FORWARD

1 The Qatar Construction Specifications (QCS) includes references and certain sections which address occupational health and safety. To ensure that the users of the RD/SAMAS are fully aware of where occupational health and safety issues are addressed in the QCS, the following table summarises where potential overlaps may occur. For consistency, it is recommended that in matters relating to occupational health and safety reference is made first to the RD/SAMAS. For the purpose of clarity, however, references are made in the relevant section of the RD/SAMAS to their comparable sections in the QCS and vice versa.

2 The purpose of QCS is to provide as a general technical guide for acceptable construction work practices in the State of Qatar, considering this; any addition for technology, material, specification, standard that are not mentioned in this section or their modification, shall be subject to approval as stated in the introduction of QCS (00-02).

Sr. No	QCS Section No.	Part No.	Part Name	Item No.	Item Name
1	1	7	Submittals	7.5.2	Health and Safety Organization Chart
2	1	7	Submittals	7.6.1	Health and Safety Plan
3	1	8	Building Demolition and Waste Management	8.1.6	Safety
4	1	10	Welfare, Occupational Health and Safety	All	All
5	1	11	Engineer's Site Facilities	11.4.6	Safety Equipment and Clothing
6	1	14	Temporary Works and Equipment	14.4	Test Certificates for Cranes and Lifting Tackle
7	1	15	Temporary Controls	All	All
8	1	16	Traffic Diversions	16.1.3	Safety
9	3	1	General	1.4.12	Safety and Management
10	4	1	General Requirements for Piling Work	1.6	Safety
11	4	4	Deep Foundations	4.9.1.7	Safety Precautions
12	4	4	Deep Foundations	4.9.1.13	Protection of Testing Equipment
13	6	1	General	1.6	Temporary Fencing
14	6	7	Asphalt Plants	7.8.13	Safety Requirements
15	6	14	Works in Relation to Services	14.2.2	Safety
16	8	1	General	1.3.2	Health and Safety
17	8	8	Protective Coatings and Painting	8.1.9	Safety
18	8	9	Trenchless Pipeline Construction	9.2.5	Safety Requirements
19	8	10	Pipeline Cleaning and Inspection Survey	10.1.7	Safety Requirements
20	8	11	Sewer Rehabilitation	11.2.2	Safety
21	9	1	General	1.2.8	Safety Guards
22	9	1	General	1.2.16	Noise Levels and Vibration
23	19	5	Hot Water Storage	5.1.6	Safety
24	21	1	General Provisions for electrical Installation	1.1.11	Fire and Safety Precautions
25	21	1	General Provisions for electrical Installation	1.1.23	Safety Interlocks
26	24	1	General	1.1.4	Scaffolding
27	29	1	Design Related Issues Aspects	1.1.5	Fire Resistance Period
28	29	3	Geotechnical Specifications	2.3.1.5	Safety
29	29	4	Tunnel	4.5.8	Safety Regulations
30	29	4	Tunnel	4.5.9	Fire Prevention
31	29	4	Tunnel	4.6.4	Safety Measures and Systems
32	29	7	Concrete Structures	7.1.10	Safety Railing

Construction Site Safety

1.5.1 Working With or Near to Buried Services

1.5.1.1 Key points

1 Many injuries and deaths have occurred because the location and exposure of buried services were not carried out in a safe manner.

2 Cable plans and charts cannot be depended upon to accurately identify the exact route of a buried service.

3 Safe digging procedures are essential; final exposure of buried services by hand-digging will be necessary.

4 Prior consultation with utility companies and client engineering departments will be necessary in most circumstances.

5 There are now devices available for locating all types of underground service; operators must be trained and competent in their use, including the interpretation of survey results.

6 The exposure of buried marker tape or tiles whilst digging will indicate the presence of buried services below.

7 It should always be assumed that buried services are 'live' unless proved otherwise.

8 On certain sites old and abandoned metallic services or other metallic items can pick up signals from known services and distort the survey results.

9 Accidental damage to any buried service must be reported immediately to the relevant authorities and organizations who are responsible for the utility.

Note: Section 8, Part 9 and Section 8, Part 10 of the QCS cover trenchless pipeline construction and pipeline cleaning and inspection, respectively.

1.5.1.2 Introduction

1 Buried services are, to a great extent, forgotten until, perhaps, there is a fault or another reason to excavate. Every year people are injured and some killed due to accidental contacts with buried services, such as electricity cables and gas pipes. In every case, the damage and injury could have been avoided if the proper procedures had been followed.

Reference

Refer to Section 11 – Part 1 – 1.8.1 – Sources of Health and Safety Information.

