Level 3 Diploma in Installing Electrotechnical Systems & Equipment

C&G 2357

Unit 303 - Practices & procedures for organising the work environment

Risk assessment

Designer: F. Bloggs.			**People at risk**	**Project:** Installation of a 3Φ motor and associated control gear.			
Ref. No.	**Work element**	**Potential hazard/risk**		**Risk rating**			**Action at design stage**
				L	**S**	**R**	
001	Site preparation	Slips, trips and falls.	Installer and trainee.	4	4	16	Tidy up site before starting work.
		Dust explosion.		6	5	30	Agree with farmer to carry out work when mill is not working.
002	Motor setup	Handling - back.		4	4	16	Two people to lift motor.
		Dust explosion.		6	5	30	See above.
		Power tools.		4	4	16	Cover leads

Produced by

B&B Training Associates Ltd

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Aims and objectives

By the end of this study book you will have had the opportunity to:

Outcome 1

- Specify sources of technical and functional information which apply to electrotechnical installations.
- Interpret technical and functional information and data.
- Identify and interpret technical and functional information relating to electrotechnical product or equipment.
- Describe the work site requirements and procedures of:
  - Services provision.
  - Ventilation provision.
  - Waste disposal procedures.
  - Equipment and material storage.
  - Health and safety requirements.
  - Access by personnel.
- Identify equipment and systems that are compatible to site operations and requirements.

Outcome 2

- State the limits of their responsibility for supplying technical and functional information to others.
- Specify organisational policies/procedures for the handover and demonstration of electrotechnical systems, products and equipment, including requirements for confirming and recording handover.
- State the appropriateness of different customer relations methods and procedures
- Identify methods of providing technical and functional information appropriate to the needs of others.
- Explain the importance of ensuring that:
  - Information provided is accurate and complete.
  - Information is provided clearly, courteously and professionally.
  - Copies of information are retained.
  - The installation, on completion, functions in accordance with the specification, is safe and complies with industry standards.
- Describe methods for checking that relevant persons have an adequate understanding of the technical and non-technical information provided, including appropriate Health and Safety information.

Outcome 3

- State the applicable Health and Safety requirements with regard to overseeing the work of others.
- State the procedures for:
  - Interpreting risk assessments
  - Applying method statements
  - Monitoring changing conditions in the workplace
  - Complying with site organisational procedures
  - Managing health and safety on site
  - Organising the safe and secure storage of tools and materials.

Outcome 4

- Describe techniques for the communication with others for the purpose of:
  - Motivation
  - Instruction
  - Monitoring
  - Cooperation
- Describe methods of determining the competence of operatives for whom they are responsible.
- Specify their role in terms of:
  - Responsibility for other staff
  - Liaison with their employer
  - Communication with others.
- Identify appropriate methods of communicating with and responding to others.
- Specify procedures for re-scheduling work to coordinate with changing conditions in the workplace and to coincide with other trades.
- Clarify organisational procedures for completing the documentation that is required during work operations.

Outcome 5

- Describe how to plan:
  - Work allocations
  - Duties of operative for whom they are responsible
  - Coordination with other services and personnel.
- Specify procedures for carrying out work activities that will:
  - Maintain the safety of the work environment
  - Maintain cost effectiveness
  - Ensure compliance with the programme of work.

- Identify the industry standards that are relevant to activities carried out during the installation of electrotechnical systems and equipment, including the current editions.
- Identify within the scope of the work programme and operations their responsibilities.
- Identify how to determine the estimated time required for the completion of the work required taking into account influential factors.
- State the possible consequences of not:
  - Completing the work within the estimated time
  - Meeting the requirements of the programme of work
  - Using specified materials
  - Installing materials and equipment as specified.
- Specify methods of producing and illustrating work programmes.

Outcome 6

- Interpret the installation specification and work programme to identify resource requirements for the following:
  - Materials
  - Components
  - Plant
  - Vehicles
  - Equipment
  - Labour
  - Tools
  - Measuring and test instruments.
- Interpret the material schedule to confirm that materials are:
  - The right type
  - Fit for purpose
  - In the correct quantity
  - Suitable for work to be completed cost efficiently.
- Specify the storage and transportation requirements for all materials required in the work location.
- Specify procedures to ensure the safe and effective storage of materials, tools and equipment in the work location.

1: Researching sources of technical information

In this session the student will:

- Gain an understanding of the sources of technical and functional information.
- interpret technical and functional information and data
- identify and interpret technical and functional information relating to electrotechnical products or equipment

Electricians have to be able to find information about a wide range of items. The type of cabling to install, any special requirement in the installation of equipment, the size of fuse, the position of the switch on a wall, the list is endless. There is no way that you can have all this information in your head.

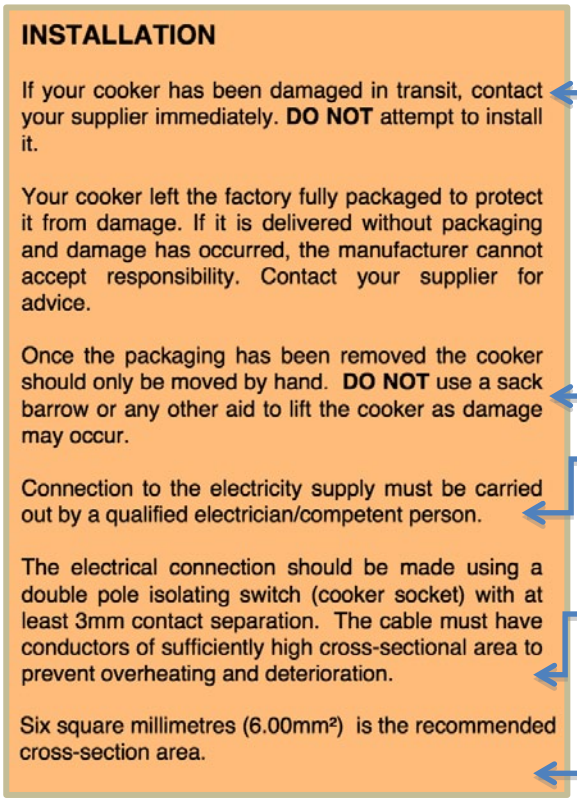
In this first session we are going to consider the type of information that is needed and places to find that information.

The type of data sources for technical information will cover things such as textbooks, reference books, codes of practice, guidance notes, data sheets, leaflets, British Standards (BS), Euro-norms (BS EN), magazines, drawings, videotapes, micro-film, micro-fiche, asking questions etc. There is so much information and so many different places to look. Functional information will generally be supplied by the manufacturer.

The main source of information for electrotechnical information is the current edition of the BS: 7671 wiring regulations which will tell you most things that you need to know to comply with the law and electrical safety. Along with that you need the current edition of the on-site guidance notes which will help you work out what the regulations mean in practice.

Manufacturer's information and data

Manufacturer's information and data is essential for the designer and/or installer of an electrical installation. Indeed, Regulation 510.3 requires that every item of equipment is selected and erected in accordance with BS 7671 and that due account is taken of manufacturer's instructions.



INSTALLATION

If your cooker has been damaged in transit, contact your supplier immediately. **DO NOT** attempt to install it.

Your cooker left the factory fully packaged to protect it from damage. If it is delivered without packaging and damage has occurred, the manufacturer cannot accept responsibility. Contact your supplier for advice.

Once the packaging has been removed the cooker should only be moved by hand. **DO NOT** use a sack barrow or any other aid to lift the cooker as damage may occur.

Connection to the electricity supply must be carried out by a qualified electrician/competent person.

The electrical connection should be made using a double pole isolating switch (cooker socket) with at least 3mm contact separation. The cable must have conductors of sufficiently high cross-sectional area to prevent overheating and deterioration.

Six square millimetres (6.00mm²) is the recommended cross-section area.

For example, here a manufacturer of cookers and ovens recommends five specific installation requirements:

i. If the cooker is damaged contact the supplier and don't install it.

ii. Only move the cooker by hand.

iii. Use a qualified/competent person to connect to the supply.

iv. To use of a double pole isolator, and,

v. A minimum cable size.

There are two main reasons for this:

- Manufacturer's know about the operation of their equipment and to ensure the safe operation of the equipment it is unwise to ignore this, and
- A manufacturer is likely to consider any change from their instructions/guidance as a breach of warranty and, should there be a subsequent problem, will not uphold any complaint.

Standard guarantee conditions

We, _____, undertake that if within 12 months of the date of the purchase this _____ appliance or any part thereof is proved to be defective by reason only of faulty workmanship or materials, we will, at our option repair or replace the same FREE OF CHARGE for labour, materials or carriage on condition that:

- The appliance has been correctly installed and used only on the electricity supply stated on the rating plate
- The appliance has been used for normal domestic purposes only, and in accordance with the manufacturer's instructions
- The appliance has not been serviced, maintained repaired, taken apart or tampered with by any person not authorised by us
- All service work under this guarantee must be undertaken by a _____.
- Any appliance or defective part replaced shall become the Company's property
- This guarantee is in addition to your statutory and other legal rights

Home visits are made between **8.30am** and **5.30pm** Monday to Friday. Visits may be available outside these hours in which case a **premium** will be charged.

Manufacturers will also supply safety data sheets with any information regarding REACH or COSSH.

Interpreting information on the operation of equipment

Information on the operation and control of equipment may require sourcing material from specifications or from the results of test sheets, verbally from other operators or from the client who has described a fault.

All this information needs to be gathered so that you understand the equipment, the operating characteristics and any other relevant data.

When interpreting information for equipment you will need to understand.

- The operational characteristics
- How the controls function
- The purpose of the settings
- The effects that making adjustments might have.

Without understanding this information you might make a fault worse or unknowingly cause harm to the equipment and/or users.

Measuring and test instruments

To test and measure an installation or to fault find you need to have the correct instrument for the task and to understand the operating requirements and the implication of the test procedure. This will be covered later in the course.

The Electrical Equipment (Safety) Regulations 1994

The supplier is regulated and can only sell Electrical Equipment which conforms to the EC Declaration of Conformity under the Low Voltage Directive

All the electrical equipment has to meet the safety requirements, which includes three main elements - technical documentation, European Community (EC) Declaration of Conformity and affixing a CE mark.

Clause 5 also states that; Electrical equipment shall be—

(a) safe;

(b) constructed in accordance with good engineering practice in relation to safety matters and in particular shall be designed and constructed to ensure that it is safe when connected to the electricity supply system by providing a level of protection against

electric shock which relies on a combination of insulation and the protective earthing conductor contained within the electricity supply system or which achieves that level of protection by other means.

The Supply of Machinery (Safety) Regulations 2008 requires that a responsible person, such as a supplier, only places machinery on the market or into service unless:

- all the applicable health and safety requirements are satisfied,
- the technical file is compiled and made available,
- the information to operate it safely is supplied,
- it has had its conformity assessed and a declaration of conformity is issued with a CE mark attached.

Information from your employer

This will come in many forms, from the way he/she expects you to conduct yourself, the type of training you need, the clothes you need (uniform, PPE), the type of work you would be expected to do to instruction in Health and safety.

To undertake a task the employer will be supply you with information on;

- The location
- The installation type
- Plans or specifications
- Possibly list of equipment to be installed
- Any special instructions

Plus anything else you need to complete the task

2: Specifications

In this session the student will:

- Describe a manufactures specification
- Describe installation specifications

There are two main types of specification

1. Supplied by the manufacture.

Below is the specification of a shower from this information you can decide the size of the cable needed, if the water pressure is adequate, and extra protective devices etc.

Specifications

Electrical

Nominal power Nominal power rating at 240V rating at 230V8.5kW – (40A MCB rating) 7.8kW – (40A MCB rating) 9.5kW – (40A MCB rating) 8.7kW – (40A MCB rating)10.5kW – (45A MCB rating) 9.6kW – (45A MCB rating)

Water

Inlet connection – 15 mm diameter. Outlet connection – ½" BSP male thread.

Entry Points

Water – top, bottom, back, left or right. Cable – top, bottom, back, left or right.

Materials

Backplate, cover, controls, showerhead – ABS.Sprayplate – Acetal.Elements – Minerally insulated corrosion resistant metal sheathing.

Dimensions

Height – 305 mm Width – 210 mm Depth – 110 mm

Standards and Approvals

Waterproof rating IPX4.

Complies with the requirements of current British and European safety standards for household and similar electrical appliances.

Complies with requirements of the British Electrotechnical Approvals Board (BEAB).

Meets with Compliance with European Community Directives (CE)

2. Installation specification

This is more involved because, any work that is to be carried out for an electrical installation, irrespective of the size of work that is to be done, must be based on an agreement between the client and the person/organisation that is to carry out the work. This may involve preparation work, such as design calculations or the implementation of agreed works within the installation.

A typical small installation specification will include;

Your name/company
The clients name/ address
A written outline of the task to be completed
Any time constraints imposed on the work
Any standards that need to be met during the installation i.e. Part P compliant
A list of materials/equipment required
A list of any special safety requirements
Any charts/diagrams required.
Inspection/ testing sheets that need completing

This specification sheet should be shown to the client before work commences and preferably signed so that there can be no dispute afterwards. Any changed to the specification should also be agreed and signed before work commences or re-commences.

3: Drawings and diagrams

In this session the student will:

- Describe types of drawings, diagrams and scales.

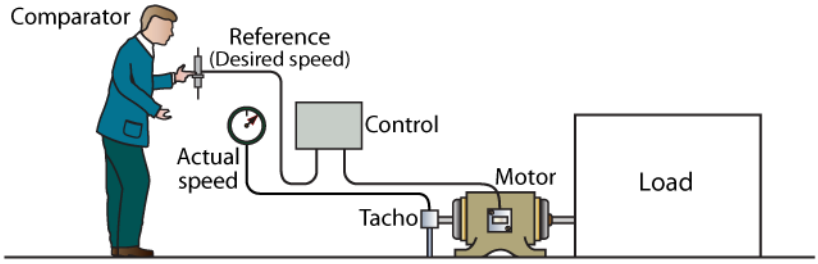
Drawings

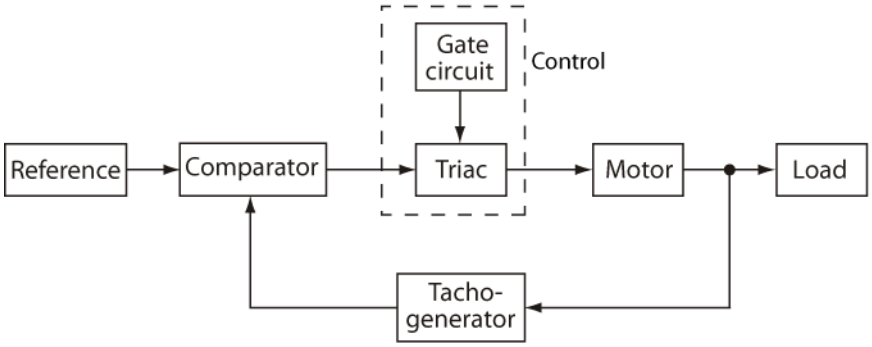
There are many different types of drawings and diagrams used within the electrical industry. These include architectural drawings for floor plans, site plans, elevations, cross sections and detail. They can be used for presentations, surveys, records, or as working drawings.

Other types of drawing include block diagrams, circuit diagrams, wiring diagrams, layout diagrams and the like. These are used to provide detail, clarify operating principles or provide an overview.

Block diagram

A block diagram clarifies the way that a circuit operates. It gives no help with the actual circuitry, but gives a great deal of help with understanding what is happening.

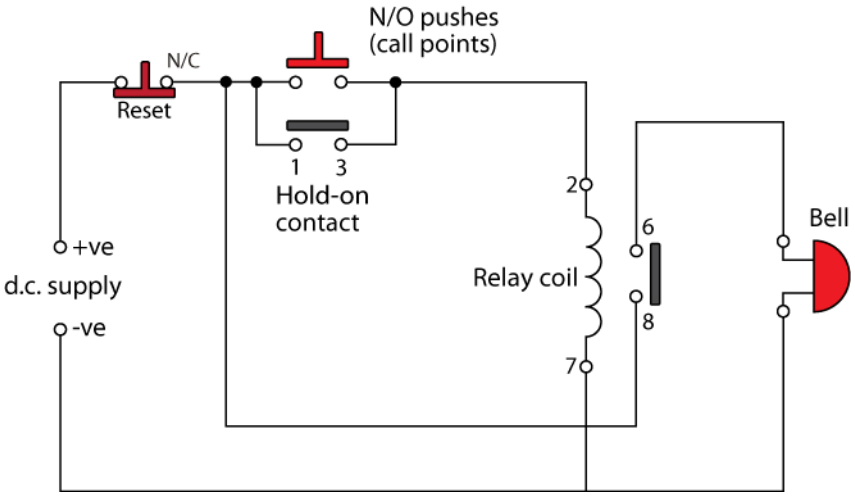




This shows a block diagram of a motor speed control. Notice that there is no actual circuitry!

Circuit diagram

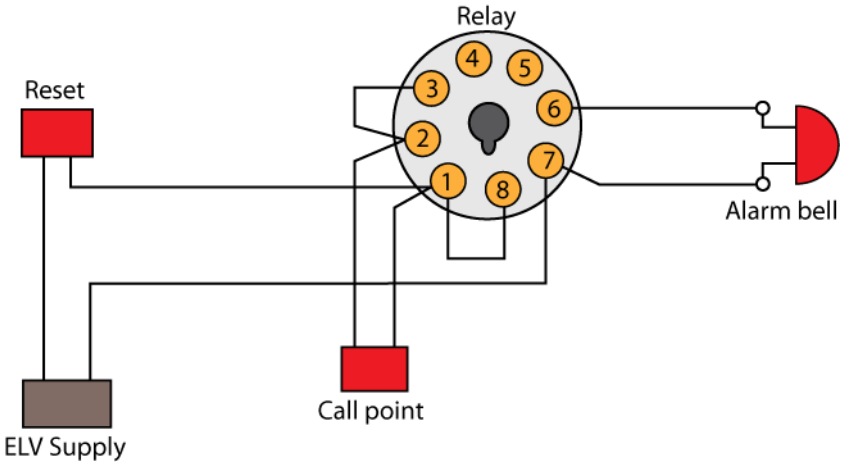
This type of diagrams' main function is to be clearly understood. It shows how the system works and all the components are drawn where they give the clearest picture and the greatest understanding.



This shows a simple open circuit alarm system. Remember, that a circuit diagram does not show where the components will be positioned; they show what is actually happening.

Wiring diagram

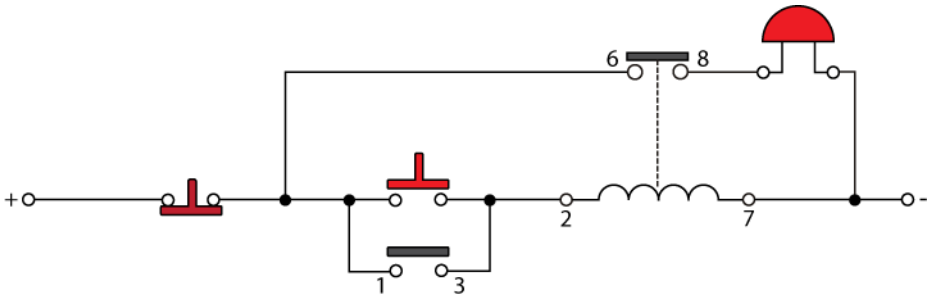
A wiring diagram shows how a system is to be wired. This means that all the components should be shown in their correct positions and should be drawn to scale. Simple shapes are used along with some help in showing the relative positions of components.



This shows an open circuit alarm system. Notice the difference between the wiring and the circuit diagram.

