity, the overall project completion time can be calculated. The chart also helps us to see what happens if a task is delayed unexpectedly. The critical path is the sequence of activities that fix the duration of a project.

3. The client asks you to alter the position of a socket outlet which has been wired and fixed in situ. What should you do and what document should be issued to cover the alteration? What is the purpose of this document?

Answer should include:

- **Report the request to your supervisor.**
- **A Variation Order should be issued before any alteration takes place.**
- **Variation Order is issued to ensure the extra work is not only sanctioned, but that the contractor will be paid for the extra work.**

No alterations should be undertaken without Variation Orders, as the whole design of a circuit could be compromised.

Page 234: Progress check

1. How would you establish whether you have the right materials, whether they are fit for purpose of the right quantity and available to you?

Carefully read the drawings and specifications. Take measurements from scaled drawings and then establish quantities. Establish the type of material required from the specification. Check the materials are fit for purpose against your knowledge of the intended installation. Place an order from the wholesalers/manufacturers/company stores and establish delivery dates.

2. You are setting up on site and are awaiting the delivery of all of the materials and equipment needed. The equipment will include specialist glass lighting fittings, mineral-insulated cable and some purpose-made control panels that contain electronic components. You also will be using a mobile scaffold tower. The site is 50 miles from your employer's premises. Describe:
- What arrangements need to be made to have everything delivered
 - Once delivered, how you intend to transport them to your storage area
 - Your considerations for storing everything

Make sure there is a safe route from drop off to storage facility and make the main contractor aware of your plans. Make sure sufficient staff are present to safely unload and transport materials without risk of injury or damage to the equipment or materials. Always check deliveries against orders. Make sure the storage area is dry, lit, ventilated and secure and plan its layout so that delicate items can not be broken (use shelving or storage racks if required). Plan walkways through the equipment and arrange the layout so that frequently used items can be stored in a way that avoids damage being caused to other items as they are collected. Always check what fire precautions are required and establish who has permission for access and to check material in or out of the storage area.

3. List all the resources that you think could be necessary on this project.

Answers could include:

- Labour
- Material
- Equipment
- Plant
- Measuring tools
- Transport for staff
- Access equipment
- Storage

Page 234: Progress check

1. Which of the following is a drawing that uses symbols to represent circuit components?

- a) Assembly drawing
- b) Layout drawing
- c) Block diagram
- d) **Circuit diagram**

2. Which one of the following would **not** be included in a site visitor's book?

- a) Date
- b) Visitors Name
- c) **Visitors car colour**
- d) Time out

3. Identify the trade association from the list below:

- a) JIB
- b) **ECA**
- c) UNITE
- d) NICEIC

4. The main function of the electrician on a large construction site is to?

- a) **Work to the supervisor's orders**
- b) Alter circuits as the client verbally requests
- c) Pay and coordinate sub contractors
- d) Oversee the work of contracts engineers

5. To maintain good customer relations on site, you should?

- a) Use derogatory terms about your employer
- b) Deliberately tell lies when questioned as to project progress
- c) **Be honest**
- d) Gossip about the customer

6. Site records would **not** be transmitted by using?

- a) Microforms
- b) CDs
- c) Emails
- d) **Telephone**

7. When checking the technical competence of a new employee what would you look for?

- a) Type of PPE
- b) **ECS card**
- c) First Aid certificate
- d) Certificate of unit credit

8. Which of the following documents is used for alterations to the original contract?

- a) Day work sheet
- b) **Variation Order**
- c) Time sheet
- d) Purchase order

9. Under the Data Protection Act 1998 data must?

- a) Be shared with all suppliers
- b) Be accessible to all on site workers
- c) **Not be kept longer than is necessary**
- d) Be transferred to other countries

10. Critical path networks allow site managers to see?

- a) How much the contract will cost
- b) **The length of time tasks take**
- c) The profitability of the contract
- d) The number of suppliers utilised.

ELTK 04: Understanding practices and procedures for preparing and installing systems and electrotechnical equipment

Page 245: Progress check

1. Before commencing work on site you are obliged to take account of safety. What should you do first?

Undertake a risk assessment to ensure:

- safe access and egress to, from and around the work area
- all work area hazards to property, personnel and livestock are eliminated or controlled.

2. Identify the general preparations to be done before starting work.

Answer could include:

- Interpret drawings and specifications to produce accurate material and equipment requisites.
- Identify and select material and equipment that meets the specification (where not specified).
- Identify suitable installation, fitting and fixing methods.
- Identify where coordination with other trades is required.
- Confirm that the site is ready for the installation including suitable storage facilities.
- Confirm that all tools, equipment and instruments are ready and fit for purpose.
- Identify suitable access or if required, lifting equipment.