The following Standard are referred to in this part of specification:

BS 1710	Specification for identification of pipelines and services
BS 2754	Construction of electrical equipment for protection against electric shock; (EN 61140 Protection against electric shock - Common aspects for installation and equipment)
BS 4078	Powder actuated fixing systems -
BS 4078-1	Powder actuated fixing systems - Code of practice for safe use
BS 4275	Guide to implementing an effective respiratory protective device programme; (EN 529 Respiratory protective devices. Recommendations for selection, use, care and maintenance. Guidance document)
BS 4363	Specification for distribution assemblies for reduced low voltage electricity supplies for construction and building sites
BS 5228	Code of practice for noise and vibration control on construction and open sites-

BS 5228-1	Code of practice for noise and vibration control on construction and open sites – Noise
BS 5228-4	Noise and vibration control on construction and open sites - Code of practice for noise and vibration control applicable to piling operations; (BS 5228-1 Code of practice for noise and vibration control on construction and open sites – Noise; BS 5228-2: Code of practice for noise and vibration control on construction and open sites - Vibration)
BS 5378	Safety signs and colours – ; (ISO 7010 Graphical symbols. Safety colours and safety signs. Registered safety signs)
BS 5607	Code of practice for the safe use of explosives in the construction industry
BS 5975	Code of practice for temporary works procedures and the permissible stress design of falsework
BS 6031	Code of practice for earthworks
BS 6164	Health and safety in tunnelling in the construction industry. Code of practice
BS 6187	Code of practice for full and partial demolition
BS 7121-	Code of practice for safe use of cranes -
BS 7375	Distribution of electricity on construction and demolition sites. Code of practice
BS 7430	Code of practice for protective earthing of electrical installations
BS 7671	Requirements for Electrical Installations. IET Wiring Regulations
BS 8008	Safety precautions and procedures for the construction and descent of machine-bored shafts for piling and other purposes
EN 50144	Safety of hand-held electric motor operated tools
EN 50144-1	Safety of hand-held electric motor operated tools - General requirements; (EN 50580 Safety of hand-held electric motor operated tools - Particular requirements for spray guns)
EN 60079-14	Explosive atmospheres - Electrical installations design, selection and erection; (IEC 60079-14 Explosive atmospheres - Part 14: Electrical installations design, selection and erection)
EN 60309-2	Plugs, socket-outlets and couplers for industrial purposes - Dimensional interchangeability requirements for pin and contact-tube accessories; (IEC 60309-2 Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes - Dimensional compatibility requirements for pin and contact-tube accessories)
EN 60598	Luminaires -; (IEC 60598- Luminaires -)
EN 60598-1	Luminaires - General requirements and tests; (IEC 60598-1 Luminaires - General requirements and tests)
ISO 8643	Earth-moving machinery — Hydraulic excavator and backhoe loader lowering control device — Requirements and tests

1.5.1.3 Legislative requirements

The Management of Health and Safety

1 All work, including any work in relation to the location and exposure of buried services, must have been subject to a risk assessment.

2 These Regulations place a requirement on every Contractor to make a suitable and sufficient assessment of every work activity to identify any hazard that employees or any other person

might encounter as a result of the work being carried out. Method Statements shall clearly identify the methods that will adapted to communicate such hazards prior to commencing work.

3 Once those hazards have been identified, it is then the Contractor's duty to put control measures into place to either eliminate the hazard or, where this is not possible, reduce the risk of injury as far as is reasonably practicable.

4 The Contractor must provide employees with comprehensible and relevant information on any risks that exist in the workplace and of any control measures that have been put in place to reduce those risks.

5 In the context of this module, some of the factors that the risk assessment must take into account are:

(a) the equipment and work methods employed to safely identify, locate, expose and, if necessary, work on the services

(b) the potential hazards posed

(c) accidental damage to the buried services

(d) the competence of the persons who are to plan, supervise and carry out the work

(e) satisfactory reinstatement of the disturbed ground.

6 Employees, in turn, have a duty under these Regulations to tell their Contractor of any work situation which presents a risk to the health and safety of themselves or of any other person who may be affected.

The Provision and Use of Work Equipment

7 All equipment used in conjunction with excavations or buried services is 'work equipment".

8 These Regulations require that a Contractor only supplies work equipment that is correct and suitable for the job and ensures that the equipment is maintained and kept in good working order.

9 It is essential that any work equipment used to locate buried services:

(a) is suitable and sufficient, for example, a cable avoidance tool that works by detecting electromagnetic fields will not detect a plastic gas pipe

(b) is fully serviceable and calibrated where appropriate

(c) is used by a trained and competent operator who has the knowledge and experience to interpret the results.