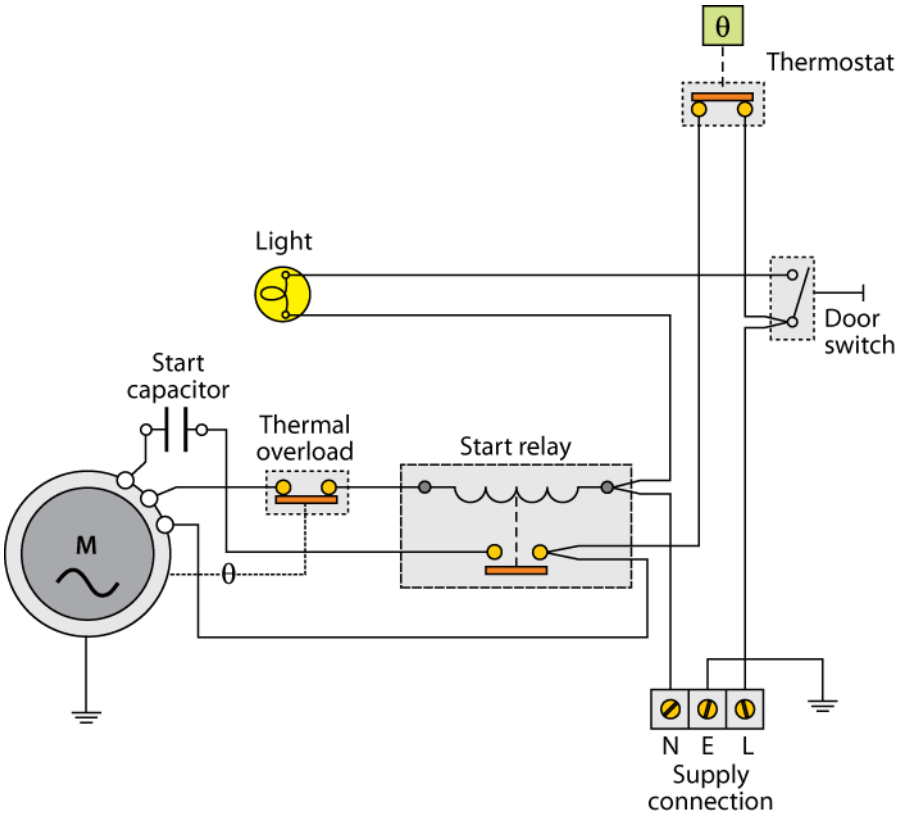
Schematic diagram

A schematic diagram gives a theoretical picture of the circuit. Components are drawn to IEC 60617 and the conductors are drawn as straight lines. It is assumed that the flow of energy is from left to right or top to bottom.



Layout diagram

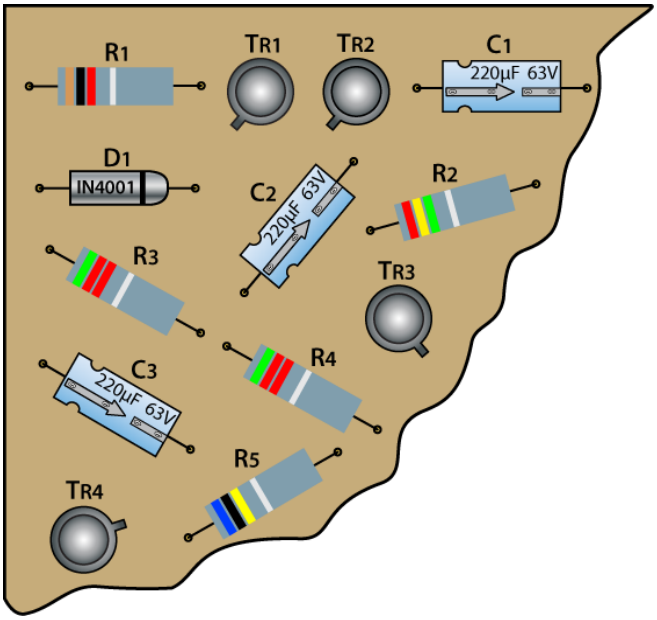
This type of diagram shows the physical positions of the components and they are shown in circuit form. The general path of the wiring is shown relative to the components and the connection of the cables is shown at each component. Often the layout diagram and the wiring diagram are treated as part of the same process.



Component positional reference

When assembling or fault finding a circuit board, it is essential that you are able to find the position of components quickly. There are two general methods used with a component positional referencing system.

Method 1



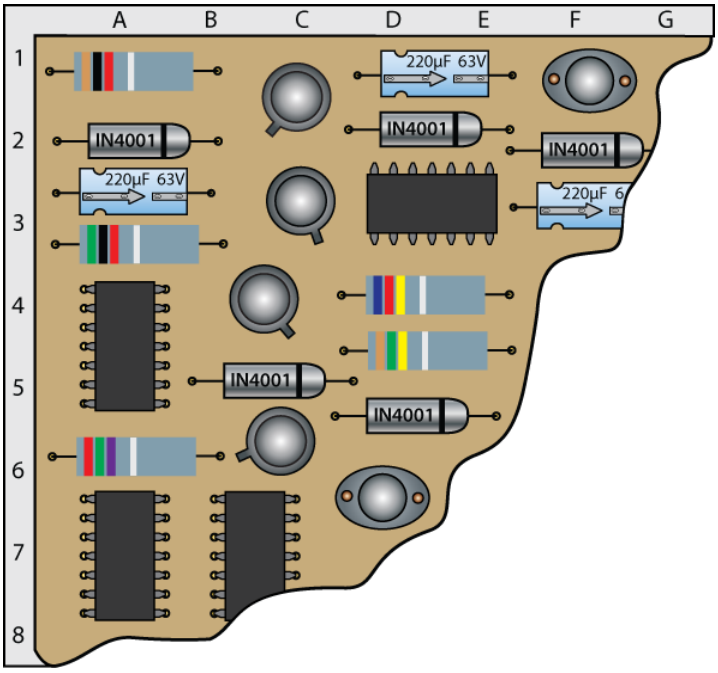
With this method, each component is given a code or number such as **R_1** or **C_2** etc. the number or code is then printed on the circuit board next to where the component is to go.

Component	Value
R1	200kJ
TR1	

There would be a table or legend attached to the diagram similar to the above. This method is fine for circuit boards that have comparatively few components. For those circuit boards that are more densely packed another method is needed.

Method 2

With this method, a drawing is produced of the layout of the circuit. A grid is then overlaid on the circuit board and the components are located by using a reference system.



Along with the grid there is a table relating the component to its position on the board.

Component	Value	Location
R_1	100kJ	A1
Tr_1		C2
C_2	100µF	D1
Tr_2		C1
Tr_3		C3

The table increases in size as the circuit becomes more complex. At least you should be able to go to the appropriate component.

We have covered the basic types of diagrams that an electrician may be expected to come across however there are other types of drawing that are common, particularly to the installation electrician.

Installation drawings

Installations drawings come in a variety of types depending at what point you are in the contract, particularly with the larger type of installation.

The drawings that make up a complete set of tender drawings for the contractor will be made up of a number of sheets labelled with a drawing number and a drawing title as well as a specification. The drawings are only used for guidance. The specification is a detailed list of the standards to be maintained, the materials to be installed and other details that relate to the contract. These make up the tender documents. The tender is the price that you enter to gain the work.

The actual position of the equipment that has to be installed has to be confirmed by the contractor before the contract begins. Any errors after this time will be solely due to the sub-contractor and will have to be put right at his cost.

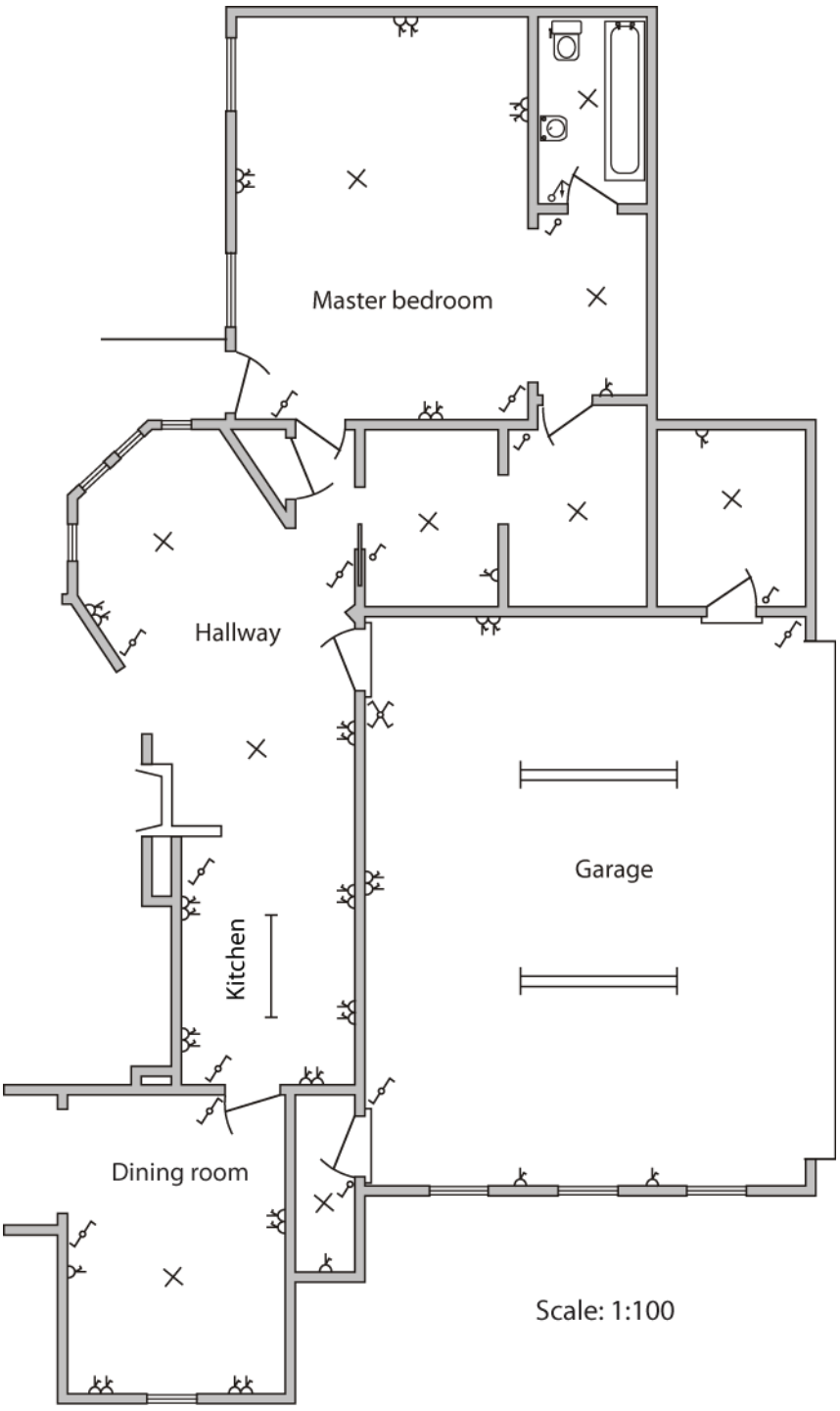
The contractor should make all necessary modifications as the work progresses, but should always have these modifications agreed by the consultant/architect or main contractor before doing them.

The contractor can inspect the mechanical services drawings at the engineer's office and the architectural drawings can be viewed at the architect's office. Any appointment to see the architect's drawings would be made through the consulting engineer.

The contractor is also responsible for notifying the consulting engineer of any discrepancy between the varying drawings. The consulting engineer's view is final, and accepted as what was intended at the time of tender.

All drawings that make up the contract show the approximate extent of the work. It is the specification however, that takes precedence over them. The drawings that accompany a specification are for pricing purposes only. They are not the working drawings.

The contractor who gets the work would be expected to make '**working**' or '**installation**' drawings. These would be shown to the consulting engineer before work commenced and the price of creating them would form part of the tender price.



Part of a domestic installation with a scale set at 1:100 is shown below.

Full use should be made of IEC 60617 symbols. Often there are no details about which switches control which lights or what types of fittings are being installed. Where this occurs it is as an aid to clarity. Any installation would contain a range of types of light fitting and socket-outlets, depending on the client's needs.

Commonly, a drawing is used to draw up a ‘material list’ or a ‘requisition list’.

Requisition/Material list

Company Name			
Description of Material	**Catalogue No.**	**Quantity**	**Cost**
Single switched socket outlet	XX001	10	
Double switched socket outlet	XX004	14	
One gang one way switch	ZZ001	6	
One gang two way switch	ZZ002	10	
One gang intermediate switch	ZZ003	1	
Pendant light fitting	WW001	10	
Fluorescent fitting	AA002	3	
Plaster depth switch boxes	GG001	17	
Single socket boxes (25mm)	FF002		
Double socket boxes			

This is not an exhaustive list. For example, it doesn’t include screws, greensleeving, rawlplugs etc. Also note that there are no costs put in. This is because to price a job is not a job for the average electrician; it is more for the employer or estimator within a company.

This is a very much-simplified list but it does convey an idea of what is required.

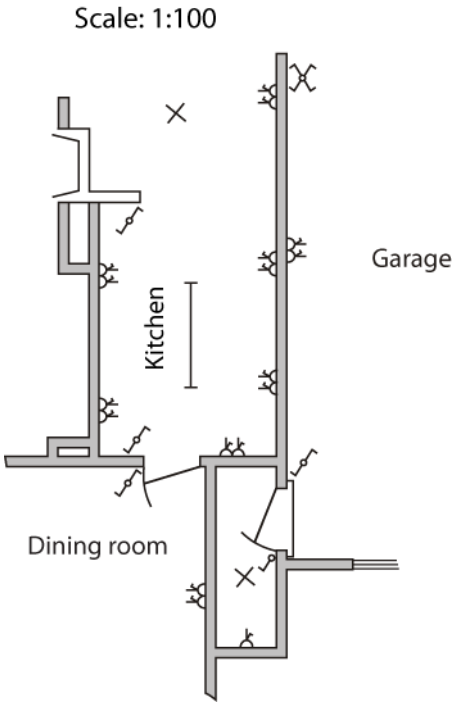
Scales

The vast majority of working drawings will come on a large sheet of either A1 $\left(594\ \text{mm} \times 841\ \text{mm}\right)$ or A0 $\left(841\ \text{mm} \times 1189\ \text{mm}\right)$ paper, and will have a scale shown in the bottom corner.

Effectively the designer is stating that the drawing that you are looking at is an exact representation of the installation, and that if the drawing grew by a certain amount then it would exactly overlay the floor plan of the installation.
The most common scales are in electrical installation work:

- 1:20
- 1:50
- 1:100

A scale rule will help when taking a direct measurement from the drawing.



Considering the kitchen only

The kitchen measures approximately 24 mm across by 33.54 mm along. As the scale is $1:100$ the actual room size is to be $24 \times 100 = 2400$ mm $= 2.4$ m across by $33.54 \times 100 = 3354$ mm $= 3.354$ m along.

Notice that it is the actual measurement multiplied by the scale, which in this instance is 100. If the scale were $1:50$ then for the same kitchen, the size will be $24 \times 50 = 1200$ mm $= 1.2$ m across by $33.54 \times 50 = 1677$ mm $= 1.677$ m along.

It is important to become comfortable with scales. The other rooms can be measured as follows for a scale of $1:100$ and $1:50$.

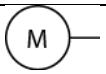
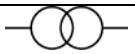
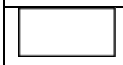
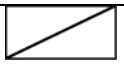
Room	**1:100 (m)**	**1:50 (m)**
Kitchen	2.4 and 3.54	1.2 and 1.68
Dining room	3.0 and 4.0	1.5 and 2.0
Master bedroom	5.6 and 5.4	2.8 and 2.7
Garage	6.4 and 7.7	3.2 and 3.85
Hallway (At its longest and widest)	3.75 and 5.35	1.88 and 2.68

There are certain common themes however in all working drawings:

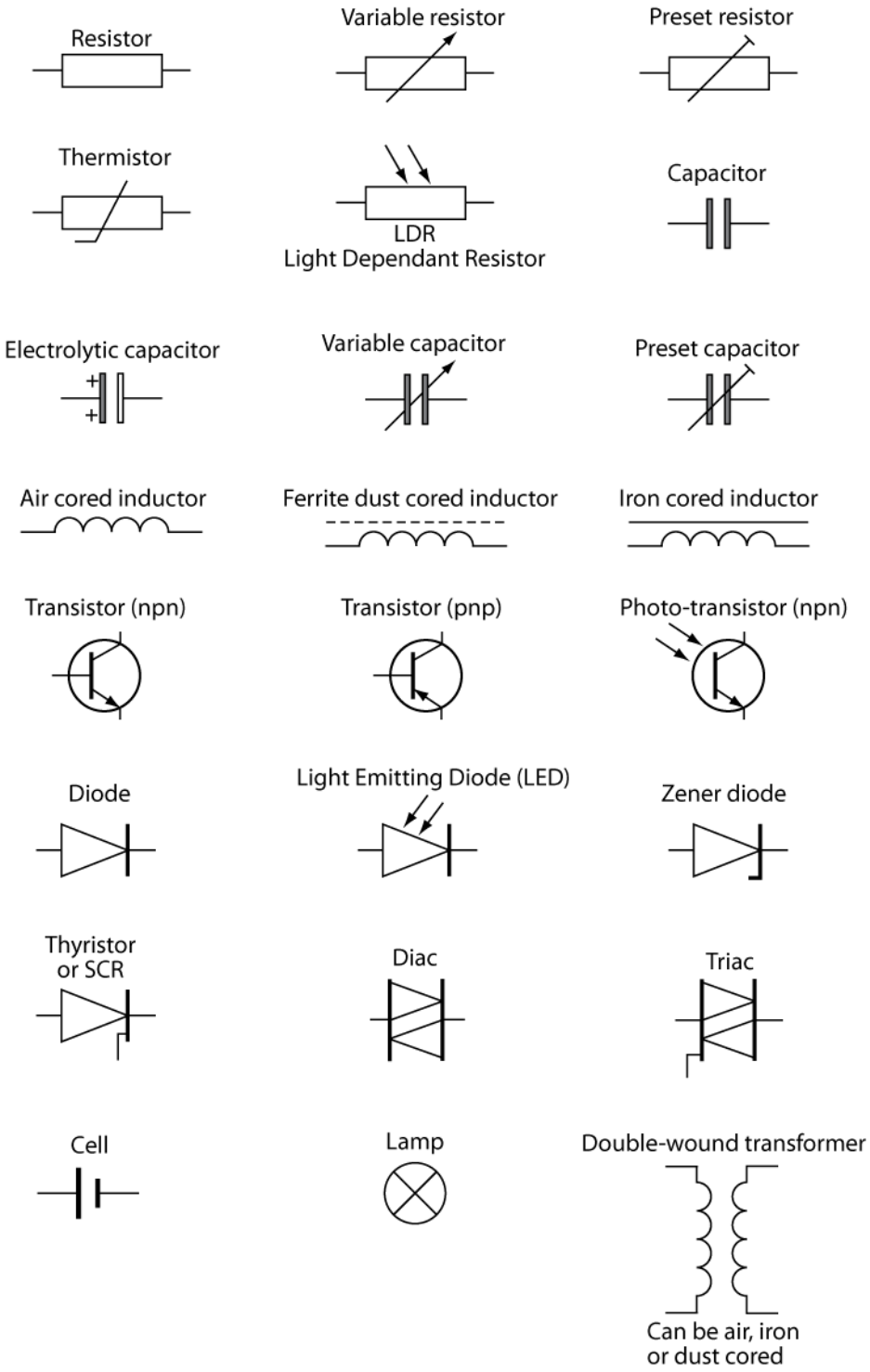
- The first one is that we always make use of the IEC 60617 architectural symbols. These symbols may vary slightly from architect to architect or consulting engineer to consulting engineer depending on their own particular bias
- As the contract progresses a set of record drawings would be created. These would show the exact location of equipment, including cable and conduit runs etc. these drawings would, when the work has finished, be supplied to the consulting engineer, and are called '**as-fitted**' or '**as-installed**' drawings.

Symbols

The standard that is used in diagrams is IEC 60617.

Symbol	Description	Symbol	Description
	One gang one way switch		Emergency luminaire
	One gang two way switch		Main switch
	Intermediate switch		Telephone point
	One gang one way pull cord switch		Bell
	Light point		Buzzer
	Single tube fluorescent light point		Push button
	Wall-mounted light point		Loudspeaker
	Wall-mounted light point with switch		Motor
	Unswitched socket-outlet (single)		Transformer
	Switched socket-outlet (single)		Electrical appliance
	Switched socket-outlet (twin)		Heater
	Consumer unit		Meter
	Thermostat		Double-pole switch
	Fan		Main control point

The images over the page are IEC 60617 symbols for electronic devices used in circuit diagrams.



4: The work site procedures

In this session the student will:

- Describe the work site requirements and procedures of:
  - Services provision.
  - Ventilation provision.
  - Waste disposal procedures.
  - Equipment and material storage.
  - Health and safety requirements.
  - Access by personnel.
  - Equipment and systems that are compatible to site operations

On site services

Before any work came be done on an installation, it is necessary to make sure that the correct services have been provided on site. You also have to identify existing services present (e.g. electric cables or gas mains, water pipes) and take effective steps (if necessary) to prevent danger to or from them.

Low voltage should be used for tools and equipment, eg battery-operated tools or low-voltage systems.

Where mains voltage has to be used, there should be trip devices (eg residual current devices (RCDs)) provided for all equipment. These should be checked daily by users and properly maintained.

Any cables and leads should be protected from damage.

Access by personnel

There should be safe access to the site on which you are working, both to yourself, visitors and vehicles. Construction work should be fenced off and suitably signed. This will protect people (especially children), from site dangers and the site from vandalism and theft. New employees should be shown around the site and any dangers pointed out to them and the site safety rules explained.