3. What are the essential steps in the establishment of a safe working system?

Answer should include:

- Identification
- Disconnection
- Secure isolation

Page 273: Progress check

1. When selecting a cable for an electrical installation, what are the main criteria to consider?

Answer should include:

- conductor material
- conductor size
- insulation
- environmental conditions.

2. Identify the main factors affecting the choice of size of conductor to be selected.

Answer should include:

- **Load and future development**
- **Ambient temperature**
- **Grouping**
- **Type of protection**
- **Thermal insulation**
- **Voltage drop**
- **Insulation**

3. What are the significant advantages of PVC/SWA over PVC/PVC cable?

Answers could include:

- **Additional mechanical protection from SWA**
- **It can be laid direct in the ground**
- **It is available in larger c.s.a.**

4. Identify suitable fire resistant cables for fire alarm installations.

Answers could include:

- **MICC**
- **FP100**
- **FP200**
- **FP400**

5. What are the benefits, of utilising bus-bar distribution systems in a factory for machinery?

Answers could include:

- **The contractor can achieve savings with respect to material, i.e. cable trays and multiple fixings, and also labour costs associated with multiple runs of cable.**
- **Installation time will be reduced as busbar trunking requires less fixings per metre run than cable.**
- **The repositioning of distribution outlets is simpler.**
- **The system is easily extendable.**
- **The system is more aesthetically pleasing in areas of high visibility.**

Page 290: Progress check

1. Describe briefly how a one-way lighting circuit could be converted to allow two switching positions.

Answer should include the following but may also include a suitable diagram:

- **The first step in this process is to replace the existing one-way switch with a two-way switch.**
- **The new two-way switch should then be connected, noting that the supply has been taken to terminal L1 and not the Common terminal as normal.**
- **The next step is to install a three-core and cpc PVC/PVC flat cable between the existing switch locations and the new two-way switch location and complete the circuit connections.**

2. How may additional socket-outlets be added to a ring circuit?

Answers should include:

- **At the origin of the circuit.**
- **From a socket-outlet on the ring.**
- **From a joint box.**

3. To ensure the supply to essential equipment is maintained without loss what system should be employed?

Answer must include reference to Uninterruptable power supplies (UPS).

Page 303: Progress check

1. Explain the difference between:
 - a) emergency escape lighting
 - b) escape route lighting

Emergency escape lighting is provided to enable safe exit in the event of failure of the normal supply.

Escape route lighting is provided to enable safe exit for occupants by providing appropriate visual conditions and direction-finding on escape routes and in special areas/locations, and to ensure that fire-fighting and safety equipment can be readily located and used.

2. Identify the following classifications of emergency lighting systems:

- M3
- NM2
- S1

Answers should include:

- **M3 – a maintained system of emergency duration three hours**
- **NM2 – a non-maintained system of emergency duration two hours**
- **S1 – a sustained system of emergency duration one hour**

3. Identify the following BS 5839 Part 1 fire alarm systems:

- Type M
- Type P

Answers should include:

- **Type M – Manual ‘break glass’ contacts operated by occupants operate sounders for protection of life. No automatic detection.**
- **Type P – Automatic detection systems for the protection of property.**

4. Explain the difference between ionisation and optical type smoke detectors.

Answer should include:

- **The ionisation detector is very sensitive to smoke with fine particles such as that from burning paper or spirit, whereas the optical detector is sensitive to ‘optically dense’ smoke with large particles such as that from burning plastics.**
- **The optical smoke detector, sometimes known as the photoelectric smoke detector, operates by means of the ‘light scattering’ principle. A pulsed infrared light is targeted at a photo receiver but separated by an angled non-reflective baffle positioned across the inner chamber. When smoke and combustion particles enter the chamber, light is scattered and reflected on to the sensitive photo receiver, triggering the alarm.**

5. Identify the minimum sounder levels for fire alarm systems set in BS 5839 Part 1.

Answers should include:

- **A minimum level of either 65 dBA, or 5 dBA above any background noise likely to persist for a period longer than 30 seconds, should be produced by the sounders at any occupiable point in the building.**
- **If the alarm system is to be used in premises such as hotels, boarding houses etc. where it is required to wake sleeping persons, then the sound level should be a minimum of 75 dBA at the bed head.**

Page 317: Progress check

1. Describe briefly the difference between passive infrared and ultrasonic detectors used in security systems.

Passive infrared

These devices are used to protect large areas of space and are only activated when the intruder has already gained entry. The device monitors infrared which detects the movement of body heat across its viewing range; this in turn sends a signal to the panel and activates the sounder.