Construction (Design and Management) CDM

10 Under these Regulations, the client must provide the project-specific information needed to identify hazards which can be obtained by making sensible enquiries. This includes information from utility companies and client organizations on the location of underground services.

11 By providing this information to the designer, the client creates an opportunity for hazards to be avoided by design.

12 Information on new or modified services installed should be passed to the Engineer for inclusion in the health and safety file.

13 Contractors are required that energy distribution installations are located, checked and clearly

marked to prevent danger. Any changes observed on site during surveys or site activities shall be reported to the utility company and / or client organizations for updating relevant drawings to reflect the changes.

14 Suitable and sufficient steps must be taken, so far as is reasonably practicable, to prevent risks to health and safety from construction work likely to damage or disturb underground services

15 Furthermore, under these Regulations the following requirements are particularly relevant to working with or near to buried services:

(a) no duty-holder may arrange for any person to carry out design or construction work unless they are competent to carry out the work they are required to do, or are under the supervision of a competent person

(b) all duty-holders must co-operate with each other to ensure that each can fulfil their duties under these Regulations

(c) every person working on a project under the control of another person is required to report to that person anything which is likely to pose a risk to health or safety of any persons

(d) duty-holders must co-ordinate their work activities to ensure, so *far as is reasonably practicable,* the health and safety of those people carrying out the construction work and any other person who might be affected by it

1.5.1.4 Types of buried services

1 The most obvious examples of buried services are those used to carry gas, electricity, water and telecommunications. These may be found almost anywhere. However, drains and sewers are also buried services, the location of which must be identified before excavation starts.

2 There are many other types of buried services, the presence of which may not be known or detected unless a thorough investigation is carried out. They include services associated with cable television, hydraulics, process fluids, pneumatics, railway signalling, petroleum and fuel oils (large bore, deep pipelines linking major installations), private telecommunications, highway authorities, street lighting, civil aviation and military authorities.

3 Work in the vicinity of gas transmission pipelines, normally operating at above 7 bar (100 psi), often requires special measures to be taken and the local gas distribution company will be able to supply details of appropriate procedures. When planning to work anywhere near such gas pipelines, Contractors shall coordinate with the asset owners and acquire relevant permits prior to start of the activity.

1.5.1.5 Risks and cost of damage

1 A significant risk of injury results from accidental contact with electricity cables. Buried electrical cables often carry high voltages, and accidental damage and contact has resulted in death or major burns. Most injuries are caused to people using pneumatic drills or jackhammers and involve 415 volt cables which were located within 0.5 metres of the surface.

2 Damage to gas pipes can cause a leak resulting in fire and an explosion.

3 In the event of a gas leak, suspected gas leaks or any other emergency relating to gas, immediately ring:

Gas Emergency Service Number:

4 The consequences of damaging water pipes and telephone cables may be less immediately evident but are nonetheless serious, both in terms of disruption and cost. The interruption of

services can create serious problems for places critically dependent upon them - for example, hospitals - and many people are likely to be put at risk or inconvenienced.

5 The cost of damage can be considerable. Fibre optic telecommunication cables are very expensive and a simple break may mean the replacement of a 2 kilometre length, at a cost measured in thousands of Riyals. Indirect costs, in some cases resulting from loss of production and disruption of business activities, will be borne by all affected, including those whose negligence caused the incident.

1.5.1.6 Checking for buried services

1 Before any digging takes place, a check must be made with all public and private utilities, such as gas, electricity, telecommunication and cable TV companies, and the owner or occupier of the land for the existence of services in the proposed work area.

2 The routes of known buried services should be clearly marked on the site plans

3 When looking at plans, it should be borne in mind that reference points may have been moved, surfaces may have been regraded, services moved without authority or consent, and that not all service connections or private services are shown. Plans must be interpreted with care; the route shown may only be approximate. There may be other services present not shown on the plans.

4 It is not unknown on certain sites for old and abandoned services or other buried metallic items, such as tram lines or cast iron pipes, to pick up the electro-magnetic signals from known cables and distort the survey results.

5 Where appropriate, the route, when established, should be identified with paint, tape or markers but not steel spikes which might penetrate a cable or pipe.

6 A line on a plan does not necessarily mean a pipe or cable is located exactly in the position marked. It only indicates that it is roughly in that location. The exact position will only be known when the buried service is uncovered.