Everyone who visits the site for whatever reason should be entered into the visitor's book or site log and provided with suitable protective equipment. They need to be shown around and the rules of the site explained.
All visitors should be treated with respect, their identity checked and the reason for the visit, and the person they are there to see noted.

Health and safety requirements Health and safety requirements

The construction site is highly dangerous and therefore safe systems of work need to put in place. The law requires health and safety issues to be managed and controlled both by you and by employers.
The main causes of accidents are falls, trips, unsafe lifting techniques, electrical, falling objects and mobile plant, all personnel on site should have training on how to avoid these accidents.

Before you start work on any installation you need to consider if there are any hazards you can avoid altogether, decide which risks need to be controlled, consider the best ways of controlling them; and then put procedures into place to prevent accidents.

Everyone who works on any site must have access to adequate toilet and washing facilities, a place for preparing and consuming refreshments
Every site should have a first aid box, an appointed person to take charge of first-aid arrangements and information telling workers the name of the appointed person or first aider and where to find them.

Ventilation

All workplaces need an adequate supply of fresh air.
Ventilation usually means using a fan to blow air into the workroom and /or extracting contaminated air out. Sometimes powered ventilation is an integral part of a set of control measures, eg the welding of large fabrications in a workshop. An effective extraction system needs to be usable by the workforce. It should be powerful enough to capture or contain the harmful substances, be positioned to receive the harmful substance from the process, filter and discharge the air to a safe place.

If you are working inside you need to ensure that you have adequate ventilation, paints, glues etc may give off hazardous vapours. Make sure the space you are working in has enough ventilation to make the air fit to breathe.
Do not use petrol or diesel engines because exhaust gases are harmful.
Remember, open-flued gas heaters and gas cooking rings can produce carbon monoxide if there is inadequate ventilation. When poorly maintained, they also give rise to leaks of methane which can ignite or explode without warning. Gas appliances should not be used in site huts, containers or other enclosed areas unless there are vents or louvres that cannot be closed off and that give a permanent supply of fresh air.

Equipment storage

The law says you must keep every part of your construction site in 'good order' and every place of work clean. The safe and organised storage of tools and equipment is important for several reasons; firstly you can access what you need and secondly you can keep track of equipment and readily see if anything is missing and also it prevents breakages.

Designated storage areas for plant, materials, waste, flammable substances (eg foam plastics, flammable liquids and gases such as propane) and hazardous substances (eg pesticides and timber treatment chemicals) should be provided. Flammable materials will usually need to be stored away from other materials and protected from accidental ignition.

Do not store materials where they obstruct access routes or where they could interfere with emergency escape. If materials are stored at height, make sure necessary guard rails are in place to prevent falls when stacking or collecting materials or equipment.
Keep all storage areas tidy, whether in the main compound or on the site itself.

Equipment used on site must be compatible with the conditions that you would expect to find; therefore they must be robust enough to withstand the possible damp and dusty conditions. Any electrical equipment must be compatible with the electricity supplied, preferably low voltage.

Waste disposal procedures

All waste produced can present a real safety hazard to workers on site and the environment if it is not properly managed.

- **Flammable materials** - make sure that all flammable waste materials (such as packaging and timber off cuts) are cleared away regularly to reduce fire risks;
- **Work areas** - make clearing waste a priority for all trades. Check that everyone is aware of what is required that it is being done;
- **Skips** - waste materials need storing safely before their removal from the site so make sure that you allow sufficient space for waste skips and bins etc. Plan where the skips can be positioned and how often they will need to be collected;
- **Waste within buildings** - consider waste generated inside the building and whether you need to provide wheeled bins or chutes etc. to enable it to be brought out of the building safely

Burning of waste on site is environmentally unsound, dispose of materials correctly. By reducing the amount of waste you produce you can save costs.

5: Record keeping and certification

In this session the student will:

- Describe the appropriate test forms used for commissioning an electrical installation. Including:
  - Electrical installation Certificate.
  - Minor electrical installation Works Certificate.
  - Electrical Installation Condition Report.

Results of any test taken or inspections carried out must be recorded. Without records there is no evidence that any testing has taken place and, if any problems were to appear at some later time, no evidence to suggest proper tests have been performed.

It is a requirement that all test results are recorded. Chapter 63 of BS 7671 covers the reporting and certification of an installation's test results. Indeed, the same requirement of the Electricity at Work Regulations (Regulation 4(4)) applies, in that records should be kept of the maintenance of an installation.

There is a standard format for all inspection and tests. These forms may be found in Appendix 6 of BS 7671, and in Part 5 of GN3. These can also be found on the IET's own website.

The two forms used for any new work or alteration to an existing circuit(s) are:

- Minor Electrical Installation Works Certificate
- Electrical Installation Certificate.

One form is used when checking the condition of an existing installation:

- Electrical Installation Condition Report.

The Electrical Installation Certificate (EIC) and the Electrical Installation Condition Report (EICR) must be supplemented by a Schedule of Test Results and a Record of Inspection (Regulation 631.1 and Regulation 631.2 refer). Certificates and reports based on the template in Appendix 6 of BS 7671 are provided by other organisations.

The inspection part is usually a ‘tick box’ affair. This simplifies things a great deal, and allows the descriptions to be memory joggers.

The significant change in has occurred in the EICR Inspection Schedule for domestic and similar premises up to a 100 A supply. This has significantly increased in length and detail.

There is much that is similar between the periodic report and installation certificate, and so I will only highlight the differences between the two.

Each form will be shown as a blank, with the following page showing how it might be filled in. You can get the pre-amendment 1 forms from the IET web site directly. Currently (August 2011) they do not have the updated forms on their website

Minor Electrical Installation Works Certificate

PART 1:Description of minor works

1. Description of the minor works
2. Location/address
3. Date minor works completed
4. Details of departures, if any, from BS 7671:2008

PART 2:Installation details

1. System earthing arrangement TN-C-S ☐ TN-S ☐ TT ☐
2. Method of fault protection
3. Protective device for the modified circuit Type ..... Rating ..... A

Comments on existing installation, including adequacy of earthing and bonding arrangements (see Regulation 132.16):

PART 3:Essential Tests

Earth continuity satisfactory ☐

Insulation resistance:

Line/neutral ..... MΩ

Line/earth ..... MΩ

Neutral/earth..... MΩ

Earth fault loop impedance ..... Ω

Polarity satisfactory ☐

RCD operation (if applicable). Rated residual operating current $I_{\Delta n}$ ..... mA and operating time of ..... ms (at $I_{\Delta n}$)

PART 4:Declaration

I/We CERTIFY that the said works do not impair the safety of the existing installation, that the said works have been designed, constructed, inspected and tested in accordance with BS 7671:2008 (IET Wiring Regulations), amended to ..... (date) and that the said works, to the best of my/our knowledge and belief, at the time of my/our inspection, complied with BS 7671:2008 except as detailed in Part 1 above.

Name:	Signature: .....
For and on behalf of:	Position: .....
Address:.....	
.....	Date:.....
.....	

A Minor Electrical Installation Works Certificate is used for alterations to existing circuits, not additions to a distribution board or consumer's unit.

Electrical Installation Condition Report

The Electrical Installation Condition Report (EICR) takes over from the Periodic Inspection Report (PIR) but is simply a name change.

The EICR is issued when an inspecting engineer assesses the state of an electrical installation.

ELECTRICAL INSTALLATION CONDITION REPORT

Section A. Details of the client / Person ordering the report
Name……
Address……
……

Section B. Reason for producing this report……
……
Date(s) on which inspection and testing was carried out……

Section C. Details of the installation which is the subject of this report
Occupier……
Address……
……
Description of premises (tick as appropriate)
Domestic □ Commercial□Industrial□ Other (include brief description)□ ……
Estimated age of wiring system……..years
Evidence of additions / alterations Yes □ No□ Not apparent □ If yes, estimate age…….years
Installation records available? Yes □ No □ Date of last inspection…….

Section D. Extent and limitations of inspection and testing
Extent of the electrical installation covered by this report
……
……
Agreed limitations including the reasons (See Regulation 634.2)
……
Agreed with:……
Operational limitations including the reasons (see page no……)
……
The inspection and testing detailed in this report and accompanying schedules have been carried out in accordance with BS 7671:2008 (IET Wiring Regulations) amended to: ……..
It should be noted that cables concealed within trunking and conduits, under floors, in roof spaces, and generally within the fabric of the building or underground, have not been inspected unless specifically agreed between the client and inspector prior to the inspection.

Section E. Summary of the Condition of the installation
General condition of the installation (in terms of electrical safety)
……
……
Overall assessment of the installation in terms of its suitability for continued use
SATISFACTORY / UNSATISFACTORY* (Delete as appropriate)
*An unsatisfactory assessment indicates that dangerous and/or potentially dangerous conditions have been identified.

Section F. Recommendations
Where the overall assessment of the suitability of the installation for continued use above is stated as UNSATISFACTORY, I / we recommend that any observations classified as 'Danger present' (Code C1) or 'Potentially dangerous'(Code C2) are acted upon as a matter of urgency
Investigation without delay is recommended for observations identified as 'Requiring further investigation'
Observations classified as 'Improvement recommended'(Code C3) should be given due consideration.

Subject to the necessary remedial action being taken, I / we recommend that the installation is further inspected and tested by ……(date)

Section G. Declaration
I/We, being the person(s) responsible for the inspection and testing of the electrical installation (as indicated by my/our signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the inspection and testing, hereby declare that the information in this report, including the observations and the attached schedules, provides an accurate assessment of the condition of the electrical installation taking into account the stated extent and limitations in section D of this report.

INSPECTED AND TESTED BY:	REPORT AUTHORISED FOR ISSUE BY:
Name (Capitals)……..	Name (Capitals)……
Signature……	Signature……
For/on behalf of……	For/on behalf of……
Position……	Position……
Address……	Address……
Date……	Date……

Section H. Schedule(s)
……schedule(s) of inspection and …….schedule(s) of test results are attached.
The attached schedule(s) are part of this document and this report is valid only when they are attached to it.

The inspector uses the current version of BS 7671 to assess whether the existing installation is safe for continued use. The EICR should be issued with both a Test Schedule and an Inspection Schedule. Without these two documents to EICR is incomplete.

ELECTRICAL INSTALLATION CONDITION REPORT

Section I. Supply characteristics and earthing arrangements

EARTHING ARRANGEMENTS	NUMBER AND TYPE OF LIVE CONDUCTORS	NATURE OF SUPPLY PARAMETERS	SUPPLY PROTECTIVE DEVICE
TN-S ☐ TN-C-S ☐ TT ☐ TN-C ☐ IT ☐	a.c. ☐ d.c. ☐ 1-phase, 2-wire ☐ 2 wire ☐ 2 phase, 3-wire ☐ 3 wire ☐ 3 phase, 4-wire ☐ Confirmation of supply polarity ☐	Nominal voltage, U/U_0 (1) .....V Nominal frequency, f (1).....Hz Prospective fault current, I_{pf} (2).....kA External loop impedance Z_e (2)..... Ω Note: (1) by enquiry (2) by enquiry or by measurement	BS (EN)..... Type..... Rated Current.....A

Alternative source of supply (as detailed on attached schedule)

Section J. Particulars of installation referred to in report

MEANS OF EARTHING	DETAILS OF INSTALLATION EARTH ELECTRODE (WHERE APPLICABLE)
Distributor's facility ☐ Installation earth electrode ☐	Type..... Location..... Resistance to Earth..... .. Ω

Section K. Main protective conductors

Earthing conductor	Material.....	Csa.....mm²	Connection / continuity verified ☐
Main protective bonding conductors	Material.....	Csa.....mm²	Connection / continuity verified ☐
To incoming water service ☐	To incoming gas service ☐	To incoming oil service ☐	To structural steel ☐
☐ To lightning protection	To other incoming service(s) ☐ Specify.....		

Section L. Main switch / switch-fuse / circuit-breaker/RCD

Location..... ..... BS(EN)..... No of poles.....	Current rating.....A Fuse / device rating or setting.....A Voltage rating.....V	If RCD main switch Rated residual operating current ($I_{\Delta n}$).....mA Rated time delay .....ms Measured operating time(at $I_{\Delta n}$).....ms

Section M. Observations

Referring to the attached schedules of inspection and test results, and subject to the limitations specified at the Extent and Limitations of the Inspection and testingsection

☐ No remedial action is required. ☐ The following observations are made

OBSERVATION(S)	CLASSIFICATION CODE	FURTHER INVESTIGATION REQUIRED (YES / NO)
.....	.....	.....

One of the following codes, as appropriate, has been allocated to each of the observations made above to indicate to the person(s) responsible for the installation the degree of urgency for remedial action.

C1 - Danger present. Risk of injury. Immediate remedial action required

C2 - Potentially dangerous - urgent remedial action required

C3 – Improvement recommended

This is the second page of the EICR.

The table over the page is an example of the Schedule of Test Results which is common to both the Electrical Installation Certificate and the Electrical Installation Condition Report.

Further forms are listed in Appendix 6 of BS 7671.

The significant change between the Periodic Inspection report and the Condition Report is the additional list of inspection items.

There are numerous pages detailing many of the items within an installation that should be inspected. This has been done to help the inspector to 'ask the right questions' of the installation.

Generic schedule of test results

SECTION O. SCHEDULE OF CIRCUIT DETAILS

DB reference no..... Location..... Zs at DB (Ω)..... I_{pf} at DB (kA)..... Correct polarity of supply confirmed yes / no Phase rotation confirmed (where appropriate).....	Details of circuits and/or installed equipment vulnerable to damage when testing	Details of test instruments used (state serial and/or asset numbers) Continuity..... Insulation resistance..... Earth fault loop impedance..... Earth electrode resistance..... RCD .....

	Circuit details								Test results															
		Overcurrent device				Conductor details			Ring final Circuit continuity(Ω)					Continuity (Ω) ($R_1 + R_2$) or R_2		Insulation Resistance (MΩ)		Correct polarity (yes / no)	Z_s (Ω)	RCD (ms)			Remarks (You may continue on a separate sheet)
Circuit number	Circuit Description	BS (EN)	type	Rating (A)	Pfc (kA)	Reference Method	Live (mm^2)	cpc (mm^2)	r_1 (line)	r_n (neutral)	r_2 (cpc)	Cross-connected line and neutral	Cross-connected line and cpc *	($R_1 + R_2$)	R_2	Live-Live	Live-E			@ $I_{\Delta n}$	@ $5I_{\Delta n}$	Test button operation	

* Where there are no spurs connected to a ring circuit this value is also the (R_1+R_2) of the circuit

There is nothing stopping you creating your own inspection checklist, particularly if you work in an area where there is a strict limit on the areas that need checking. The actual errors should be recorded.

Inspection Schedule

This is common to both the Electrical Installation Condition Report and the Electrical Installation Certificate. As with all of these reports it is important to remember that you can add as many sheets as are necessary to complete the task.

The only significant difference between an Electrical Installation Condition Report and an Electrical Installation Certificate, other than the Schedule of Inspection, is that the Electrical Installation Condition Report requires an '*Extent and Limitations*' box completing, whilst the Electrical Installation Certificate requires three signatures for Design, Construction and Inspection and Testing.

In BS 7671, there are certain things that need to be listed. These are listed below:

- a description of the extent of the work inspected
- details of prevailing dangerous conditions, and any which are likely to develop
- any restrictions that have been imposed during inspection and testing
- any serious defect that should, if possible, be remedied immediately.

The Electrical Installation Certificate and the Electrical Installation Condition Report should be given to the person ordering the work (Regulation 632.1 and Regulation 634.1 refers).

The Electrical Installation Certificate must be signed for the three aspects of the installation (Regulation 632.3 refers). These are the:

- design
- construction
- inspection and testing.

For many contractors this may well be the same signature for all three parts. It could just as easily, however, require three different signatures. For example, the designer could be the consulting engineer, the contractor could sign for the construction and the contractor may call in a specialist to inspect and test.

An Electrical Installation Certificate should not be given when the installation does not comply with the requirements of BS 7671 (Regulation 632.4 refers).

For installations that have been altered, you need to be aware that you may well end up having to test the whole of the new and old installation. Regulation 610.4 requires that due account is taken of any effect that adding to an installation may bring about. For example, existing earthing arrangements.

Now attempt end of outcome questions.

1: Electrical specialisms and electrotechnical activities

In this session the student will:

- Describe the services provided by different specialisms within the electrotechnical industry.

To most people the word ‘electrician’ means the person who comes and to their house when the lights don’t work or they want a new socket in the kitchen. Electricians can in reality be working in a wide range of installations and occupations

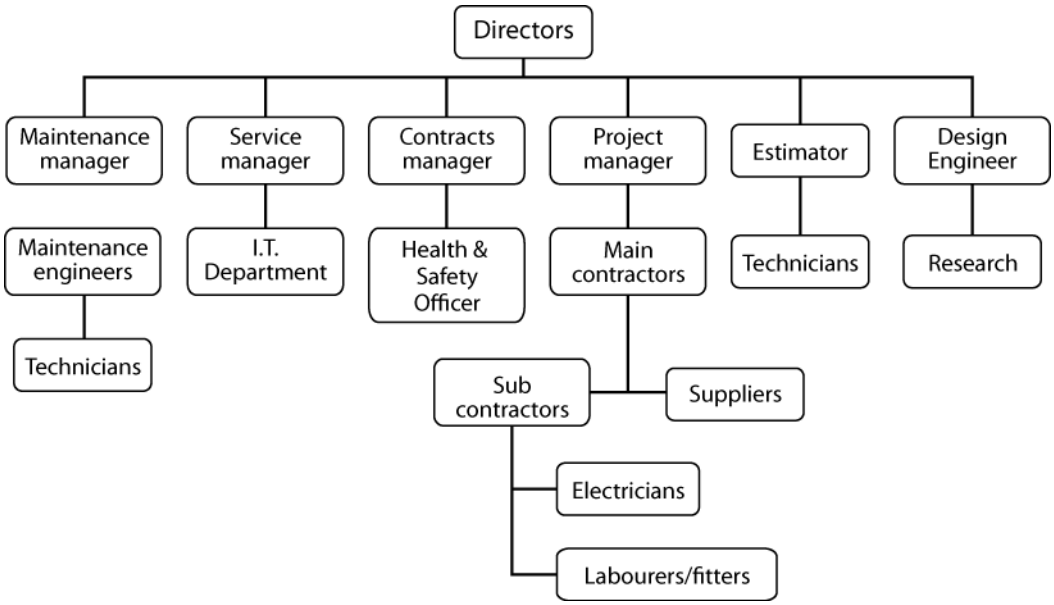
- Electrical contracting – the design, installation and testing of fixed wiring
- Auto-electrician – electrical work within moving vehicles
- Protection engineer – working on protection systems within industry
- HV engineer – working on high voltage systems
- Building services engineer – involved in the design and oversight of engineering systems (including electrical systems) within properties
- Electronic engineer
- Electronic technician
- Maintenance electrician- repairing buildings and systems

There are many other roles some will overlap.

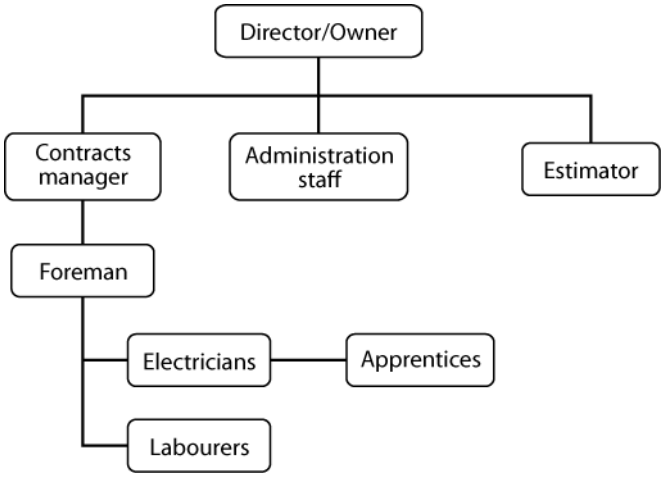
Organisations need organisational systems so that they can run safely and effectively. There is rarely such a thing as a '*typical*' organization; however size does tend to dictate the level of complexity that exists within an organization. The type of personnel that will exist within an electrical installation firm will depend on the size of the company and may contain one or more of the following:

- Design engineer
- Maintenance engineer/manager
- Service manager
- Estimator/cost engineer
- Contracts manager
- Technician
- Supervisor/foreman
- Operatives-installation, maintenance, servicing
- Mechanic/ fitter-installation, maintenance, servicing

Large electrical contracting company might be organised as below.



Smaller electrical contracting company might be organised as below.