Ultrasonic devices

These devices send out sound waves and receive back the same waves when no-one is in the building. However, when an intruder enters the detection range, the sound waves change (because of deflection) and trigger the alarm panel.

2. Explain briefly how an electric storage heater works.

Electric storage heaters consist of several heating elements mounted inside firebricks, which in turn are surrounded by thermal insulation such as fibreglass, all housed inside a metal cabinet. The firebricks are made from clay, olivine, chrome and magnesite, which have very good heat retaining properties. Connected to a special tariff meter in the property, the bricks are heated up during 'off peak' hours (normally overnight usually Economy 7 tariff) and the heat is stored within the bricks. The outlet vent is then opened the following day and allows the warm air to escape and hence heat up the room.

3. What is the significant difference between a 'S' Plan and a 'Y' Plan central heating control system?

Answers should include:

'S' Plan uses two 2-port valves (one for heating; one for hot water)

'Y' Plan uses one 3-port mid position valve (it handles both hot water and heating)

Page 332: Progress check

1. Identify four light fixing devices.

Answers should include:

- Plastic plugs
- Gravity toggles
- Spring toggles
- Rawlnuts

2. List typical hand tools an electrician may carry.

Answer could include:

- Pliers
- Cutters
- Strippers
- Measuring tape
- Screwdrivers
- Hammer

Page 380: Progress check

1. When a cable is to be installed in a wall less than 50 mm from the surface what protection should be applied?

Answers must include:

- It should incorporate an acceptable earthed metallic covering.
- It should be enclosed in acceptable earthed conduit, trunking or ducting.
- It should be mechanically protected to prevent penetration by nails, screws etc.
- It should be installed in a zone. Please note that a zone formed on one side of a wall of less than 100 mm thickness extends to the reverse side, but only if the location of that accessory can be determined from the reverse side.
- If not under supervision of a skilled or instructed person, it should be provided with additional protection in the form of a suitable RCD.

2. What are the maximum horizontal distances supports should be applied to the following cables:

- A 12 mm PVC non-armoured cable (generally)
- A 16 mm MICC cable

Answer should include:

- 300 mm
- 1500 mm

3. If $10 \times 1.5 \text{ mm}^2$ cables with stranded copper conductors were to be installed in a 4 m straight length of conduit, what would be the minimum size of conduit required?

As an example, if $10 \times 1.5 \text{ mm}^2$ cables with stranded copper conductors were to be installed in a 4 m straight length of conduit, their cable factor will be 220 (10×22). We therefore need to select a conduit with a factor greater than 220. We would also need to select a 20 mm conduit with a conduit factor of 286.

Page 411: Progress check

1. When planning an electrical installation the general characteristics need to be considered. What areas will this cover?

Answers should include:

- **Assessment of general characteristics (Chapter 30)**
- **The purpose of the installation and its supplies (Chapter 31).**
- **The external influences it will be exposed to (Chapter 32).**
- **The compatibility of its equipment (Chapter 33).**
- **Its maintainability (Chapter 34).**
- **Recognised safety services (Chapter 35).**
- **Assessment for continuity of service (Chapter 36).**

2. What is the main purpose of inspecting and testing an installation before it is put into service as required by Part 6 of the IET Wiring Regulations?

Every installation shall during erection and upon completion, before being put into service, be inspected and tested to verify that the requirements of the Regulations have been met.

3. BS7671 has a number of special installations and locations, including bathrooms. Summarise the main requirements.

Answers should include:

- **All circuits supplying the bathroom (irrespective of the points they are serving) have to be protected by 30 mA RCDs.**
- **Supplementary equipotential bonding is not required when all of the following are met:**
 - **All circuits for the bathroom meet the requirements for ADS.**
 - **All final circuits have 30 mA RCD protection.**
 - **All extraneous conductive parts of the bathroom are connected to the protective equipotential bonding of the installation (411.3.1.2).**
 - **SELV socket outlets and shaver sockets are permitted outside Zone 1. 230 V socket outlets are permitted provided they are more than 3 m horizontally from Zone 1.**

Page 413: Check your knowledge

1. When selecting the correct type of cable for an electrical installation, which of the following is **not** a consideration?
 - a) Environmental conditions
 - b) Conductor size
 - c) Insulation
 - d) **Cost**