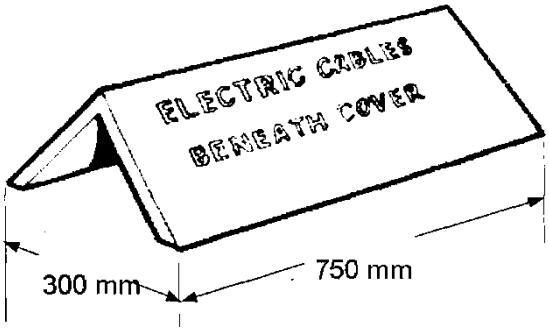
7 In many cases, there is no indication above the ground that a buried service exists. They may be found almost anywhere and at any depth from immediately beneath the surface to 1.5 metres or more below.

8 Indications that buried services do exist include the presence of lighting columns, illuminated traffic signs, telephone boxes, concrete or steel manhole covers, and hydrant and valve pit covers.

9 A change in the colour of the surface material may indicate the line of a trench where services have previously been installed.

10 Indicator posts, usually on the verge, or plaques on walls, are a clear sign that buried services are present. Indicator posts belonging to water and gas suppliers often give the size of the pipe and its distance from the post. The absence of posts or covers must not be taken as evidence that there are no buried services. Access covers can be as much as 1.5 km apart.

11 Cables or pipes may be laid loose in the ground, run in earthenware, concrete, metal, asbestos or plastic ducts, or be buried in cement-bound sand, loose sand, fine backfill or material dissimilar from the surrounding ground. Plastic marker tape, tracer wire, boards, tiles or slabs may have been laid above the service to indicate that there is something below. These may, however, have been removed or damaged in the past; they are also liable to be laterally displaced by ground water or movement and thus no longer indicate the true location of the service.



12 It is common practice for brightly coloured polythene tape (150 mm wide) or expanded plastic mesh, sometimes incorporating metallic tracer wire, to be placed in the backfill about 300 mm above the pipe or service. A text on the tape identifies the type of service below. When uncovered, these tapes indicate the presence of a pipe or cable before any damage is done. The absence of a tape should not be taken as evidence that there are no pipes or cables at the location; it may simply mean that no marker tape was used.

Caution

13 **Never** assume that services have been installed at the recommended depth, they are often shallower.

14 **Never** assume that when you have located a service that it is the only one, there may be others adjacent to, above or underneath it.

15 **Beware** of services encased in concrete bases, structures or in the concrete backing to kerbs.

16 **Beware** of services rising over obstructions, culverts, bridges etc. They are often much shallower in these locations.

1.5.1.7 Use of cable and pipe locators

1 A wide range of instruments are available for the detection of buried services. Often they are just referred to as CATs (Cable Avoidance Tools). Several different principles may be applied in the task of detection and an instrument may incorporate more than one of these.

2 **Note:** Both CAT and Generator must be used together to give an effective search for services. Using the CAT alone will only give part of the picture.

3 **Power detection.** Virtually all electricity cables give off or radiate a magnetic field while current is actually flowing through them. This magnetic field or 'hum' is usually easy to detect by a CAT.

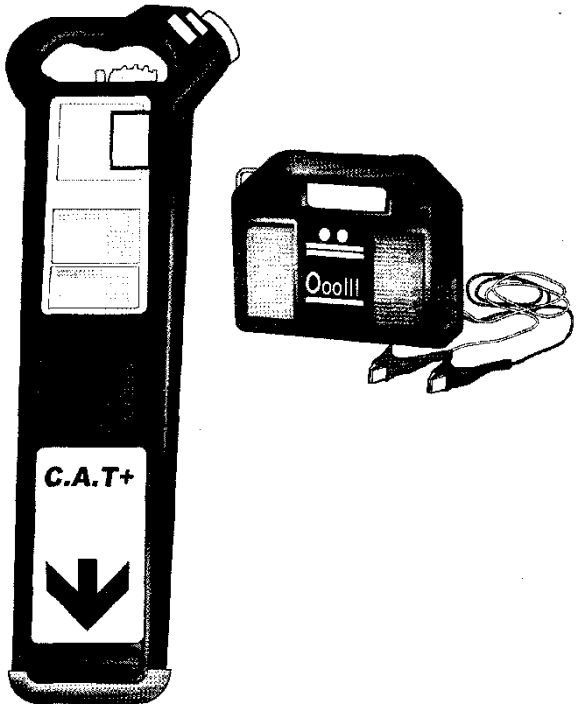
4 However, it should be noted that CATs may not be able to detect live cables:

(a) when there is no current flow because the cable has been disconnected from its load. (An example of this is a live pot-ended cable)

(b) when the loading on a three-phase supply is evenly distributed across the three phases

(c) when the current flow is so small that it is beyond the detection capability of the detection tool

(d) when there is no current flowing because the device is inactive, for example, street lighting during the daytime.