Electrical contracting industry

Within the organisation are different people who work to ensure that the project runs smoothly. Not all organisations will have all of the people listed below

Client	The person who wants the work done
Architect	They design the project so that it does what the client requires it to do. • Depending on the size of the project they could enlist other specialist engineers. • They are responsible for making sure that the project complies with appropriate rules and regulations
Design engineer	Acts for the architect. • Creates drawings • Acts as a link between the electrician, the main contractor and the client
Quantity surveyor	Controls and manages the financial side of the installation • Prepares the quantities • Monitors the amounts used
Clerk of works	Controls the quality of work, materials and workmanship • Inspects the work • Checks standards
Main contractor	This is usually the builder • Employers other contractors • Pays and co-ordinates sub-contractors
Nominated sub-contactors	These are specified by the client and must be used by the main contractor
Non-nominated Sub-contractors	Chosen and contracted by the main contractor
Contracts manager	Oversees the work of the contract engineers
Project engineer	Responsible for the day to day management of the site
Site manager	Contractors representative • Normally an approved electrician • Responsible for other electricians and apprentices • Uses drawings and specifications

	• Ensures materials etc are on site when required • Liaises with the contract engineer if there are changes to be made
Electricians, apprentices	The people who carry out the work
Electrical fitters	Electricians who carry out the mechanical work

There are a number of organisations that impinge both directly and indirectly onto the contracting company.

Trade unions

These are organisations that exist for the interests of their members. They help when negotiating pay and conditions of work. They also help with legal problems, industrial tribunals etc. Nowadays you are not required to be a member of a particular trade union, although it is probably to your benefit. Unite is the trade union which looks after the interests of the electrical installation industry

Electrical Contractors Association (ECA)

The Electrical Contractors' Association (ECA) is a trade association representing the interests of contractors who design, install, inspect, test and maintain electrical and electronic equipment and services.

The ECA's stated aims are:

1) To provide a comprehensive, first-class range of tools and expert support services to its Registered Members.
2) To work with regulatory bodies, government and opinion formers to build an efficient and sustainable industry, based on high standards of training and practice.
3) To form strategic relationships with those who specify electrical work to enhance the profile and promote the use of Registered Members of all sizes, improving their profit potential.

Joint Industry Board (JIB)

This is a joint trade union and management organisation. It has, over the years, set wage rates, holidays and grades within the industry. It has been of immense help in limiting trade disputes. Nowadays it has a training arm (JTL) which trains and registers apprentices.

Advisory, Conciliation and Arbitration Service (ACAS)

This organisation is a Government *quango* (Quasi-Autonomous Non-Governmental Organisation). ACAS stands for Advisory, Conciliation and Arbitration Service. They aim to improve organisations and working life through better employment relations. ACAS helps with employment relations by supplying up-to-date information, independent advice and high quality training, and working with employers and employees to solve problems and improve performance.

Whether you're an employer or an employee ACAS provide free advice from their website or by calling their telephone helpline. Employers might also be interested in their more specialised services, including training, workplace projects, conciliation and mediation.

NICEIC

NICEIC is the UK electrical contracting industry's independent voluntary body. They offer certification services, Building Regulations Schemes, products and support to electrical contractors and many other trades within the construction industry.

Contractors can apply to be placed on the roll of the NICEIC, and are then inspected, usually once a year. If a company is removed from the NICEIC books they may lose many contracts.

NAPIT

NAPIT was formed in 1992 as the National Association for Professional Inspectors and Testers. NAPIT's role has evolved and expanded to be one of the Government Approved register holders for Part P Registered Domestic Electrical Installers (both full and defined scope) while continuing to serve the needs of those carrying out equipment testing and electrical installation and testing in commercial and industrial sectors.

2: Sharing technical information

In this session the student will:

- Describe the importance of accurate record taking.
- Describe the nature of technical information and how it might be passed on.

The sharing of information is necessary in all businesses. Failure to communicate in the appropriate way at the appropriate time may lead to much confusion.

The information that is shared must be accurate and sufficient for the purpose. It is important to build good working relationships with colleagues and customers. The building of good working relationships within an organisation helps to promote strong teams, grow a good working atmosphere and improve profitability.

In your daily and weekly contacts you are likely to come into contact with many of the following:

- Safety officers
- General foreman
- Site manager or agent/Project manager
- Trade foreman
- Chargehands
- Tradesmen
- Site engineer or surveyor
- Client
- Architect
- Health and safety inspector

One of the more formalised occasions for people to meet is the ‘site meeting’.

Site meetings

Site meetings can be either formal or informal. Indeed, informal meetings take place all the time. People meet, talk about the task, make or amend plans or clarify some technical point or receive further instruction and then carry on with their work.

Formal meetings are more structured and will follow a standard format. A formal meeting exists to discus progress, changes to plans, and difficulties that have arisen or are foreseen. Formal meetings:

- Are scheduled for a specific date and time
- Have specific items to be discussed
- Record the topics discussed and the decisions made (or not made).

An agenda is a record of the specific items to be discussed. These will be set out in a simply list, usually having main headings and sub-headings.

Meetings should stick to the agenda and is an important element in the sharing of information. The people who attend should be prepared and have an understanding of the issues that exist.

During a meeting it is important that a record of all decisions made and views expressed is made. This record is called the ‘minutes’ of the meeting and they are the agreed record of all decision made. If, at some later stage, there is a disagreement between parties then reference is made to the minutes to confirm the agreed view of the meeting.

Site diary

The site diary is the responsibility of the foreman or charge hand of the electrical contractor. The Main Contractor will also maintain a diary

The site diary is kept safe in the site office and is a record of any information that is relevant to the installation/site. The diary will usually record a number of items. These will include:

- Site visits
    - Here the name, date and time of the visit should be recorded along with any other details that may be necessary. This might include safety training etc.
- Site meetings
    - All details (called minutes) of the meeting should be kept. Minutes are only the record of decisions taken and objections expressed, any more are an essay and should be avoided.
- Telephone calls
    - The name, time of call and the nature of the call need to be recorded.

Additionally, a site diary will record any correspondence that has been dealt with, dismissals of staff, hiring of staff, along with the details of the hiring and firing processes. There should also be a record of any disciplinary action that has been taken. This is not an exhaustive list and it may be necessary to record other information.

The diary is not a storybook. You are keeping records. It is not necessary to use perfect English, but it is necessary to be able to communicate accurately what has happened.

Technical information

Technical information is usually presented using a combination of numbers and symbols, tables, graphs, diagrams and charts, and words! It is important that this information is presented in a way that can be understood by the person receiving it.

Numbers

Small numbers without units are usually written as words. For example:

- ***four*** different choices
- there are ***two*** reasons for this

In all other instances numbers are written as figures:

- there are 245 emails outstanding
- there is a leakage current of 4.5 mA
- measured at 10 m intervals

Where numbers grow larger, it is often easier to read by splitting the number into groups of three with a space left between them. For example:

- 57600 becomes 57 600
- 1897590 becomes 1 897 590

It is not recommended to use commas between numbers instead of a space as this can cause confusion.

Large or complex numbers may be expressed in standard form such as:

- 4.56×10^6

Where units are used it is also permitted to reduce this even further. For example:

- 4.56×10^6 W becomes $4.56\,\text{MW}$.

Accuracy

Accuracy is important; however the level of accuracy should be assessed against the immediate situation. For example, when measuring the earth fault loop impedance it may be necessary to be accurate to two decimal places, whereas, when measuring insulation resistance rounding up to the nearest 10 000 may be appropriate.

Where units are used a space should exist between the quantity and the unit. For example:

- 23A should read 23 A
- 0.456Ω should read 0.456 Ω.

Tables

Tables are a neat way of presenting information. This might be numbers or text, but the writer should keep things as simple as possible. Use appropriate units and, where possible, for clarity add the units in the header rather than by each quantity.

Below is an example of a descriptive table.

Capacitor type	**Uses**
Air	Used in laboratory work.
Paper	Used in power factor correction and some electronic circuits.
Plastic film	Types such as polycarbonate, polyester and polystyrene. Used in electronic circuits for filtering, coupling and bypassing.
Metallised paper	Used in automobile ignition circuits-local short circuits can self-heal!
Mica	Used in electronic tuning circuits.
Ceramic	Used in electronic circuits for signal coupling, filtering and frequency selection.
Electrolytic	Used in electronic circuits for power supplies, bypassing, coupling at low frequencies etc. They have very high capacitance values.

Graphs

Graphs are useful when you want the reader to grasp a pattern or trend in the results, and when precise numerical details do not have to be communicated through the graph. There are many different types of graphs available, and not all graphs are suitable for all types of data.

Graphs should be as simple as is possible and should communicate the required information the inclusion of appropriate labels is an important

When making your decision about the ideal type of graph to use, think about what sort of data you have. Data can usually be categorised into:

- **Discrete or categorical data**

  This is data that falls into distinct categories such as the number of electricians, plumbers and plaster on site in a given period this information would be shown on bar charts and similar

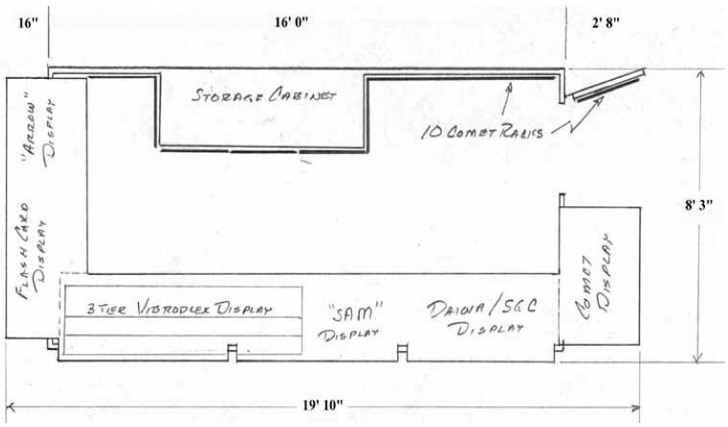
- **Continuous data**

  This is data such as the number of man hrs worked each month, this information would be shown on x-y axis type charts

Diagrams

Although already touched upon, diagrams are an important feature of reports. For example, an Electrical Installation Condition Report (Periodic Inspection Report) may require a diagram to be drawn to clarify specific issues.

Often such diagrams may be line drawings or something akin to a schematic diagram. However, there may be instances where it is reasonable to create a simple sketch.



For example, a simple sketch of a room layout with added socket-outlets and the like will aid a future inspection and test, ensuring the tester will know what existed at a particular moment in time.

3: Supplying technical information

In this session the student will:

- State the limits of their responsibility for supplying technical and functional information
- State the appropriateness of different customer relations
- Identify methods of providing technical and functional information

There are many people that you will meet during your work, and during this time you will be require to give them information. This could be anything, from the name of the company you work for, to complicated technical information.
Giving this information puts a responsibility on you. The answer you give must be accurate and truthful. If you don't know the answer, don't guess, say you don't know and go and find someone who does, or direct the questioner to that person.

Good customer relations are one of the most important parts of your job. If you don't have this you are unlikely to be asked to do any more work for them or for any contacts your customer might have. Bad relationships with your customer could end up with you being out of a job.

Good customer relations

Customer service is a relatively simple concept and there are a number of steps that people can take to improve the chances for repeat business of good 'word of mouth' recommendations. These are:

- Answer the phone – be available using call back, call forwarding or an answering service.
- Don't make a promise that you can't keep – a plan to keep a promise is not the same as a promise. Customers expect reliability and keeping promises demonstrates this.

Cont...

- Listen to customers – if a customer tells you of an issue and then you ignore them they are likely to become frustrated. It is reasonable to suggest solutions to the problems they raise as this demonstrates they are being listened to.
- Be helpful even if there is no immediate benefit – a good impression remains. Potential customers remember.
- Train staff to always be helpful, courteous and knowledgeable – good knowledge of relevant standards helps a customer/client to have confidence in you. It is your business to know your job. Don't be afraid of saying you don't know something, but offer to find out.
- Ensure you protect the property, use dust sheets, ask for furniture to be moved
- Be clean and present yourself well, pay attention to personal hygiene.
- Clean up after yourself, leave the property clean and tidy
- Go the extra mile – people notice those who make an extra effort.
- Throw in something extra – this might be a coupon for a future discount, additional information on how products work or how to manage the simple checks for an installation.

Negatively, never:

- Bad mouth an employer to a customer/client etc.
- Use bad language
- Gossip about the customer to other, confidentiality is part of your job!
- Do '*favours*' for others using company property.
- Speak for your employer when not authorised to do so. Never assume that you know what your employer wants. If you are unsure ask!
- Work where there are young children or animals
- Use hazardous substances without informing the client first

The client might have queries which need answering. Always try to provide answers about your work, if you can't provide the answer straight away, admit it find out and come back later with an explanation.

Typical questions might be:

- How long will the job last?
- How easy is it to use?
- How long will it be before it needs replacing?
- Is this definitely what I need? My friend has something different.
- Will it cost a lot to run?

To answer some questions, you might have to ask questions yourself, are they worried about something, perhaps they feel they can't afford to use the new fire when you have installed it, or the boiler controls are not easy to use.

The client although normally in domestic installation work would be a house holder, requiring general information and any safety information. Your client could well be the contracts engineer. The questions he/she might ask would be more technical, this is where you need to show your knowledge and training. Answer as much as you can, they will be able to spot if you are not telling the truth.

To back up the information that you have supplied to the client, you can use table's, charts and diagrams.

Ways of providing information

There are advantages to having written information as this can be referred to in the future, misunderstood verbal communications could prove costly.

Written information is still the most common form of storing communication. This could be in the form of leaflets, books, data sheets, charts, contracts and so on. Increasingly this is changing to other methods, namely electronics. This helps lower the costs and increase the speed in which the information can be delivered.

Information can be sent by fax machines but these are being phased out as we enter the paperless age. CD/DVD and USB devices are becoming the most frequently used as they are low cost and are easily transferable. Information can quickly be downloaded from the internet, via web pages. Emails provide quick almost instant communication, with web conferencing and video links, making distances no object.

There is still the post which although slower means bulker items can be sent and if the item is sent by secure mail, it is signed, for an authentication guarantee.

Communicating with other trades

Not only are good customer relations important, the relationship between yourself and other trades on site is equally important if you don't want your socket boxes plastering over. Establish a good working relationship and tell others, if it is appropriate, where and when you will be working.

Hand over procedures

For handover purposes an Operations and Maintenance Manual (O&M) should be compiled for a client. Such a manual would contain at least the following for an electrical installation:

- Index of contents
- Specification of the works
- Commissioning certificates
- Test results & distribution schedules
- System operating instructions
- Schedules of equipment installed
- Schedules of addresses
- Specialist services operating instructions
- Service recommendations
- List of tools/keys handed over
- CAD record drawings

As well as handing over documentation is usual to show the client the finished installation, and explain the key features. This is an opportunity to make sure that the client understands what everything does and how to operate it correctly.

It is important that any health and safety issues are pointed out and that the client is aware of them and the consequences of any misuse.

To do this you must be confident that you know the operating principles yourself. This handover can be done at a formal handover meeting or at a suitable point when the installation is finished. This is an opportunity for the client or client's representative to state any defects that he might see or alterations that he thinks require doing. This would be termed a 'snagging list'. Any changes or alterations would need to be done before the contract is deemed finished.

1: Organising for health and safety

In this session the student will:

- Gain an understanding of the application of health and safety when overseeing the work of others.

The law

Under the Health and Safety at Work etc Act 1974 (the HSW Act), you have to ensure the health and safety of yourself and others who may be affected by what you do or do not do. It applies to all work activities and premises and everyone at work has responsibilities under it, including the self-employed.

How to manage health and safety

What you have to do to manage health and safety effectively is:

- Know about the risks in your work.
- Control the risks that need it.
- Make sure the risks stay controlled.

Know about the risks in your work

The hazards

- A hazard is anything that might cause harm (eg chemicals, electricity, and vehicles, working from ladders).
- Risk is the chance (big or small) of harm being done, as well as how serious that harm could be.

Who do I have to consider?

You need to consider people who:

- work for you
- use the workplace
- visit your premises;
- may be affected by your work, eg your neighbours or the public;

What do I have to do to comply with health and safety in the workplace?

Carry out a risk assessment

Display a current certificate as required by the Employers' Liability (Compulsory Insurance) Act 1969, if you employ anyone.

Provide free health and safety training for your employees so they know what hazards they may face and how to deal with them.

Provide toilets, washing facilities and drinking water for all your employees, including those with disabilities.

Display the Health and Safety Law poster for employees, or give out the leaflet with the same information.

Notify certain work-related incidents, accidents and occupational diseases

We have already seen that the objective of a risk assessment is to determine the measures required to comply with the relevant health and safety legislation and guidance. It is inherently a planning process.

To carry out a risk assessment however, and fail to recognise that it should lead to action is foolish. The process of carrying out a risk assessment is to ensure that work is carried out in a safe manner. The following is an example of a risk assessment

What are the hazards?	Who might be harmed and how?	What are you already doing?	What further action is necessary?	Action by whom?	Action by when?	Done
Manual handling	Fitter and contractors may suffer back pain or pain elsewhere from handling heavy and/or bulky objects.	■ Manual handling aids – lift truck, porters trolley, wheelbarrow etc – available. ■ Fitter trained in safe manual handling. ■ Contractors told to ensure their staff follow safe manual handling techniques. ■ For jobs involving difficult manual handling, eg some machinery repairs, fitter, contractor and relevant others discuss beforehand and agree a safe system of work.	■ No further action at this stage.			
Noise	Fitter/contractors may suffer discomfort and potential hearing damage if working in noisy areas or using noisy equipment (eg angle grinders).	■ If possible, jobs in production areas done when the presses are not in use. ■ Fitter has ear defenders and knows how to use them effectively and maintain them properly. ■ Contractors instructed to wear suitable hearing protection when the job exposes them to loud noise. ■ Maintenance machinery, eg drills, angle grinders, maintained to ensure they run as quietly as is possible.	■ No further action at this stage.			
Electricity	Fitter/contractors may suffer shock and burns injuries from faulty electrical equipment or installation.	■ Fitter, contractors and relevant others discuss electrical safety before each job begins to ensure that relevant machinery, circuits etc are isolated and locked off throughout the job. ■ Contractors told to inspect all electrical appliances pre-use and not to bring any equipment on site where condition of cables, switches etc give rise to concern. ■ Electrical installation and all equipment (including machinery in fitter's workshop) is inspected to a planned schedule.	■ No further action at this stage.			
Machinery	Fitter and others may suffer serious injury from unguarded moving parts of machinery.	■ All dangerous parts of machinery guarded to manufacturers' standards. ■ Machinery guards inspected every month and maintained in good condition. ■ All new machinery checked before first use to ensure they have the CE standard mark, a 'Declaration of Conformity' and there are no obvious accessible dangerous moving parts, or siting of the machine does not cause additional hazards, eg feed tables, take-off bins etc. ■ Fitter (who is trained to set tools and do daily checks of power press guards) checks that setters on the shopfloor do daily checks of power press guards.	■ No further action at this stage.			

What a risk assessment does not necessarily do is lead to a way in which work should be carried out. To this end a method statement is often written.

Applying method statements

Although not required in law, a method statement is a helpful way to formally detail how an activity or task should be undertaken. The method statement draws together the information on various hazards and the ways in which they are to be controlled into a single document. This information should be gathered from the risk assessment. The method statement, therefore, becomes a useful management tool for controlling the manner in which work is carried out, particularly higher level work.

Before a method statement, or indeed a safe system of work is prepared a number of elements should be considered:

- The task to be done.
- The potential hazards.
- Are any existing procedures in place and are these still appropriate?
- Who is expected to carry out the work? – What are the skills of the workers and is any additional training required?
- Who is in control?
- Special tools and clothing. Are they available and people trained in their use?
- Any specific isolation requirements.
- Permit to work requirements.
- How will the work interfere with other activities? What processes are required to inform other affected organisations and sections?
- Are there any special communication issues?
- Is it necessary to notify emergency services?
- Who needs a copy of the method statement or safe system of work?
- Who and how is the work monitored?
- What process exists for review?

In general, however, a method statement is not required for all types of work, but rather that work that carried a particular level of risk.

A simple template should help.

Health and Safety Method Statement		
Company:		
Site:		Task No.
Task:		
Prepared by:		
Date:		
Initial risk assessment:		
Client's name:		
Client's address:		
Site address:		
Task commencement date:		
Task completion date:		
Persons carrying out task: (Include skills and any specific training needs)		
Equipment to be used: (Include make, model registration etc.)		
Detail site access requirements:		
Detail nature of site: (Include parking, storage, welfare facilities and emergency procedures etc.)		
Detail site hazards: (include power lines, buildings, trenches, processes etc.)		
Standards required:		
Planned procedures: (include diagrams where required)		
Supervision:		
How task will proceed: Safe system of work		
Signed:		Date:

Monitoring changing conditions

All businesses must monitor their various activities.