2. The only striped conductor used in fixed electrical installations is?
- Phase
 - Neutral
 - CPC**
 - Functional earth
3. Which of the following cable types is most suitable for burying direct in the ground?
- PVC insulated
 - PVC insulated and sheathed
 - PVC Steel Wire Armoured**
 - PVC insulated bell wire
4. Which of these containment systems is not suitable for single insulated cables?
- Trunking
 - Ducting**
 - PVC conduit
 - Steel conduit
5. Where lighting circuits are utilised on long corridors, they normally incorporate two-way and intermediate switching arrangements. How many intermediate switches may be employed?
- 1
 - 2
 - 3
 - unlimited**
6. A radial circuit feeding sockets-outlets and protected by a 30/32 A protective device may cover a floor area of?
- 20 m²
 - 50 m²
 - 75 m²**
 - 100 m²
7. Emergency lighting systems must follow the detailed guidance in which document?
- BS 5266**
 - BS 5839 Part I
 - BS 5839 Part 6
 - BS 7671
8. Fire alarm systems are classified into general types, which one of the following represents protection for life?
- Type S
 - Type P
 - Type M
 - Type L**
9. In security systems passive infra red detectors are activated by?
- Pressure
 - Vibration
 - Body heat**
 - Sound waves

10. Final connections to water heating systems must be made in?

- a) Single-insulated cable
- b) PVC-insulated and sheathed cable
- c) Heat-resistant flexible cord**
- d) PVC-insulated cord

11. When selecting hand tools an electrician would not consider?

- a) Pliers
- b) Screwdrivers
- c) Cutters
- d) Pipe bender**

12. An **unsuitable** fixing method to fasten an electrical accessory to a wall would be?

- a) Nails**
- b) Screw and plastic plug
- c) Screw and fibre plug
- d) Spring toggle

13. Which of the following would not be considered when selecting a wiring system?

- a) Moisture
- b) Cost**
- c) Mechanical stress
- d) Ambient temperature

14. Part 4 of BS 7671 covers the following topic.

- a) Definitions
- b) Selection and erection of equipment
- c) Protection for safety
- d) Special installations and locations

15. Where an insulation resistance test has been carried out on a 230 V lighting circuit the minimum acceptable value should be?

- a) 0.5 M Ω
- b) 1.0 M Ω**
- c) 0.5 Ω
- d) 1.0 Ω

16. Which of the following is **not** regarded in BS7671 as a special installation or location?

- a) Bathroom
- b) Swimming pool
- c) Kitchen**
- d) Construction site

17. The temperature class or ignition temperature of the gas or vapour involved would **not** be classified as?

- a) T1
- b) T2
- c) T4
- d) T8**

ELTK 05: Understanding the principles, practices and legislation for the termination and connection of conductors, cables and cords in electrical systems

Page 435: Check your knowledge

1. The reason BS 7671 requires all connections to readily accessible is for?
 - a) Ease of terminating
 - b) Quicker to terminate
 - c) Inspection, testing and maintenance**
 - d) Cost-effectiveness
2. BS 7671 requires all connections to be?
 - a) Readily accessible**
 - b) Enclosed in junction boxes
 - c) Enclosed in trunking
 - d) Concealed under floors
3. Loose connections at terminals can result in?
 - a) Excess current
 - b) Excess heat**
 - c) Cooling of the terminal
 - d) Operation of the protective device
4. Joints in non-flexible cables should **not** be made by?
 - a) Soldering
 - b) Brazing
 - c) Terminal strips**
 - d) Compression
5. Which of the following results would indicate a good connection?
 - a) 0.01 Ω**
 - b) 240 Ω
 - c) 3 M Ω
 - d) 100 M Ω
6. The cable that must be sealed at each end to avoid ingress of moisture is?
 - a) PVC singles in conduit
 - b) PVC multi-core cable
 - c) PVC steel wire armoured cable
 - d) Mineral-insulated cable**
7. A BW gland used to terminate steel wire armoured cable has a?
 - a) Single seal (outer sheath) for braided cable
 - b) No seal**
 - c) Single seal to outer sheath
 - d) Double seal

8. Safe isolation of an installation to be worked on is required when?

- a) **Risk of electric shock is present**
- b) Always before work commences
- c) Never
- d) Before client arrives

9. Which of the following cables is used in data wiring?

- a) MICC
- b) PVCSWA
- c) Bell wire
- d) **Twisted pair**

10. A suitable fire resisting cable would be?

- a) **FP200**
- b) PVC-insulated
- c) PVC-insulated and sheathed
- d) PVC steel wire armoured