5 Used in the power detection mode, CATs will occasionally detect metal, gas and water pipes, and telephone cables in proximity to electricity cables.

6 **Radio frequency.** Metal pipes and cables can act like radio aerials and re-broadcast low and very low frequency radio signals which can be detected. There are limitations due to geography and initial broadcast signal strength. If this method is used, other metallic objects may also radiate the signal, but it is a useful method and can sometimes detect electricity cables that have not been found by power detection. Not all CATs have this function.

7 **Transmitter and receiver (inductive or conductive).** This method is used when the service is not carrying electricity or there is no current flow in the service to be located.

8 A small portable transmitter or signal generator (Genny) is connected to an exposed part of the cable or pipe, or placed very close to it, so that the signal is fed into or induced in the pipe or cable. This signal is then detectable by a CAT. In order to use this method, the location of at least one section of the cable or pipe must be accessible, so that the transmitter can be positioned or attached.

9 It is important to continue to use the locator as the excavation progresses.

10 **Metal detectors.** Conventional metal detectors will usually locate flat metal covers, joint boxes, etc., but may well miss round cables or pipes. The deeper the object, the less the chance of detection. Reinforcing bars, metal deposits in the ground and discarded metal objects will usually also be registered by a signal. Some cable locators have a metal detector function.

11 Developments in 'moles', 'pigs', 'mouses' and 'sondes', which are detection devices put into pipes and services to trace their routes, mean that previously undetectable pipes and services can be followed and, in some instances, blockages and joints can be located.

12 **Ground-penetrating radar.** A portable radar transmitter is used to 'sweep' the area of land under which the buried services run. A display on the transmitter indicates variations in the density of the materials below the surface and can show where the land has previously been disturbed.

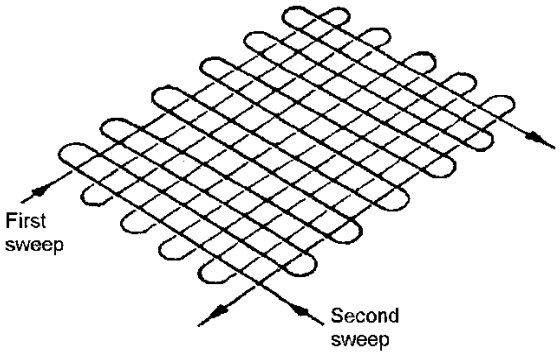
13 The display will also show solid objects such as cables or pipes filled with air, gas or liquids, and indicate the depth at which they are buried. By marking all the spots on the ground where an underground service has been located, its route can be traced. Ideally, this method should be supported by existing service plans.

14 The proper training of operatives is essential. Interpretation of the radar display can be difficult for the untrained. A skilled and trained operative with the correct instrument can detect the majority of underground services.

15 In unskilled hands, the average locator will not reveal exactly what has been found, or exactly where and how deep it is.

16 One problem that can arise in the use of ground-penetrating radar is the detection of individual buried services where more than one service follows the same route. The majority of detectors cannot distinguish between cables or pipes running close together. Consequently, the uncovering of one cable or pipe does not mean there is not another close by.

17 Some of the detectors or detection modes are not Omni-directional and it is therefore essential to cover or sweep the area twice to ensure a good chance of detecting a buried service. This is especially true in the case of electricity cables. The sweep must be made up and down, then from side to side.



Training

18 It is important that those using any type of cable locating equipment are given sufficient training and experience to be competent.

Recording location of services

19 A record of the nature, co-ordinates, line and level of newly installed services as well as those exposed on site should be kept and passed to the Client. This will enable those in the future to locate underground services more accurately.

1.5.1.8 Colour-coding of buried services

1 A national agreement exists between the utilities groups for the colour-coding of buried services.

2 The colours used for ducts, pipes, cables and marker/warning tapes are listed in Appendix 1 of this module. The listing has been reproduced from the publication *NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities Apparatus* (December 2007).

3 These colour-coded buried services should not be confused with the colour system contained in BS 1710 Specification for identification of pipelines and services, which generally applies to all above-ground building and process services.

4 It should be noted that both green and black plastic-covered cables have been laid for private telecommunications and television, some of these in earthenware ducts or previously used metal pipes.