Monitoring arrangements will need to be discussed and agreed with the client as they form part of the management arrangements.

The purpose of monitoring is to ensure that the precautions described in the construction phase plan are appropriate and followed in practice.

Where contractors do not work safely or comply with the plan, principal contractors must take appropriate action to deal with the risk. Principal contractors are responsible for ensuring the health and safety of everyone on site. Everyone on site must co-operate with the principal contractor to enable them to comply with their duties.

The plan needs to be routinely reviewed, revised and refined by the principal contractor as the project develops. Monitoring may show the plan has shortcomings and needs to be modified. Any significant changes in the plan should be brought to the attention of all those affected.

Managing health and safety on site and site organisational procedures

Setting up a site

When setting up a site the following should be addressed:

- Site access
- Site boundaries
- Welfare facilities
    - Toilet and washing facilities
    - Rest facilities
    - Storing and drying clothing and personal protective equipment
    - Drinking water
- Good order, storage areas and waste materials
- Lighting
- Emergency procedures
    - Planning for an emergency
- Fire
    - Precautions in case of fire
    - Precaution to prevent fire
- First aid
- Reporting injuries, diseases and dangerous occurrences
- Site rules

Construction-phase health and safety

When construction work begins, at least the following should be addressed:

- Site management and supervision
- Working at height
- Site traffic and mobile plant
- Moving goods safely
- Groundwork
- Demolition, dismantling and structural alteration
- Occupational health risks
- Electricity
- Slips and trips
- Working in confined spaces
- Prevention from drowning
- Protective equipment
- Work affecting the public
- Monitoring and reviewing

At every level however, it must be recognised that no amount of planning and preparation will reduce accidents unless those who are on site cooperate with those having a responsibility for health and safety.

Following site instructions and procedures are essential in reducing, and hopefully eliminating, accidents.

Storage

We have already considered many aspects of the safe storage of material in previous sessions.

There should be designated storage areas for plant, materials, waste, flammable substances, such as, foam plastics, flammable liquids and gases, and hazardous substances, such as, pesticides and timber treatment chemicals.

Flammable materials will need to be stored away from other materials and protected from accidental ignition. Materials should not be stored where they obstruct access routes or where they could interfere with emergency escape.

If materials are stored at height, guard rails should be in place.

Storage areas should be kept tidy, whether in the main compound or on the site itself, plan deliveries to keep the amount of materials on site to a minimum.

Ensure that waste is removed from the site at timely intervals. Waste materials may need storing safely before their removal from the site, therefore you may need to make sure that sufficient space for waste skips and bins has been allowed for.

1: Communicating with others

In this session the student will:

Describe the techniques for the communication with others for the purpose of;

- Motivation
- Instruction
- Monitoring
- Co-operation
- Team working

Any successful working relationship will need members of the team, no matter how large or small, to communicate with each other. If you are going to in charge of a work force you will have to learn to communicate with them effectively. The communication can be for motivation, instruction, monitoring or to encourage co-operation between the team members or others.

Motivation

Motivation will take different forms for different people. Motivation can be described as happening when people are working together for the common good. This might happen if a bonus is to be paid if the job is finished before time, or an early home time if the jobs are completed satisfactorily on a certain day.

A good leader can inspire motivation of the work force by taking an interest in the likes/dislikes of individuals, encouraging and praising the team during site meetings.

There are other forms of motivational practises such as ‘team building’ games and activities which encourage members to get to know each other’s likes/dislikes strengths and weaknesses. This also helps to naturally select leaders and improve communication.

Instruction

Instruction is given for many reasons and by many people.

There are different instruction styles, the formal ones you will have from your tutor, the less formal ones you will have from your supervisor at work. You will also receive instruction from employers, clients, site agents, contractors and site supervisors to name a few.

Instruction as we have already looked at can come in the form of books, manuals, diagrams and by electronic means. Instruction can come in the form of demonstration, again either in the lecture room or by your supervisor. In this form of instruction you will need to show and communicate that you have understood and can replicate the instructions to the required standard.

Monitoring

All working needs to be monitored for safety and measuring progress of the individual or project.

Monitoring is a useful tool for;

- Defining working practices
- Checking progress
- Deciding on levels of training or skills required
- Assessing financial or economic goals or requirements
- Performance techniques

Monitoring can be achieved by observation, written statements and by personally asking and checking.

Co-operation

Co-operation can be achieved by a combination of motivation, instruction and monitoring. By developing and encouraging team development a greater co-operation can be achieved. To run a successful project co-operation is also required from other services, you need to know when you can start the '2nd fix' etc.

Communication between yourself and the client is essential; you will not be popular if you haven't informed the client that they will have no power or internet access.

The public also need to be informed of any information that would involve them, such as loss of access to buildings etc.

Team working

A definition of a team is:

> **'a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable'.**

It has been recognised that a team goes through distinct stages of development. These relationships will change as the team develops. The stages of the development have been modelled and called:

- storming, forming, norming, performing

It takes time to build a team around a common goal.

Each of the elements of team building has recognised characteristics. Let's consider each in turn.

Forming

This is the first stage where people are coming together, and getting to know each other. There is great dependency on the leader

- Feelings not dealt with
- The workplace is for work
- People prefer to conform to the established line
- 'Rocking of the boat' is frowned on
- Poor listening
- Weaknesses covered up
- Unclear objectives
- Little involvement with planning
- Bureaucracy
- The boss takes all the decisions.

Storming

This is the stage when the duties and the task become clearer and people start to become more sure of themselves, and concern is shown for other workers.

- Experimentation
- Risky issues debated and discussed
- Other options are considered
- Personal feeling raised
- More listening
- Concern for others.

Norming

This is when the roles and personalities have become established.

- Methodical working
- Agreed procedures
- Established ground rules.

Performing

At this stage everyone knows what is expected of them and any issues that arise are dealt with positively. Everyone looks out for each other; the leader can get on with overseeing the tasks and managing his part of the project.

- High flexibility
- Appropriate leadership
- Maximum use of energy and ability
- Essential principles and social aspects considered
- The needs of all are met
- Development is a priority.

In many ways it is the process of building the team that is the key, and without the process then the team cannot function and we are dealing with a working group. The process enables the team to have shared ideas and a clear understanding of their function within the team.

There are several characteristics that an effective team will always have. These are:

- very high efficiency and results-oriented
- very high levels of enthusiasm. Good morale with all members committed to the goal/s
- the team acts in unison with each member performing his/her function for the good of the other team members. Personal desires match and are focussed on a common goal
- there is a real sense of purpose
- there is an excellent working atmosphere. People trust and respect one another. Good communication with conflicts quickly resolved
- strong leader who gets all involved and able to share responsibility. Strengths of the individual are used for the good of the team.

2: Communication and competence

In this session the student will:

- Describe ways of communicating and responding to others
- Describe ways in which competence can be determined.

Theodore Roosevelt (26th President of the United States) once said,

> "The most important single ingredient in the formula of success is knowing how to get along with people."

All issues relating to good working practices are based around the issue of 'people skills'. People skills are a combination of good inter-personal skills (how well we work with others), and intra-personal skills (how well we manage ourselves – attitudes and emotions).

Developing rapport

Forming a good rapport is a foundational principle when building relationships with other people. Good rapport requires behaviours such as:

- 'making a connection'
- taking a genuine interest in the other person
- attentive and active listening
- developing mutual trust and cooperation.
- Making a connection

Making a connection requires little effort and is done by everyone in certain situations, for example, when meeting someone who supports the same football team.

The minimum requirements when making a connection are:

- Make eye contact.
- Smile – not a false one.
- Be helpful when asked.
- Greet in a friendly way.
- Show some consideration for the other person – this might be a simply asking if the other person wants a drink.
- Be polite and friendly.
- Make comments or ask questions that show an interest without being too personal.
- Be consistent in either friendly or distant behaviour – do not give mixed messages.

Take a genuine interest

It is normal for people to feel more comfortable with those having a similar background; differences can be unsettling.

Developing good people skills enables people to be more accepting of differences with real benefits including:

- The world becomes more interesting.
- Life is less boring.
- We become more comfortable around strangers.
- Others are more comfortable around us.
- We understand the world a little better and are able to make better judgements.
- We become better able to manage situations involving other people.

Attentive and active listening

Listening is more than hearing sounds. For example, people react negatively when they are 'not heard' or where someone is not 'really listening'. This negative reaction is greater where the person is new to a group or gathering.

Active listening involves understanding the message, the situation and the other person or other people. At the least active listening involves:

- Appropriate body language.
- Permit people to finish what they are saying before responding (or not).
- Listen for the meaning behind the words. Often an underlying message is being delivered which differs from the words that are spoken.

- Check that you have understood correctly what the other person has said. Have you misheard or misread a situation?
- Check and clarify matters of detail.
- Don't be embarrassed by silences. A pause acts like a full stop and gives others permission to speak/reflect on what has been said/manage an emotional response.

Develop mutual trust and cooperation

Usually, trust grows out of relationship. For example, it is unlikely that you will tell a complete stranger your life story and yet, perhaps, we will volunteer all sorts of information about ourselves to our partners.

In many ways cooperating with someone enables trust to grow. Such cooperation is critical within a working environment and includes:

- Sharing ideas.
- Revealing personal information.
- Negotiating compromises.
- Commissioning work.
- Offering contracts.

The above forms of communication are informal. To communicate in a more formal manner with people you will come in contact with such as customers/clients, Site managers and Major/Sub-contractors is different again.

Writing good letters and reports are part of your communication process; you will from time to time need to write to wholesalers for queries over deliveries, clients for information and instruction. Reports will need to be prepared for; meetings, progress of projects, monitoring of people and situations, information for legal purposes and not least of all financial statements and lists of costing's.

Report writing

A report is simply an ordered set of written details that inform of the events that occurred on a site. The report can cover a simple incident or it can be a weekly activity detailing the events as recorded in the site diary.

It needs to be short and to the point with a short introduction, followed by the detail and finished off with a conclusion and recommendation.

Often a series of statements is all that is necessary. Your report is then used as a base on which to make any decision(s) that may be necessary.

Report

Date: 05/10/2011

From: F. Bloggs

To: S. Wiggum (Contracts Manager)

Job: XYZ Cromwell Road

1). The materials have arrived and no further problems are expected.

2). There are three men on site.

3). There are no problems with the main contractors.

4). Expect three AIs next week. It should only take us 2 days to complete the extra work

Recommendations:

We need an extra man to get us back on schedule.

Letter writing

Letter writing can also include faxing and emailing, this is probably be the main way you will convey information to customers, clients and the public. Whichever method you choose you need to be clear about what it is you need to say.

- Be clear about the purpose of the letter
- Write to the level of the technical knowledge the reader has
- Get all the information you need together and in a logical order
- The first paragraph should be a summary of what you want to say
- Once you have started to write, keep checking to make sure you are writing what you meant to say
- Don't waffle, keep to the point
- Make the information interesting
- Check spellings and grammar

Competence

Competence is a critical concept to grasp within an industry where people may be seriously injured or even die because of the work we do.

Competence might be defined as:

> 'It is a combination of practical and thinking skills, experience and knowledge'.

There are three levels of competence recognised within BS 7671:

1) Skilled person
2) Instructed person
3) Ordinary person.

Skilled person

A skilled person is defined in Part 2 of BS 7671 as:

> 'A person with technical knowledge or sufficient experience to enable him/her to avoid dangers which electricity may create.'

You can see that this definition closely resemble that of a competent person.

It is worth noting that a skilled person need not be skilled in every aspect of electrical work. He/she, however, should be capable of recognising their limitations and acting accordingly.

Instructed person

It is not always necessary for a skilled person to carry out a specific work activity. For example, it might be reasonable to get an adequately trained person under the oversight of a skilled person to repair items of equipment which are, by their very nature, repetitive.

BS 7671 calls such a person as an instructed person and defines them as:

> 'A person adequately advised or supervised by skilled persons to enable him/her to avoid dangers which electricity may create.'

Ordinary person

An ordinary person meets neither the terms of a skilled or instructed person and is, therefore, not competent.

BS 7671 defines an ordinary person as:

> 'A person who is neither a skilled person nor an instructed person.'

Everyone must be trained to do the task they are allotted to do. The electrotechnical industry is a skilled occupation, to have an unqualified or inexperienced person is dangerous.

To check the identity and the level of competency of anyone you are thinking of employing there are several schemes available.

CSCS - Construction Skills Certification Scheme

To hold a CSCS card the employee must have demonstrated their occupational competence and, in most cases, passed the Construction Skills Health and Safety Test within the previous two years. The aim of the test is to examine knowledge across a wide range of health and safety topics in order to improve safety and productivity on site.

The green card is available to operatives who carry out basic site skills only

A blue skilled card shows they have achieved an NVQ or SVQ level 2 or completed an employer sponsored apprenticeship which included the achievement of a City and Guilds of London Institute Craft Certificate.

A gold skilled card shows they have achieved an NVQ or SVQ level 3, or completed an approved indentured apprenticeship (e.g.with NJCBI, BATJIC etc.) or an employer sponsored apprenticeship which included the achievement of a City and Guilds of London Institute Advanced Craft Certificate.

Joint Industry Board (JIB)

Electrotechnical Certification Scheme (ECS)

Holding an ECS card means that the employee can prove their identity, their qualified status and their occupation when working on-site.

It is affiliated to the Construction Skills Certification Scheme (CSCS). So when people say that you need a CSCS card – this ECS card is the one that's relevant to the Electrotechnical Industry

To be eligible for an ECS Installation Electrician card, applicants must meet the following criteria:

- Have successfully completed an Approved Apprenticeship
  – or –
- Hold the City and Guilds 2360 Part One and Two, or City and Guilds 2351 or City and Guilds 2330 Levels 2 and 3 or Approved Equivalent
  – **plus** –
- NVQ Level 3 in Installation and Commissioning
  – **and** –
- Hold a current (up-to-date) Health & Safety Certificate or recognized H&S qualification
  – **and** –
- Hold a formal BS7671 qualification in the current edition of the wiring regulations (currently BS7671: 2008, 17th edition)

These details can be checked on-line or by a card reader. The information contained on the card will only give you the qualifications they hold, to find out their practical skills or inter-personal qualities you might need to research further, by following up references from previous employers.

Employee performance can be monitored by only offering a probation period until you are satisfied of their suitability.

3: Rescheduling work and responding to changing conditions

In this session the student will:

- Describe the importance of maintaining necessary paperwork to track changes in schedules including:
  - Timesheets
  - Day work.
  - Variation orders
  - Purchase orders
  - Delivery notes
- Describe the importance of keeping accurate records.

No matter how well a job is planned there can be unforeseen circumstances when the work schedule needs changing. Without maintaining accurate paperwork chaos can quickly happen.

These problems would normally be discussed at a site meeting between the involved parties. These parties would include the client, contractor and sub-contractors, the architect and/or the consulting engineers. In some instances variation orders (VO) will be required.

If the variation in the work is small, then to maintain goodwill it might be prudent to carry out the change, particularly if no extra time and cost is required. However in some circumstances this is not possible, and the main contractor or architect or other responsible person provides a variation order. The purpose of the VO is to record the new agreement for the extra work to be done and any new costs incurred in completing the project.
Every firm should have its own supply of standard forms called *Advice of Variations*.

Day work sheets

Any work done outside the original contract is known as day work. This work is usually charged at a higher rate than the original quote. Because of the risk of disputes it can cause, day work sheets are completed and signed by the client or client's representative.
A typical day work sheet might look like this.

Day work sheet												**B&B electrical contractor** **Brightest Sparks**
Name	**Grade**	**M**	**T**	**W**	**T**	**F**	**S**	**S**	**Total Hrs**	**Rate**	**Total £**	**Description**
Add %												
Labour total												
Materials description									**Qty**	**Rate**	**Total £**	**Summary**	**£**
												Labour	
												Material	
Add %												Total	
Material total												Signed supervisor: Signed Customer:	

The day work sheet will be returned to the contractor's main office where it can be priced and the bills sent to the appropriate person/organisation.

The day work will vary in content depending on the size of the site and the type of company. However, they will always record:

- the time that the work took in man hours
- the material used.

Time sheets

All of us either fill in time sheets or clock in and out of our work. Time sheets exist for a number of reasons:

- a record of the work carried out
- to be able to log time against a particular job
- to monitor efficiency over a period of time.

Time Sheet					**B&B electrical contractor** **Brightest Sparks**
Time sheet ref. no.					
Week ending				**Workplace**	
Day	**Date**	**Start time**	**Finish time**	**Total hours**	**Description**
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					
Total hours					
Employee name:				Authorised by:	
Employee signature:				Position held:	
Employee no.:				Print name:	
				Date:	

A timesheet will include at least the following:

- Date
- Start time
- Finish time
- Total time at work per day
- Total time at work per week
- Description of work done
- Place of work
- Name.

Additionally there may be slots for travelling and specific codes for jobs.

Purchase orders

Before any supplier will dispatch materials they will require a purchase order. Unless you deal regularly with a particular supplier, they will want an official copy with your or your employer's details on. The order will state the specific quantities, sometimes a particular manufacture, the date and delivery destination of the items. A copy is kept of the order to check against when the delivery arrives.

Delivery records

Whenever anything is delivered to site then problems may arise, for example, the right numbers of luminaires or whether someone has signed for the delivery. If accurate records are not kept then, what is in the stores cannot be monitored, and this can lead to pilfering as well as aggravation when work is held up because of missing equipment.

When a delivery of materials comes on site then a number of factors must be considered:

- delivered items must be counted up and compared with the delivery note
- if there is insufficient time to count the delivered goods then the delivery note must be signed as 'unchecked'
- materials must be stored in a safe location whilst waiting to be installed
- if it is found that some items are missing from the delivery then a series of options are open to us:
    - call the wholesaler and ask for the missing items – this is the easiest and it is often the case that a simple error has occurred
    - if the wholesaler does not accept that the goods were undelivered then we are in dispute with the wholesaler
        - a record must be kept of the conversations we have had, the times and a note of what was said
        - call the head office and get them to contact the wholesaler directly
        - be polite but firm. Avoid aggressive language, gestures or threats.

The procedures for ordering and receiving goods will vary from organisation to organisation, but the goods must be tracked by comparing the purchase order against the delivery note and the completion of the order not signed until everything is on site.

Extra work

There are a number of details that need to be considered before any extra work begins on a site.

- Final positions of all equipment should be checked against the latest architect's drawings.
    - The contractor should ensure that all marking out is accurate, and care should be taken with the positioning of switches in relationship to doors etc.
    - The contractor should discuss with the other trades the positioning of their services to ensure that electrical equipment has adequate clearance.

Any changes to work will need to be discussed with others involved. This will usually involve a site meeting. The site foreman or whoever is in charge will conduct this and items such as the problems caused by the delay will be discussed and the redeployment of workers and resources agreed. The minutes of the meeting will need to be recorded for future reference. This information will need to be given to other trades.

1: Rights and responsibilities as they relate to current legislation

In this session the student will:

- Gain an understanding of what employment legislation exists and why it is needed.

It is an employer's duty to protect the health, safety and welfare of their employees and other people who might be affected by their business. Employers must do whatever is reasonably practicable to achieve this.
This means making sure that workers and others, are protected from anything that may cause harm, effectively controlling any risks to injury or health that could arise in the workplace.

If you are going to employ or supervise others there are many other pieces of legislation that need to be taken into consideration. The law in the UK sets minimum standards and rights which the employer must give to their employees. The UK is also heavily influenced by European law.

Some items of employment legislation are:

- Employment Rights Act 1996
- Data Protection Act 1998
- Disability Discrimination Act 1995
- Race Relations Act 1976
- Race Relations (Amendment) Act 2000
- Sex Discrimination Act 1975
- Human Rights Act 1998.
- The Equality Act 2010

Employment Rights Act 1996

The Employment Rights Act 1996 gives statutory rights to employees such as;

- An itemised pay statement
- Minimum pay
- Minimum holidays
- Maximum working hours
- Right to maternity/paternity leave
- The right not to be dismissed unfairly
- Protection of wages
- The right to opt out of Sunday working
- The right to time off for
    - Public duties
    - Training
    - Domestic reasons
    - To seek other work

The Employment Act 2008 came into being and introduced the provision for dealing with disputes, including compensation and the enforcement of the National minimum wage.
You can see, simply from the headings that the Employment Rights Act is large and covers many areas. It is this Act that provides best protection for those at work from being treated unfairly.

In the light of this complex piece of legislation, as well as others, becoming a member of a Trade Union or an association might be worth considering. Trade Unions usually provide the ability to protect their members interests and, although in many cases this industrial muscle has been wielded unwisely, in vast numbers of cases people have been helped with lawyers, wage bargaining, improved pension and holiday entitlements and the like.