5 Identification of colours in conditions of poor light or artificial lighting may be difficult.

6 The colour-codings in Appendix 1 apply to services being laid now. With the great variety of pipes and services laid over a period of years, there is a wide mixture of materials and colours. The principal ones, excluding cement, plastic, metallic or earthenware ducts, are summarised in the table below. This table also highlights the different services that may have similarly coloured pipes or cables.

Pipe or cable	**Service(s)**
Cast iron	Gas, water
Steel	Gas, water
Braided steel	Electricity
Yellow steel	Gas
Copper	Water
Lead or lead covered	Electricity, water
Asbestos	Water
Hessian wrapped	Electricity
Black PVC	Electricity, water, telecoms
Blue PVC	Water
Grey PVC	Water, telecoms
Red PVC	Electricity
Yellow PVC	Gas
Natural PVC	Telecoms

All plastic, polythene and polyvinylchloride pipes are shown above as PVC.

7 The following points should be noted:

(a) black PVC must always be assumed to be live electricity until proved otherwise

(b) all cast iron and steel must be assumed to be carrying gas until proved otherwise

(c) ducts may well contain any one of the services, irrespective of type or colour of the duct.

1.5.1.9 Digging - mechanical or manual

1 Once the approximate location of a service has been identified using all available information (including plans, marker posts and other indicators and detectors), trial holes should be dug carefully by hand to establish the exact location and depth of the service.

2 Where two holes are dug at intervals, it should not be assumed that the service runs in a straight line between them, or that it runs at a consistent depth.

3 Mechanical excavators and power tools should not be used within 0.5 metres in any direction of the indicated line of a service, unless prior agreement on a safe system of work has been reached with the service owner. Power tools may be used to break paved surfaces, but great care must be taken to avoid over penetration, since a service may have been laid at an unusually shallow depth, especially in the vicinity of buildings or other services. Power tools must never be used directly over the indicated line of a cable unless it has been made dead or steps have been taken to prevent damage.

4 Buried services that cross the route of an excavation must be supported as necessary. It is also necessary to ensure that the method used to support the sides of an excavation allow for the protrusion of buried services through the excavation's sides.

5 Before and during excavation work:

(a) Check with all utilities and landowners before starting work.

(b) Assume the presence of services when digging, even though nothing is shown on plans.

(c) Use detection devices and keep a close watch for signs of buried services, such as marker tape or tiles.

(d) Although there are recommended minimum depths for all services, they may be closer to the surface than normal, especially in the vicinity of works, structures, or other services.

(e) Markers such as plastic tape, tiles, slabs or battens may have been displaced and will not indicate the exact location of the buried service.

(f) Some electric cables and water pipes look alike, as do some gas pipes and water pipes. Ensure each pipe is properly identified before starting work on them.

(g) Services could be easily damaged by a fork or a pickaxe forced into the ground, but careful use of spades and shovels enables services to be safely uncovered.

(h) Carefully lever out rocks, stones and boulders.

(i) Over penetration of the ground or surface with hand-held power tools is a common cause of accidents.

(j) If an excavator or digger is being used near any service, take extra care to prevent accidental damage. Where possible, no one should be near the digger bucket while it is digging.

(k) Ensure the excavator operator and others excavating are informed of the presence of suspected services.

(l) If the service is embedded in concrete or paving material, the owner should de-energise it, otherwise make it safe or approve a safe system of work before it is broken out.

(m) Always assume closed, capped, sealed, loose or pot-ended services are live or charged, not dead or abandoned, until proved otherwise.

(n) Follow the guidelines and advice issued by the electricity, gas, water and telecommunication industries.

1.5.1.10 Piling and drilling, etc.

1 Piling and drilling, thrust boring, bore holing and augering must not start until all the necessary steps and precautions have been taken and a safe system of work has been devised and implemented.

2 Services shown or thought to be nearby should be exposed by hand digging to establish their precise location.

1.5.1.11 Exposure and protection

1 When a service is exposed in the bottom of a trench or excavation, it should be protected with suitable timber or other material to prevent it becoming damaged.

2 Services across a trench or along a trench above the bottom should be supported by slings or props, to avoid unnecessary stresses. In case of doubt, advice should be sought from the utilities or the owner.

3 Cables and services must never be used as jacking or anchorage points, or as footholds or climbing points. If a service pipe or cable needs to be moved to allow work to progress, the owner should be consulted and advice sought.

1.5.1.12 Reporting damage

1 Any damage to buried services must be reported to the owners. Minor damage to the sheath of a cable or to a coating on a pipe can result in moisture penetration, corrosion and subsequent failure. A cable pulled and stretched may result in a conductor or core being broken, and a broken earthenware or concrete duct may prevent a service being routed through it.

If a gas pipe is fractured or starts leaking:

2 evacuate all personnel from the area

3 enforce a ban on smoking and naked lights

4 prevent any approach by members of the public or vehicles

5 inform the gas company immediately.

If an electricity cable is damaged:

6 avoid all contact with it

7 do not attempt to disentangle it from digger buckets, etc.

8 do not attempt to leave your cab. Stay put until you are told the cable has been made safe

9 inform the electricity company

10 keep everyone clear.

11 **Note:** Some cables are automatically re-energised by the local sub-station after a short time following the supply tripping out due to damage. Do not assume that a damaged cable will remain dead.

12 Beware of old pot-ended cables and pot joints; these are easily damaged if moved. Always

consult the service provider before touching such apparatus.

If any other service pipe or cable is broken:

13 leave well alone

14 inform the owner.

Backfilling

15 **Surplus concrete, hard core, rock, rubble and flint must never be tipped onto a service while backfilling** a trench or hole, since it may result in damage.

16 Selected backfill material should be adequately settled and compacted, with care being taken to avoid mechanical shocks to the service pipe or cable. Warning tapes, tiles, etc. should be placed above the service at about 300 mm. When gas service pipes have been exposed, advice on backfill should be sought from the gas company.

Emergency works

17 Emergency works and excavations usually mean that there is no time for planning or contacting each of the utilities.

18 However, work can be carried out safely if:

(a) the area is marked out carefully

(b) detectors are used correctly

(c) trial holes are dug by hand

(d) the practice of safe digging is followed.

Permit to Work and Permit to Dig

19 Where it is appropriate, a formal Permit to Work system should be employed, with a Permit to Dig being issued, duly signed by a competent person. Those engaged on the work can then see exactly what has been done, what is expected of them and what precautions they must take. The permit also allows the person in control of the works to authorise excavation to proceed only when they are satisfied that the conditions of the permit have been met.

20 An example of a Permit to Dig is given in Appendix 2.

Conclusion

PLAN... LOCATE... DIG...

21 **Plan** the work to be done, including the risk assessment, using all available sources of information. Contact the utility companies and owners of services for information and advice on procedures and continue to liaise with them.

22 **Locate** the buried service before digging or excavation starts. Use all available information; look for indicators or markers and other signs; use detectors and locators, and dig trial holes.

23 **Dig** using a safe method of work (Permit to Work systems whenever possible); observe the rules in respect of the use of mechanical diggers and power tools. Ensure that all services are identified positively. Do not make assumptions about the number, type or exact location of services.

Construction Site Safety
1.5.1 Appendix 1

Colours of ducts, pipes, cables and marker/warning tapes

1 These guidelines, reflect utility practice in the UK. However, operators must not assume that any mains or services encountered will conform to the recommendations for positioning or colour coding detailed in this appendix.

Pipe/Duct Identification

Issue 4, dated 8 January 2009

The pipe or duct may have the owning utility's name stamped upon it.

Colour of Duct/Pipe/Cable Buried in Ground

Utility	Duct	Pipe	Cable	Colour of Marker/ Warning Tape Where Used
Electricity HV (High Voltage)	Black or red tile	N/A	Black or red	Yellow with black legend
Electricity LV (Low Voltage)	Black or red	N/A	Black or red	Yellow with black legend
Gas	Yellow	Yellow or yellow with brown stripes that is removable to reveal white or black pipe	N/A	Yellow with black legend
Water non potable & Grey water	N/A	Black with green stripes	N/A	N/A
Water -Firefighting	N/A	Black with red stripes or bands	N/A	N/A
Oil / fuel pipelines	N/A	Black	N/A	Various surface markers Marker tape or tiles above red concrete
Sewerage	Black	No distinguishing colour/ material (e.g. Ductile Iron may be red; PVC may be brown)	N/A	N/A
Telecoms	Grey White Green Black Purple	N/A	Black or light grey	Various

Water	Blue or grey	Blue polymer or blue uncoated Iron / GRP. Blue polymer with brown stripe (removable skin revealing white or black pipe)	N/A	Blue or Blue/black
Water pipes for special purposes (e.g. contaminated ground)	N/A	Blue polymer with brown stripes (no removable skin)	N/A	Blue or blue/black