Data Protection Act 1998

The Data Protection Act applies to personal information and ensures that it is handled properly...
Personal information is information about you. It can be your name, address or telephone number. It can be the type of job you do, the things you buy and the place you went to school.
The Act works in two ways. Firstly, it helps to protect your interests by obliging organisations to manage the information they hold in a proper way. It states that anyone who processes personal information must comply with eight principles, which make sure that it is:

- fairly and lawfully processed;
- processed for limited purposes;
- adequate, relevant and not excessive;
- accurate and up to date;
- not kept for longer than is necessary;
- processed in line with your rights;
- secure; and
- not transferred to other countries without adequate protection.

The second area covered by the Act gives you important rights, including the right to know what information is held about you and the right to correct information that is wrong.
You also have the right to claim compensation through the courts if an organisation breaches the Act and this causes you damage, such as financial loss. If it has, you can also claim for distress

Disability Discrimination Act 1995

The aim of the Disability Discrimination Act (DDA) is to end the discrimination that many disabled people face. The Act itself gives disabled people rights related to:

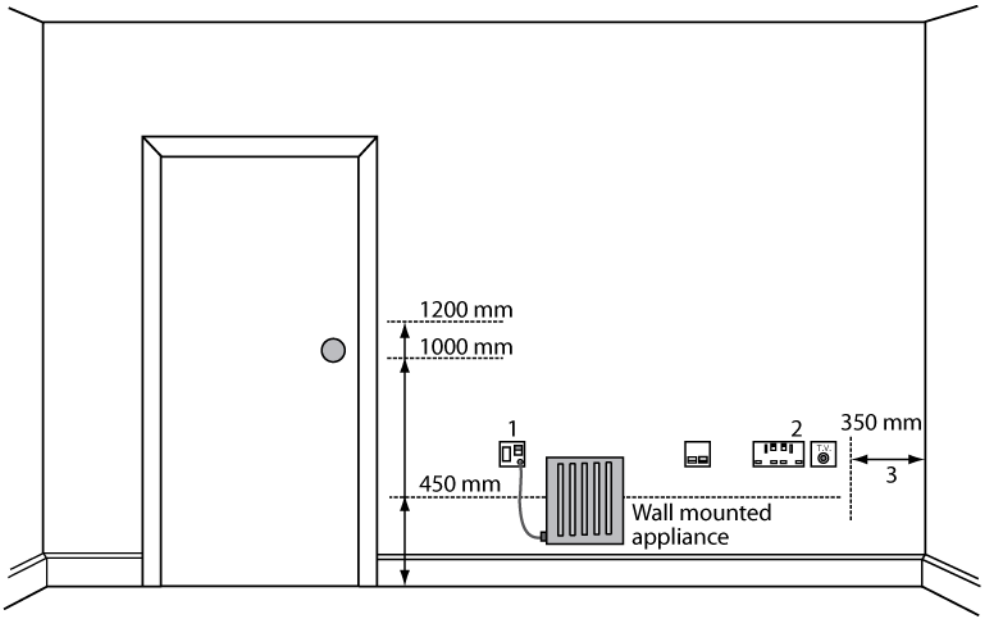
- Employment
- Access to goods, services and facilities
- Buying or renting land or property.

Disability is defined as a physical or mental impairment which has a long term effect on a person's ability to carry out normal every day activities
The DDA has been introduced over a period of time with employment rights coming into force in 1996, further access rights in 1999 and final access rights in 2004. The DDA also allows for the government to set minimum standards so that the disabled can access public transport.

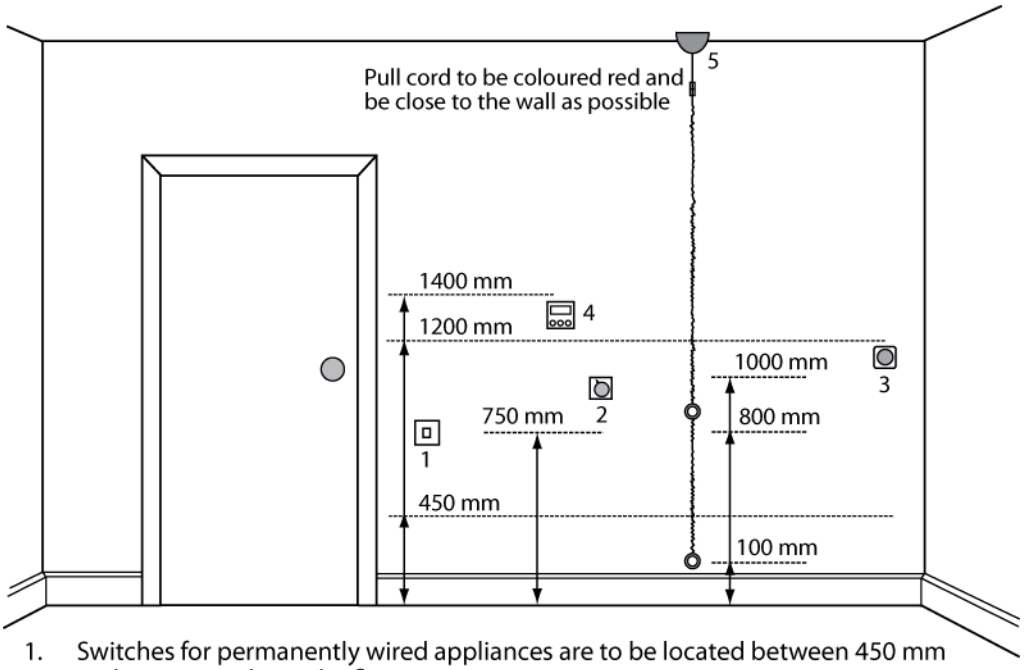
The DDA requires that reasonable adjustments are made to the working environment to enable the disabled to work or access the services. Justification can be applied to why something is not done if it is not reasonable.

Discrimination occurs when someone is treated less favourably because of their sex, race or disability. In practice the application of the DDA to the electrotechnical sector will vary depending on the nature of the work.

Approved Document M deals with access for the disabled and has recently gone through some changes. The Disability and Discrimination Act 1995 (DDA) requires that reasonable adjustments are made to enable the disabled to make use of the facilities. The DDA covers so much more, but as far as the electrical installer is concerned it is the height of switches and sockets that is the clear focus. Below we can see the range of heights for socket outlets and switches.



1. Switches for permanently wired appliances are to be located between 450 mm and 1200 mm above the floor.
2. Wall mounted socket-outlets, telephone points and TV sockets are to be located between 450 mm and 1200 mm above the floor, with a preference for the lower end of the range.
3. Socket-outlets are to be located no nearer to corners than 350 mm.



1. Switches for permanently wired appliances are to be located between 450 mm and 1200 mm above the floor.
2. Switches that require precise hand movements to be located between 750 mm and 1200 mm.
3. Simple push button controls to be located not more than 1200 mm above the floor.
4. Controls that need close vision are to be located between 1200 mm and 1400 mm.
5. Pull cords for emergency alarm are to have two red bangles, one set at 100 mm and the other set between 800 mm and 1000 mm above the floor.

The Disability Discrimination Act has been replaced by the Equality Act 2010

The Equality Act 2010

The Equality Act 2010 aims to protect disabled people and prevent disability discrimination. It provides legal rights for disabled people in the areas of:

- employment
- education
- access to goods, services and facilities including larger private clubs and land based transport services
- buying and renting land or property
- functions of public bodies, for example the issuing of licences

The Equality Act also provides rights for people not to be directly discriminated against or harassed because they have an association with a disabled person. This can apply to a carer or parent of a disabled person. In addition, people must not be directly discriminated against or harassed because they are wrongly perceived to be disabled

Race Relations Act 1976

The 1976 Race Relations Act makes it unlawful for an employer to discriminate against you on racial grounds. Race includes:

- colour
- nationality
- ethnic or national origins

Under the Act, it doesn't matter if the discrimination is done on purpose or not. What counts is whether (as a result of an employer's actions) you are treated unfavourably because of your race.

The Race Relations Act protects all racial groups, regardless of their race, colour, nationality, or national or ethnic origins.

The laws against racial discrimination at work cover every part of employment. This includes recruitment, terms and conditions, pay and benefits, status, training, promotion and transfer opportunities, right through to redundancy and dismissal.

The law allows a job to be restricted to people of a particular racial or ethnic group where there is a 'genuine occupational requirement'. An example is where a black actor is needed for a film or television programme.

There are four main kinds of discrimination:

- direct discrimination - deliberate discrimination (eg where a particular job is only open to people of a specific racial group)
- indirect discrimination - working practices, provisions or criteria that disadvantage members of any group (eg introducing a dress code without good reason, which might discriminate against some ethnic groups)
- harassment - participating in, allowing or encouraging behaviour that offends someone or creates a hostile atmosphere (eg making racist jokes at work)
- victimisation - treating someone less favourably because they have complained or been involved in a complaint about racial discrimination (eg taking disciplinary action against someone for complaining about discrimination against themselves or another person)

Employers who don't stop discrimination, harassment and bullying by their employees may be breaking the law.

Sex Discrimination Act 1975

The Sex Discrimination Act (SDA) was introduced to eliminate the openly sexual discrimination that used to occur, and may still occur in certain areas. It used to be the case that men and women doing the same work would be paid very different salaries, and that when a man and a woman went for the same post then people could simply reject the woman on the grounds of her sex.

As with so many of the other Acts we have very briefly considered, the SDA is wide-ranging and covers employment, education, goods and services as well as the exceptions that exist. More recently it has controversially included aspects that relate to those who have had gender reassignment surgery.

At its most fundamental level the SDA says that discrimination occurs when, 'on the grounds of her sex' a woman is treated less favourably than a man. This applies equally to men, except where pregnancy applies, to those who have or are to have gender reassignment surgery and to those who are married or not.

In the employment field it is unlawful to discriminate in the arrangements made for the purpose of determining who will be offered employment; in then terms of that employment and by refusing to offer that employment due to a person's sex.

The sex discrimination Act was amended to comply with the Equal treatment directive in April 2008. Harassment has been defined even further to include the fact that making the same remarks about a different sex is no longer a defence. Employment liability now extends to making harassment from a third part such as a visitor an offence if reasonable step were not taken to prevent it.

There are some exceptions permitted. These relate to where it is a genuine occupational qualification of the job, for example where being a man is required to preserve decency or to maintain authenticity, or where men/women might reasonably object to a member of the opposite sex, such as a cleaner in a public toilet.

Equality Act 2010

It's unlawful for an employer to discriminate against you because of your sex.

Sex discrimination law covers almost all workers (men and women) and all organisations in the UK. It covers:

- recruitment
- employment terms and conditions
- pay and benefits
- training
- promotion and transfer opportunities
- redundancy
- dismissal

Equal terms - equal pay

Where men and women, working for the same employer, are doing one of the following they are entitled to the same terms in their employment contract:

- the same or similar work (like work)
- work rated as equivalent in a job evaluation study by the employer
- work of equal value

There may be exceptions where there is a genuine material factor which explains the difference

Human Rights Act

The Human Rights Act 1998 gives further legal effect in the UK to the fundamental rights and freedoms contained in the European Convention on Human Rights.

These rights not only impact matters of life and death, they also affect the rights you have in your everyday life: what you can say and do your beliefs, your right to a fair trial and other similar basic entitlements.

Most rights have limits to ensure that they do not unfairly damage other people's rights. However, certain rights – such as the right not to be tortured – can never be limited by a court or anybody else.

You have the responsibility to respect other people's rights, and they must respect yours.

Your human rights are:

- the right to life
- freedom from torture and degrading treatment
- freedom from slavery and forced labour
- the right to liberty
- the right to a fair trial
- the right not to be punished for something that wasn't a crime when you did it
- the right to respect for private and family life
- freedom of thought, conscience and religion, and freedom to express your beliefs
- freedom of expression
- freedom of assembly and association
- the right to marry and to start a family
- the right not to be discriminated against in respect of these rights and freedoms
- the right to peaceful enjoyment of your property
- the right to an education
- the right to participate in free elections
- the right not to be subjected to the death penalty

If any of these rights and freedoms are breached, you have a right to an effective solution in law, even if the breach was by someone in authority, such as, for example, a police officer.

Interviews

It is possible that might be expected to carry out interview for new members of your team.

Having looked at how the law views discrimination in any form, interviews must be carried out fairly and without prejudice.

There are certain things that you would require. These include:

- References.
- Original examination/course certificates.
- List of relevant experience.

As the interviewer you are going to take into account the information that you have to hand, but you would be unwise to trust the paper qualifications without checking them out.

You will want to ask about their experience, why they want to work for you and why they left their previous employment. It is worth checking this to make sure they are being truthful.

Dismissal

Employment legislation is written to seek to maintain a balance between the power of the employer and the rights of the employee.

There is a measure of protection that an employee has. You are not allowed to fire for any of the following reasons:

- Not wanting to join a *closed shop.* A closed shop was in existence if you had to join a trade union as a condition of getting the work.
- Becoming pregnant.
- Medical suspension. You cannot be dismissed for being sick.
- Fired for short-time working. This might be created if there is an industrial dispute that affects your company, but in which you are taking no part.
- Trade union activities. You cannot be fired for being a member of a trade union.
- Being either male or female.
- Being of ethic origin
- Having different religious beliefs or background

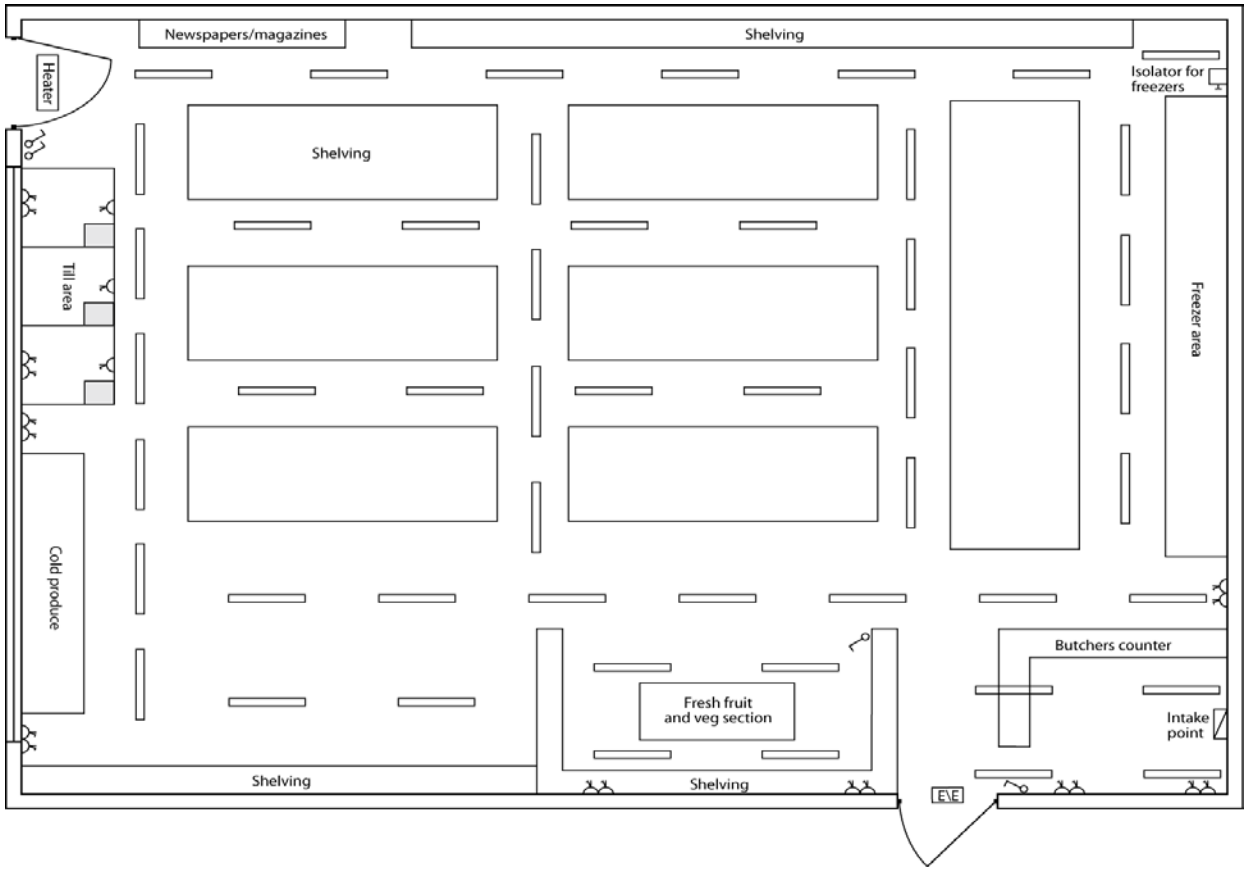
2: Work planning

In this session the student will:

- Gain an understanding of the processes to follow when planning a task or project.

This session is practical and will aim to get you to apply some principals of how to approach a task by making use of a diagram of an installation.

Take a look at the medium-sized shop in the diagram. When you look at the diagram below and think that you are going to have to wire it, a number of questions will occur.
When using diagrams like this it is advisable to become familiar with symbols on them. They should be drawn to the recognised standards for symbols BS EN graphical symbols.



Planning the work allocations, duties of the workforce.
Before work can begin as an employer you need to consider;

- Do you have enough appropriately skill workers available to finish the task?
- What materials and equipment will you need to complete the task?
- What specialist equipment needs to be available?
- Is the site going to be ready and secure?
- Is there enough secure storage areas
- Are there provisions for the storage and access for the disposal of waste material do you need any addition specialist equipment for lifting etc
- Is the site likely to be affected by weather conditions, if so have you made allowances for delays.
- are all the other services available

If the work is not completed on time you would be in breach of contract, unless there are variation orders. This will require another contract to be made. Minor time delays in completing the project can just be a nuisance to the client. In other cases there can be major financial penalty clauses which must be avoided.
If the requirements of the work program are not met or incorrect materials and equipment is installed, you could be responsible for the added cost of the work.

Work planning

What is the specification, and how does it relate to the diagram?

You need a specification for any work. Usually for this amount of work this will be detailed and will provide details of contract, work practices and rights of workers as well as types of fittings, accessories, cables etc.

Is the work site ready for working in?

It is pointless thinking you can start if walls are still being built etc. There is a natural point when all types of services, HVAC, electrical etc., will need to be installed. The time to come in will depend on the complexity of the task and the needs of the main contractor.

What will be the sequence of operations?

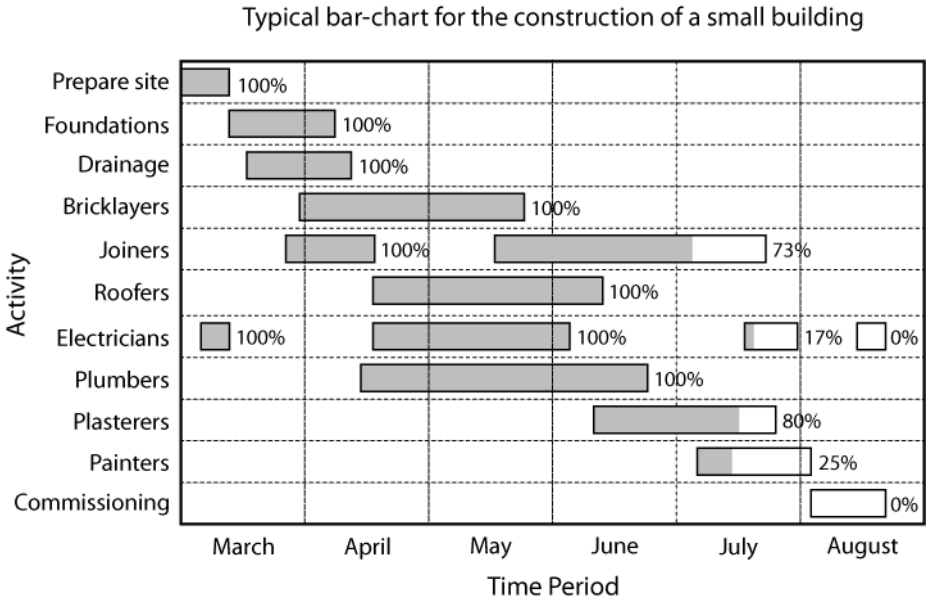
It is for the main contractor under the direction of the architect/client to maintain the site in good working order. It is for the main contractor to plan the progress of the work as a whole. However, it is for the sub-contractor (electrical in our case) to maintain their own plans so that work can fit around the requirements of the main contractor.

Good planning will also enable the sub-contractor to maximise profits and minimise time lost due to wasted productivity.

There are a variety of ways in which work activity can be planned. The first and probably simplest to understand is the Gantt chart, usually called the bar chart.

Gantt (bar) chart

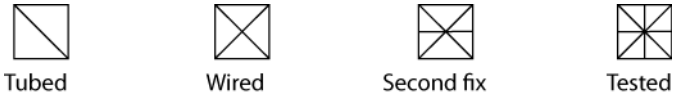
The bar chart is a means of displaying simple activities against time. They are often used on site to display the time that individual trades are operating on site at particular points in the lifetime of the contract.

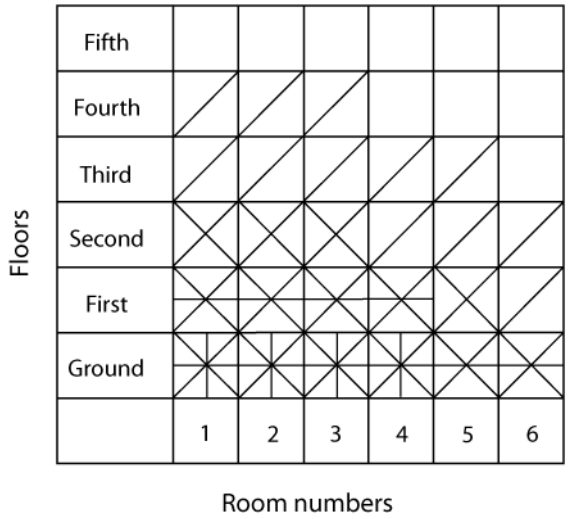


You can see in this chart that the different trades come on to the site at different times and there are times when the electrical trade is not required on a site. This often occurs between first and second fixing. It is best however if this can be avoided and the people can work on a site all the time as this reduces disruption.

Bar charts show different activities but do not show the interdependence of the activities. A bar chart is a crude measure of the progress of the work. They don't give details of the individual activities.

This type of bar chart shows the progress of the work, and operates a little like a 'tick sheet', with tasks being 'ticked off' as they have been completed.





For greater levels of detail you need something more than a bar chart. This is where network analysis comes into play.

The next means of planning time and activity is via use of critical path analysis.

Critical path analysis

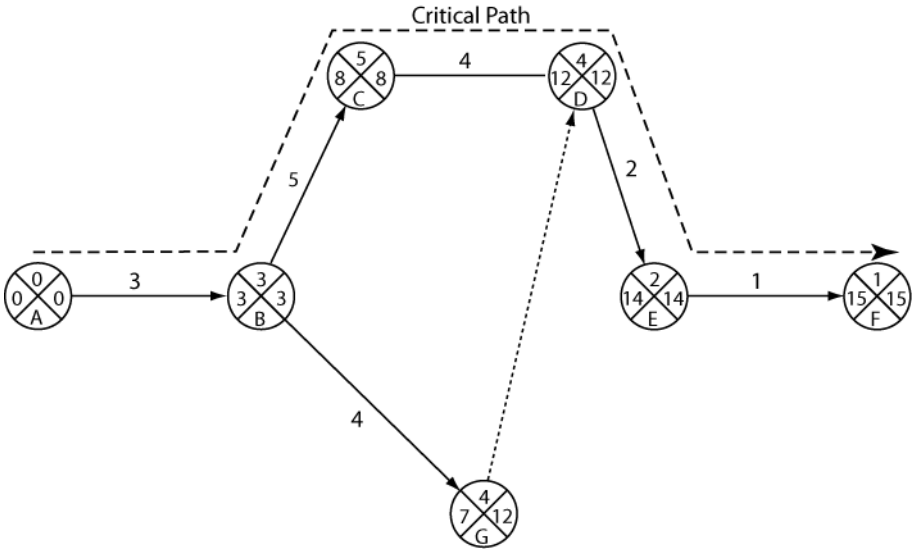
Planning is not an end in itself. You could get so busy with planning that work is not carried out. The contractor doesn't need to use complicated techniques to plan.

However, it may well be that the electrical contractor is part of a large site and it therefore becomes necessary to be able to interpret the planning techniques that others have created.

We have already looked at the bar chart, the simplest of planning tools.

When the space programme was being developed, it was essential that the coordination of the various tasks was carried out is such a way as to bring all components together at the appropriate time so the costs would not run out of hand, particularly when most of the components were built at diverse places throughout the USA. To this end NASA created a planning technique called critical path networks.

There are a variety of types of network however; one of the most common is shown below.



The bottom quarter of each circle shows the number or letter that relates to that particular task and is just a label.

The left-hand quarter of each circle shows the earliest possible start date, or event time. This shows the point at which the work can be started by. So if you look from left to right the earliest start dates relate to the period of time that a task took, shown by the number along the line.

The right-hand quarter of each circle shows the latest event time, or the last possible time that a task can be started by. In effect we are now looking at our diagram from right to left instead of left to right. You are looking back and seeing when a task is finished before another can begin.

So, as an example from our diagram. The bottom circle (G) has a different earliest and latest event time. This means that there can be some delay allowed with this task, and the whole of the job will not extend.

The final thing that needs mentioning is the top quarter of each circle. This quarter shows the amount of time that the task actually took, and is used after the work has been completed so that future plans and estimates can be made. It is the actual time that a particular task took, nothing more and nothing less! Future costings can be made more accurately with better information.

There are a number of stages in network planning:

- Identify the operations and components
- Form a network that relates the operations in a logical sequence
- Determine the duration of each operation
- Starting from the beginning, the durations are added together to determine the earliest possible time for each event
- In practice there are a large number of parallel operations taking place at the same time. Each must be calculated to determine the longest time path and the earliest moment of achievement
- Beginning at the last event, the durations are subtracted consecutively so that the latest event time for each event is decided.

Let's look at this process in the sequence stated above.

Example

An electrical contractor has won a contract to install the floodlighting in a car park. There are 8 lamp posts each to be supplied by a 4.0 mm^2 xlpe/swa/pvc cable from a distribution board. The total length of run is 95 m and the cable is to be buried at a depth of 600 mm.

Now we will work through the sequence.

Identify the operations and components.

This is done in no particular order.

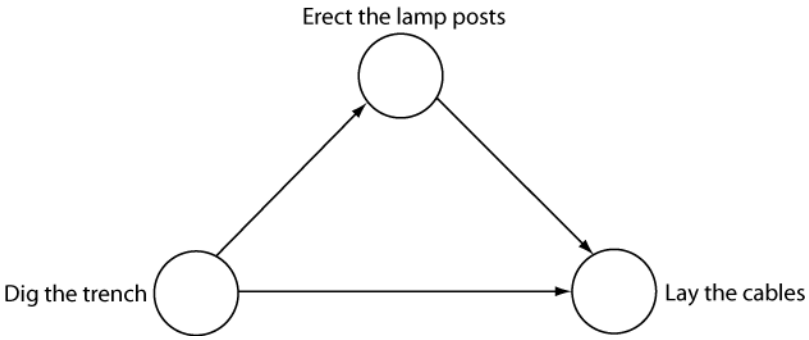
- Dig trenches (1)
- Deliver lampposts (2)
- Fix lampposts (3)
- Lay cables (4)
- 2^{nd} fix (5)
- Fill-in trenches (6)
- Inspect and test (7).

This is just a list of the separate items that will take time. Remember that I have not listed them in any particular order; rather it is just a list of those parts of the whole job that entail time.

Form a reasonable network.

At this stage you need to consider very carefully the interrelationships. We'll look at these in turn, making use of a diagram or two.

Here, you can see that the cables cannot be laid until the trenches are dug. In the same way the trenches cannot be filled in until the cables are laid. However, it is reasonable to assume that the lamp posts could be delivered and put up whilst work is going on with the trenching and cable laying.



You can see that the network begins to take a shape. This diagram would continue to be built up into a final shape.

Now we need to consider the times that accrue to this activity.

Set the durations for each event.

I am going to work in hours rather than days or weeks. However, you can just as easily plan with this method using weeks and days.

For each event I am operating on a man-hour basis.

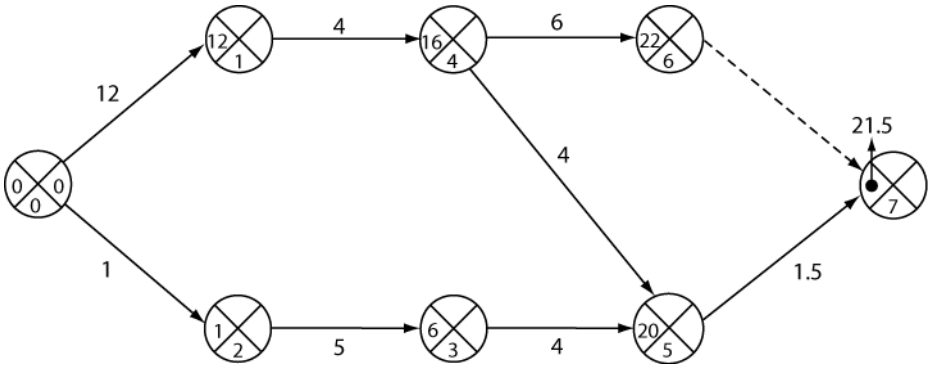
- Dig trenches (12 hours)
- Deliver lampposts (1 hour)
- Fix lampposts (5 hours)
- Lay cables (4 hours)
- 2nd fix (4 hours)
- Fill-in trenches (6 hours)
- Inspect and test (1.5 hours).

These are estimates remember. More accurate times could be ascertained from previous tasks and a more accurate understanding of the people that work for you.

The bottom quarter of each circle shows the number or letter that relates to that particular task and is just a label. So in our example the No. 1 relates to digging trenches.

The left-hand quarter of each circle shows the earliest possible start date, or event time. This shows the point at which the work can be started by. So if you look from left to right the earliest start dates relate to the period of time that a task took, shown by the number along the line.

Now the lines represent the activity, whilst the node represents the event. So look at the next stage of the diagram.



Have a look how I have determined the earliest event times shown on the diagram above.

Earliest event time - Event $1 = 0 + 12 = 12$ hrs

Earliest event time - Event $2 = 0 + 1 = 1$ hrs

Now for the next stage.

Earliest event time - Event $3 = 1 + 5 = 6$ hrs

Earliest event time - Event $4 = 12 + 4 = 16$ hrs

The next stage.

Earliest event time - Event $6 = 16 + 6 = 18$ hrs

The next stage.

Earliest event time - Event $5 = 16 + 4 = 20$ hrs

Earliest event time - Event $5 = 6 + 4 = 10$ hrs

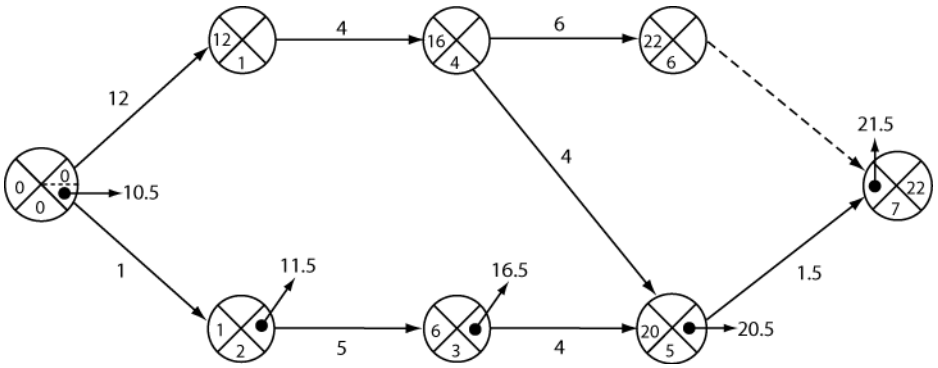
The final stage.

Earliest event time - Event $7 = 20 + 1.5 = 21.5$ hrs

This is where I have got all my earliest event times. Now for the latest event times.

Determine the latest event times

All we need to do now is to work back from the final event. Look at the network diagram again.



Work back from the last event.

Latest event time - Event 7 = 22 – 0 = 22 hrs

Earliest event time - Event 5 = 22 – 1.5 = 20.5 hrs

Next stage.

Earliest event time - Event 6 = 22 – 0 = 22 hrs

Earliest event time - Event 3 = 20.5 – 4 = 16.5 hrs

Next stage.

Earliest event time - Event 4 = 22 – 6 = 16 hrs

Earliest event time - Event 2 = 16.5 – 5 = 11.5 hrs

Next stage.

Earliest event time - Event 1 = 16 – 4 = 12 hrs

Earliest event time - Event 2 = 11.5 – 1 = 10.5 hrs

Last stage.

Earliest event time - Event 0 = 12 – 12 = 0 hrs

The complete network diagram enables us to see where the ***critical path*** is.

The critical path is the line of events that take the longest time. In our example the critical path follows events 0; 1; 4; 6 and 7.
It is this route that takes the longest and it is at this area that we need to concentrate any resources.

Three of our quarters are now complete. There are a few things that just need pointing to.

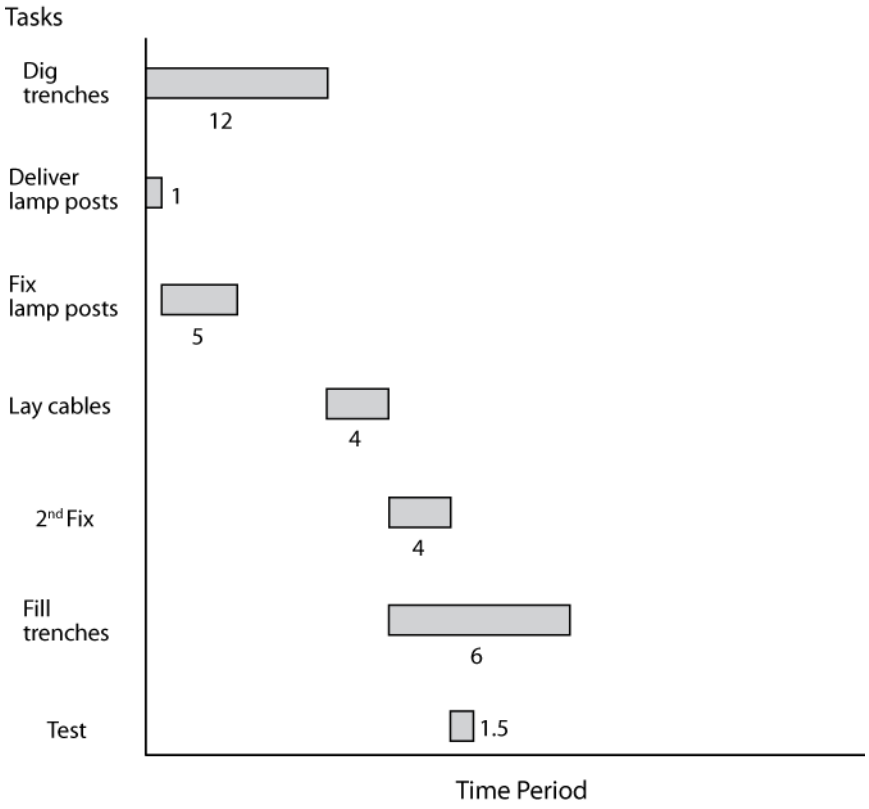
The solid lines that join the series of circles show the time that a particular task takes. The broken lines that are shown are called dummies and are there to place a restriction on the activities that follow. The dummies take no time but show a link. In our example we can see that we need to fill in the trenches by the time we come to inspect and test, but patently the inspection and testing is not affected by the filling in of holes.

The second thing that needs to be pointed out is that we have float time. Float time is the spare time that we have available on our non-critical route.

We can in effect with this float time allow people to drop off certain tasks and get them to concentrate on those areas where the critical path falls. We can plan the use of the manpower better.

The final thing that needs mentioning is the top quarter of each circle. This quarter shows the amount of time that the task actually took, and is used after the work has been completed so that future plans and estimates can be made. It is the actual time that a particular task took, nothing more and nothing less! Future costings can be made more accurately with better information.

We can now take our critical path network and convert it into a bar chart. This will show us in a more readily readable form the progress of the work and the critical path.



The main aspects of critical path networks are:

- The project must be well defined
- There is one location for the project
- Fairly small uncertainties
- Has one dominant organisation.

What tools will be required

Power tools as well as other specialist equipment will be wanted. What will it be? When will it have to appear on site? Will delays lead to down time?

What type of worker will be needed?

Skills matter. Any task needs to have those with the correct levels of competence to perform them. This means that the EWR are complied with and any instructed people are under supervision. How many people will be required at the various levels of the work? This will of course tie in with your planning process and is one of the efficiencies you will gain.

What are the relationships with other trades?

We will commonly be working with other trades. During first and second fixing, plumbers, joiners, heating engineers, ceiling installers and painters and decorators will be present at one time or another. How are good working relationships to be maintained?

You will want to have access to the main contractors' charts to determine what trade you will be working with at the same time.

Are health and safety procedures in place and monitored?

By now you should be aware of just how important health and safety is. Are procedures in place? Are all workers properly trained? Is PPE available? Have appropriate risk assessment taken place?

Does the installation work and does it match the specification?

It matters simply from a quality point of view that the customer gets both what they asked for and what they want in terms of the 'look' of the installation.

There are other things to consider when planning work schedules

- do you have enough suitable skilled staff available for the time required
- will all equipment be delivered and be available on time
- have the specified materials be sourced
- is the power supply suitable and installed
- has the access routes been decided upon
- can the site and materials be secured
- have arrangements been made for secure and safe disposal of waste materials
- inspection testing and commissioning
- hand over arrangements

3: Standards relevant to the installation of electrotechnical systems and equipment

In this session the student will:

Be able to identify the industry standards that are relevant to the activities carried out during the planning and installation of electrotechnical systems and equipment

- Management of Health and Safety Regulations
- Health and Safety at Work Regulations
- Electricity at Work Regulations
- Construction Design and Management
- BS7671 2008

When planning any work, you need to be aware of the way that the regulations laid down to protect yourself and those that will be working for or with you are affected.

This session is mainly a revision exercise

Management of Health and Safety Regulations

This regulation requires all employers and self-employed people to assess the risks to workers and any others who may be affected by their work or business. This will enable them to identify the measures they need to take to comply with health and safety law. All employers should carry out a systematic general examination of the effect of their undertaking, their work activities and the condition of the premises. Those who employ five or more employees should record the significant findings of that risk assessment.

A risk assessment is carried out to identify the risks to health and safety to any person arising out of, or in connection with, work or the conduct of their undertaking. It should identify how the risks arise and how they impact on those affected. This information is needed to make decisions on how to manage those risks so that the decisions are made in an informed, rational and structured manner, and the action taken is proportionate.

A risk assessment should usually involve identifying the hazards present in any working environment or arising out of commercial activities and work activities, and evaluating the extent of the risks involved, taking into account existing precautions and their effectiveness.

- A hazard is something with the potential to cause harm (this can include articles, substances, plant or machines, methods of work, the working environment and other aspects of work organisation),
- a risk is the likelihood of potential harm from that hazard being realised.

The extent of the risk will depend on the likelihood of that harm occurring;

- the potential severity of that harm, ie of any resultant injury or adverse health effect; and
- the population which might be affected by the hazard, ie the number of people who might be exposed.

1. Identifying the hazards

2. Identifying who might be harmed and how

Identify people who might be harmed by the hazard, including employees, other workers in the workplace and members of the public. Do not forget office staff, night cleaners, maintenance staff, security guards, visitors and members of the public. You should identify groups of workers who might be particularly at risk, such as inexperienced workers, night workers and disabled staff.

3. Evaluating the risks from the identified hazards

You need to evaluate the risks from the identified hazards. Of course, if there are no hazards, there are no risks. Where risks are already controlled in some way, the effectiveness of those controls needs to be considered when assessing the extent of risk which remains. You also need to:

- Look at what actually happens in the workplace or during the work activity; and
- take account of existing preventive or precautionary measures; if existing measures are not adequate, ask yourself what more should be done to reduce risk sufficiently.

4. Recording

All employers and self-employed people are required to make a risk assessment. The regulation also provides that employers with five or more employees must record the significant findings of their risk assessment. This record should represent an effective statement of hazards and risks which then leads management to take the relevant actions to protect health and safety. The record should be retrievable for use by management in reviews and for safety representatives or other employee representatives and visiting inspectors.

5. Review and revision

The regulation requires employers and the self-employed to review and, if necessary, modify their risk assessments, since assessment should not be a once-and-for-all activity. The employer or self-employed person needs to review the risk assessment if developments suggest that it may no longer be valid (or can be improved). In most cases, it is prudent to plan to review risk assessments at regular intervals.

Prevention

Employers and the self-employed need to introduce preventive and protective measures, to control the risks identified in the risk assessment.

In deciding which preventive and protective measures to take, employers and self-employed people should apply the following principles of prevention:

- if possible avoid a risk altogether, e.g. do the work in a different way, taking care not to introduce new hazards;
- evaluate risks that cannot be avoided by carrying out a risk assessment;
- combat risks at source, , if the steps are slippery, treating or replacing them is better than displaying a warning sign;
- adapt work to the requirements of the individual (consulting those who will be affected when designing workplaces, selecting work and personal protective equipment and drawing up working and safety procedures and methods of production
- take advantage of technological and technical progress, which often offers opportunities for improving working methods and making them safer;

Health and Safety at Work Act

The health and Safety Act states the duties of an employer or supervisor, if you are going to employ or be in charge of members of a team you have responsibility for their safety.
The HSAWA states the duties you have to those in your care. The penalties for not doing so are severe.
It is the duty of every employer to ensure, as far as is reasonably practicable, the health, safety and welfare at work of all his employees.

- To provide and maintain of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;
- to make arrangements, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;
- To provide information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees;
- so far as is reasonably practicable maintain any place of work under the employer's control in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks;
- To provide and maintain a working environment for his employees that is, so far as is reasonably practicable, safe, without risks to health, and adequate as regards facilities and arrangements for their welfare at work.

The Health and Safety at Work Act also states; 'It shall be the duty of every employer to conduct his himself and his work in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment but who may be affected, are not exposed to risks to their health or safety'.

Electricity at Work Regulations 1989

Similarly to the HASAWA you have the legal responsibility of those working for you or those you are supervising.
Electricity is a major hazard - not only can it kill directly, through shocks (and the majority of electric shock fatalities occur at voltages up to 240V), it can also cause fires and explosions.
These regulations aim to impose duties to limit the risks involved in using electricity at work.

Definitions

Electrical equipment includes anything used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.
System covers all and any electrical equipment which is, or may be, connected to an electrical energy source, and includes that source.
Danger means risk of injury.
Injury covers death or personal injury from electric shock, electric burn, electrical explosion or arcing, or from fire or explosion initiated by electrical energy, where any such death or injury is associated with the generation, provision, transmission, transformation, rectification, conversion, conduction, distribution, control, storage, measurement or use of electrical energy.

What are your responsibilities as an employer or supervisor?

Regulation 3 places duties on:

- Employers, employees and the self-employed - to comply with the regulations as far as matters are under their control
- Employees -to co-operate with their employer

Many employees in the electrical trades and other professions have responsibilities, as part of their duties, to the safety of electrical installations and systems.
The regulations quantify these responsibilities, by putting them under a legal duty to work in accordance with the requirements of the regulations.

How do you ensure general safety of electrical systems?

Regulation 4 requires that all electrical systems should, so far as reasonably practicable, be of safe construction and maintained in that state.
Work being carried out on or near systems must be carried out in such a manner as to avoid danger. Any protective equipment provided must be suitable and properly maintained and used.

Which equipment is suitable?

Regulations 5 to 11, in effect, place a duty to ensure that electrical equipment is suitable for where and how it is to be used, and is adequately protected.

Regulation 5 states that no electrical equipment should be connected into a system if there is a chance that its strength and capability may be exceeded in such a way as to cause danger.

Regulation 6 requires all electrical equipment that may be exposed to:

- mechanical damage
- the effects of the weather, natural hazards (animals, trees & plants etc)
- the effects of wet, dirty, dusty or corrosive conditions
- flammable or explosive substances

Must be constructed or protected so that danger doesn't arise.

Regulation 7 states that any conductor in a system (ie anything that conducts electricity) should either be insulated or protected in some other way from giving rise to danger.

Regulation 8 requires suitable methods of earthing,

Regulation 9 requires earthing conductors not to have their electrical continuity broken by anything that could give rise to danger and,

Regulation 10, all joints and connections must be suitable for safe use.

Regulation 11. Systems must be protected from excess current

What are the regulations covering; Isolation and 'live' or 'dead' working?

Regulation 12. All electrical equipment (except power sources themselves) must have secure and safe means of isolation from all sources of electrical energy
Regulation 13 requires suitable precautions to be taken to ensure that, once equipment is isolated so that work can be carried out on it, it cannot become electrically charged again whilst the work is in progress.
A simple example is where a fuse is removed from the main fuse box to allow work on the electrical cabling - it is insufficient just to leave the fuse lying next to the fuse box - someone could, unknowingly, re-insert the fuse, so making the system 'live' again.
In certain circumstances, it may be impossible to isolate a conductor from the electrical supply.
Regulation 14 requires that such 'live' working only occurs when it is unavoidable, and after suitable protective equipment has been provided.

What requirements are there regarding access, space and light?

Regulation 15 requires the provision of adequate working space, safe access and adequate lighting to enable work on electrical equipment to be carried out safely.

What do the regulation state regarding workers competence?

Regulation 16 requires that anyone working on electrical systems where technical knowledge or experience is necessary must have the required knowledge and/or experience or be under suitable supervision.

What defence do you have if an accident happens?

Any person who has a duty under regulations 4(4), 5 and 8-16 can, in any criminal proceedings, use the defence that they had taken all reasonable steps and exercised all due diligence to avoid the offence.

The Construction (Design and Management) Regulations 2007

The key aim of CDM2007 is to integrate health and safety into the management of the project and to encourage everyone involved to work together to:

- improve the planning and management of projects from the very start;
- identify hazards early on, so they can be eliminated or reduced at the design or planning stage and the remaining risks can be properly managed;
- target effort where it can do the most good in terms of health and safety; and
- discourage unnecessary bureaucracy.

The time and thought that you invest at the start of the project will pay dividends not only in improved health and safety, but also in:

- reductions in the overall cost of ownership, because the structure is designed for safe and easy maintenance and cleaning work, and because key information is available in the health and safety file;
- reduced delays;
- more reliable costings and completion dates;
- improved communication and co-operation between key parties; and
- improved quality of the finished product.

Pre-construction-stage health and safety plan

You are required to construct a plan for the health and safety of the project.

The pre-construction-stage health and safety plan may include:

- a general description of the work and details of project timescales
- details of health and safety risks as far as they are known, including information that clients are required to provide about site-specific risks (eg asbestos or contaminated land etc), and designers about particular project risks they were unable to eliminate and the assumptions in broad terms they have made about precautions that will be taken;
- information required by possible principal contractors to allow them to identify the health and safety competences and resources they will need for the project;
- information on which to base a construction-phase health and safety plan.

The plan only needs to contain information that is specific to the project and is necessary to assist the development of safe systems of work.

For the construction phase

For the construction phase, you need to develop the health and safety plan so that it addresses issues that are relevant to health, safety and welfare matters key to the project.

Issues which need to be considered for inclusion in the plan include:

- how health and safety will be managed during the construction phase, including details of how information and instructions will be passed to others and how their activities will be co-ordinated;
- risk assessments and health and safety method statements for high-risk activities;
- information about welfare arrangements for the project
- how material suppliers and plant and equipment supplied will be selected;
- information on necessary levels of health and safety training for those working on the project and arrangements for project-specific awareness training and refresher training such as toolbox talks;
- arrangements for monitoring compliance with health and safety law
- site health and safety rules and relevant health and safety standards where appropriate,
- Procedures for delivering information for the health and safety file.

Before you start work you must satisfy yourself that anyone you employ or engage is competent and adequately resourced; you must be able to plan, manage and monitor your own work to make sure that workers under your control are safe from the start of their work on site;

You must ensure that any contractor who you appoint or engage to work on the project is informed of the minimum amount of time which will be allowed for them to plan and prepare before starting work on site;

You must provide workers under your control with any necessary information, including about relevant aspects of other contractors' work, the site induction which they need to work safely, the need to report problems or to respond appropriately in an emergency;

All workers under your control must co-operate with others and co-ordinate their work with others working on the project;

You must ensure the workforce is properly consulted on matters affecting their health and safety; and obtain specialist advice where necessary when planning high-risk work.

CDM require the Reporting of incidents (RIDDOR)

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) require the 'responsible person' to notify any death, reportable injury, disease or dangerous occurrence to the relevant enforcing authority. The responsible person is the employer or, for the self-employed, the contractor or principal contractor.

Assess to site

Reasonable steps must be taken to prevent access by unauthorised persons to the construction site. Only people, who are explicitly authorised, individually or collectively, should be allowed access. The authorisation may need to cover the whole site or be restricted to certain areas. Authorised people should have relevant site rules explained to them and undertake any necessary site induction, and should comply with site rules and co-operate with you or other in authority. Some authorised visitors may need to be supervised or accompanied while on site or visiting specific areas.

Workforce competency

It is your responsibility to ensure that all your work force is competent for the task you have assigned them

To be competent, an organisation or individual must have:

- sufficient knowledge of the specific tasks to be undertaken and the risks which the work will entail;
- sufficient experience and ability to carry out their duties in relation to the project; to recognise their limitations and take appropriate action in order to prevent harm to those carrying out construction work, or those affected by the work

Assessments should focus on the needs of the particular project and be proportionate to the risks, size and complexity of the work.

Your responsibility means that you need to have the right person for the right job. Tasks, plant and equipment need to be allocated according to qualifications and experience. The site worker must know the standards of health and safety required for site operations; identify all foreseeable risks arising from their work activity and know what actions to take to control these risks; apply existing knowledge to new circumstances. They must be able to demonstrate good attitude and example at work and be capable of working safely with minimal supervision.

BS7671 Wiring Regulation 2008

The Wiring Regulations set the standard for electrical installation in the UK and many other countries. These regulations or requirements are more commonly known as 'The Regs', and have never been legal documents. They relate to; 'Design, selection, erection, inspection and testing of electrical installations, whether permanent or temporary, in and about building generally and to agricultural and horticultural premises, construction sites and caravans and their sites'

Compliance with BS 7671:2008 (IEE Wiring Requirements) is likely to achieve compliance with the relevant aspects of EWR. Also with the building regulations.

The On Site Guide puts BS7671:2008 (IEE Wiring Requirements) into practical settings and deals with common installation problems.

These regulations are not statutory (legally binding), but to have shown that you took all reasonable care to install equipment as require by the regulations, can be used as defence in the case of legal action.

1: Organising of materials

In this session the student will:

- Gain an understanding of the need to identify necessary material and equipment from specifications.
- Describe the requirements for storage and transportation of material and there safe and secure storage.

There is an aspect of planning that needs to be considered in a little bit of detail at this stage. This is the coordinating of men and materials with the additional factor of the safe storage of material and plant.

The planning of the installation with the use of bar charts and critical path diagrams is all well and good, but if it does not allow the planner to get materials and men on site, at the right time and in the right quantities then everything is wasted.

The delivery of materials in the right quantities and at the right time can be roughly determined from the work that has already been done on the critical path diagram. However, a degree of fine-tuning will be necessary and it is reasonable to have a certain amount of stock on hand. Too much however, and you will end up paying for material that is not strictly in use. Cash flow can then become a problem, with the additional headache of site security.

There are certain key problems that must be managed. These are:

- Taking-off and scheduling;
- Requisitioning and ordering;
- Receipt and checking of deliveries;
- Off-loading and handling;
- Storing and protection;
- Issuing and distributing;
- Use of materials;
- Quality control and supervision;
- Security.

We will deal with briefly with each in turn.

Taking-off and scheduling

There are a number of ways in which work is priced for. These usually fall into one of three types:

1) Fixed price contracts – the price is fixed in advance but is subject to variation under the terms of the contract. A 'firm price' contract is one which does not allow for change in price. The 'lump sum' type is the most common form of this arrangement.
2) Measured contracts – the price can be calculated by measuring work as it advances on site. There will be a schedule of rates list to enable accurate prices to be charged. A schedule of rates is also used with drawing and specification contracts to price additional work. There are two types of schedule:
    a. A standard schedule of rates detailing standard items and rates, with the tenderer asked to submit an overall percentage addition or subtraction to reflect current prices.
    b. Ad-hoc schedule of rates is a pricing document prepared for a single job and only those items needed for the job will be listed.
3) Cost reimbursement contracts – the contractor is paid with the prime cost of the completed work as defined in the contract and a management fee to cover overheads and profits.

Bill of quantities

A bill of quantity acts as a uniform basis for those wanting a contract to price for that work. Bills of quantities are primarily designed to aid the estimator in pricing. However, they also enable the planning of material purchasing, preparing programmes, cost control and data collection during construction for bonus payments.

There are standard methods of measuring building work (including electrical). Bills of quantities are divided into four sections:

- Preliminaries.
- Preambles.
- Measured work.
- Prime cost and provisional sums.

Estimating methods

There is a range of estimating methods. These can be split generally into two types:

- Single-rate methods
  - Functional unit or unit of occupancy method.
  - Superficial floor method.
- Multi-rate methods
  - Elemental cost plan.
  - Approximate quantities.
  - Analytical and operational pricing of bills of quantities.

Description			Quantity	Unit	Rate	Total
Breakdown	Lab rate	Plant rate	Mat rate	Sub rate		
	LAB	PLT	MAT	SUB		

LAB is the Labour rate

PLT is the plant rate

MAT is the material rate

SUB is the unit the measurement is to take, for example m^2 or m^3.

There are methods for calculating the plant rate and material rates. Indeed many errors arise because people take no account of the total cost of plant and material and fail to include haulage costs and the like.

It is normal for the person responsible for drawing up the bill of quantities to make sure that sufficient material has been allowed for.

Requisitioning and ordering

The person in charge of purchasing has a number of duties to perform before orders are placed for materials. After the schedules have been prepared, or any requisitions received, he will need to find suppliers that can provide the best possible price for the order. The site foreman would need to make sure that he is ordering for the company the best possible price, and on this basis will normally get his material from stock or via a direct delivery. It will be the site foreman's task to 'call forward' the material that the supplier holds on stock.

Receipt and checking of delivery

There should be some notification from the supplier that a delivery is to be made. It is for the foreman to organise the site ready for the delivery.

Delivery notes should accompany delivered goods and must be presented as proof of delivery. To sign for the content and quality of the goods can be a more problematic issue. Often it is impossible to count or examine the goods. However, delivery notes should not be signed until the foreman is convinced that everything has been delivered as agreed, or signed unchecked.

If material is being delivered from the main office or store of the company then an order must be made to the store. This allows for best use of material.

Off-loading and handling

To avoid the risk of injury it is essential that all material handling is properly planned. Where possible, avoid people having to lift materials at all. Where lifting is unavoidable provide mechanical handling aids wherever possible. Make sure that all equipment used for lifting is in good condition and is used by trained and competent workers. Before the job starts, decide what sort of material handling is going to take place and what equipment will be needed; avoid double handling – it increases risks and is inefficient.
Any equipment should be delivered to the site in good time and that the site prepared for it. Materials and products should, where possible, be delivered in a form that can easily be moved around the site with minimal manual handling, eg palletised loads that can be moved by fork-lift truck; ensure the equipment is set up and operated only by trained and experienced workers; Co-ordinate site activities so that those involved in lifting operations do not endanger other workers and vice versa.

Storing and protecting

This is a material dependent issue. On many sites a steel container is provided for security. This can be used for the storage of material in a manner that takes account of the frequency of use, health and safety and accessibility.

It is normal for the most used material to be set to the front of the store, so that there is minimum disturbance. Small items, such as clips etc. should be placed on a rack so that they don't get dragged all around the floor.

If a steel container is not available, a secure room should be used that has been cleaned out. This room may also double as a site office.
Designate storage areas for plant, materials, waste, flammable materials will usually need to be stored away from other materials and protected from accidental ignition. Do not store materials where they obstruct access routes or where they could interfere with emergency escape, eg do not store flammable materials under staircases or near to doors or fire exits. Waste materials also need storing safely before their removal from the site

Issuing and distributing

Much material is wasted at this stage. It is essential that an efficient store-keeping system is in place. You don't want to be working on a site to suddenly find yourself short of cable, just because no account was taken of the material on hand.
A booking out system may prove to be the most sensible way in which material is logged-out of the store. It is the site foreman's job to monitor the flow of this material.

Use of materials

There are always people who are less than careful when they think that they are working with someone else's money. The misuse of material will include leaving off-cuts of cable on drums, wasting conduit by poor bending and cutting skills, clips/screws etc. left on floors or in pockets, siphoning off material for use at home!

Tools and machinery

- Are the right tools or machinery being used for the job?
- Are all dangerous parts guarded?
- Are guards secured and in good repair?
- Are tools and machinery maintained in good repair and are all safety devices operating correctly?

Make sure employees have the knowledge they need to use and maintain tools and equipment safely. This can be given to them in manufacturer's instructions, operating manuals, and training courses.
Inexperienced employee may need some instructions on how to use hand tools safely, as well as instruction. Only competent workers should operate work equipment
Never assume an employee can use work equipment safely, especially if they have just started work, even if they have used similar equipment elsewhere.

Equipment

Any equipment that your work force use is covered by the Provision and Use of Work Equipment Regulations (PUWER)
In general terms, the Regulations require that equipment provided for use at work is:

- suitable for the intended use;
- safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case;
- used only by people who have received adequate information, instruction and training; and
- accompanied by suitable safety measures, eg protective devices, markings, warnings.

Generally, any equipment which is used by an employee at work is covered, for example hammers, knives, ladders, drilling machines, power presses, circular saws, photocopiers, lifting equipment (including lifts), dumper trucks and motor vehicles. Similarly, if you allow employees to provide their own equipment, it too will be covered by PUWER and you will need to make sure it complies.

Quality control and supervision

Regulation 7 of the Building Regulations for England and Wales requires that:
'Building work shall be carried out:

a) with adequate and proper materials which:
    i. are appropriate for the circumstances in which they are used;
    ii. are adequately mixed or prepared; and
    iii. are applied, used or fixed so as adequately to perform the functions for which they are designed; and
b) in a workmanlike manner.

As far as Regulation 133.1.1 of BS7671 is concerned:

> 'Every item of equipment shall comply with the appropriate British or Harmonized Standard.'

Additionally, the materials should match those that are stated in the specification and be installed in line with the manufacturers instructions (refer Regulation 134.1.1).
A good check is to randomly sample the material, such as looking in every other box at a socket or switch etc.

Measuring and testing instruments

Any measuring or testing instruments used for the installation or for fault finding/rectification, purposes require the operatives to understand the operating requirements of the instruments. They also need to understand the dangers that could arise while the tests are being carried out. All instruments should comply with the current standards such as GS. 38 and be regularly calibrated.

Security

Site theft is a real problem. As already stated, for the electrical contractor, there are really only two possible options. Either a steel container must be left on the site. This can be securely padlocked, or a lockable room must be provided. The only people with access to either of these rooms should be the site foreman, or some other trusted operative.
Construction work should be fenced off and suitably signed. This will protect people (especially children) from site dangers and the site from vandalism and theft. For some jobs the workplace will have to be shared. Agree who has to control each area.
Make sure there is a system to ensure necessary precautions are kept in place during working hours and that night-time and weekend protection is put in place as required before the site closes.

Traffic, vehicles and plant

For obvious reasons vehicles and pedestrians should be kept apart where possible, the easiest way to do this is by barriers and to display warning signs.
Reversing should be avoided, by using a one-way system, if not, properly trained signallers should be used?
Vehicles and plant must be properly maintained, and the drivers received proper training and are they competent for the vehicles or plant they are operating, with the loads properly secured.

Site Diary

To help in the process of organising the site a ***site diary*** should be kept.

A site diary can be, in effect two separate documents. They would be a site diary and a weekly report.

The site diary contains details on:

- Telephone calls;
- Deliveries;
- Problems;
- Promises made to individuals;
- Stoppages;
- Visitors to site;
- Site meetings.

The site diary is the responsibility of the foreman or charge-hand of the electrical contractor.

In addition to the above matters, the site diary will also record any correspondence that had been dealt with; any dismissals or hiring of staff, along with details of the process and any details with regard to any disciplinary action taken.

It may be necessary to record other information. If in doubt, write it out.

It would seem to be unreasonable to keep a site diary for a small contract, yet too often disputes arise even on small contracts and a site diary would help to limit these disputes. An element of common sense is necessary. If you are working on a contract for a period of time and there are a number of people on site, then it makes sense to keep a diary. Remember the diary is not a '***storybook***'; you are keeping records. It is not necessary to use perfect English, but it is necessary for you to be able to communicate accurately what has happened.

The weekly report is an analysis, by the foreman, of the week's events that he will extract from the site diary. This would be sent to head office for analysis.

The site supervisor also needs to be aware of current employment legislation. It is also necessary for the site supervisor to know how to respond to changing circumstances. The next section will deal with this aspect of management.

Personnel

The industry that we work within is a labour-intensive industry. With advances in electronics etc. it is still the electrician that has to run in the cables, make connections, fault find etc.

With this in mind it is important that due care is taken in both ‘hiring’ and ‘firing’ and with how people are treated.

There are a number of pieces of legislation that will apply. Some of them that apply are:

- Trade Union and Labour Relations Act
- Employment Acts
- Sex Discrimination Act
- Equal Pay Act
- Wages Act.

There are many others that apply as well.