Highway Authority Services	Duct	Pipe	Cable	Tape
Street lighting England and Wales (consult the electricity company first)	Black or orange	N/A	Black	Yellow with black legend
Street lighting Scotland	Purple	N/A	Purple	Yellow with purple black legend or
Street lighting Northern Ireland	Orange	N/A	Black or orange	Various
Traffic control	Orange	N/A	Orange	Yellow with black legend
Street furniture	Black	N/A	Black	Yellow with black legend
Telecoms	Purple/orange	N/A	Black	Various
Communications	Purple	N/A	Grey	Yellow with black legend
Communications power	Purple	N/A	Black	Yellow with black legend
Road lighting	Orange	N/A	Black	Yellow with black legend
Scotland				
Communications	Black or grey	N/A	Black	Yellow with black legend
Road lighting	Purple	N/A	Purple	Yellow with black legend

Construction Site Safety
1.5.1 Appendix 2

Example of a Permit to Dig

Work must not start until Sections A, B & C of this permit have been completed and signed by authorised persons.

Section A. Project details **To be completed by project manager**
Company: ..... Job/Contract ref: .....
Contractor: .....Location of works:.....
Start date: .....Completion date:.....
Brief description of works

Section B. Preliminary work **To be completed by the Supervisor in change of the works**			
Essential procedures	**Yes**	**No**	**Comments**
1. Have contract drawings and details been issued by the client or otherwise obtained?			
2. Do drawings show the location, type and status of buried services?			
3. Have live services been made dead as far as it is possible or necessary to do so?			
4. Has the work area been surveyed by a competent person, using appropriate detection equipment to confirm the exact location of buried services?			
5. Has a method statement been written and submitted for comment and approval?			
6. Has the method statement been explained to the operatives carrying out the work?			
7. Is the person in charge of the excavation fully conversant with the principles of safe digging and/or avoidance of buried services?			

8. Are all operatives familiar with safe excavation practices?			
9. If plant is being used, is the operator competent and familiar with safe digging practices?			
I declare that the above safety precautions will be put into place before work commences or that an explanation given as to why some or all are not necessary: Name:..... Signature:..... .Date:..... Time:.....			

Section C. Certification To be completed by the supervisor in charge of the works
I am satisfied that the precautions identified on the previous page are satisfactory to enable the excavation to be undertaken safely* I am NOT satisfied that the precautions identified on the previous page are satisfactory to enable the excavation to be undertaken safely and require the additional precautions / work outlined below to be undertaken before excavation work commences* *Delete as appropriate Name:.....Signature:.....Date:.....Time:.....
Additional precautions / work necessary prior to commencement:

Section D. Completion of work **To be completed by the supervisor in charge of the works**
I am satisfied that the precautions identified on the previous page are satisfactory to enable the excavation to be undertaken safely* I am NOT satisfied that the precautions identified on the previous page are satisfactory to enable the excavation to be undertaken safely and require the additional precautions / work outlined below to be undertaken before excavation work commences* *Delete as appropriate Name:.....Signature:.....Date:.....Time:.....

Additional work that is necessary to enable this permit to be cancelled:
Section E. Cancellation of permit **To be completed by the supervisor in charge of the works**
I am satisfied that all work has been completed and this permit is now cancelled. Name:.....Signature:.....Date:.....Time:.....

Construction Site Safety

1.5.2 Lone Working

1.5.2.1 Key points

1 The implications of lone working must be thoroughly investigated, via a risk assessment, before anyone is allowed to work alone.

2 Lone working must be avoided whenever it may put the health or safety of any person at an unacceptable level of risk. Risks should consider both human and non-human related ones.

3 Anyone working alone, for example a single person working in a lift shaft, is a lone worker even if there are other people on site.

4 The suitability of the job and the person who will undertake the work must both be taken into account to establish whether lone working is advisable.

5 A suitable and effective system of checks to confirm the continued wellbeing of the lone worker must be put in place.

6 The risk assessment might indicate the need for a rescue plan.

7 Resist the urge to carry out unplanned lone working, for example the two members of a maintenance team separating so that one of them can fix an unexpected fault, unless it is proved safe to do so.

1.5.2.2 Introduction

1 Before lone working is permitted, the risks of a single worker carrying out the task must be assessed. The findings of the risk assessment must demonstrate that the person would not be at a greater level of risk than if accompanied.

2 Contractors have responsibilities for the health and safety of their employees and other people who might be affected by the Contractor's work activities. Whilst legal duties are also placed upon employees, the Contractor still retains the legal duty to ensure the wellbeing of the employees.

3 Lone workers are people who work by themselves without any close or direct supervision.

4 As far as construction industry activities are concerned, they are likely to be people who:

(a) work on their own in a part of the site that is otherwise occupied by other people

(b) have to work alone on the site outside of normal working hours

(c) work alone in premises which are remote from the site, such as company offices or a builder's yard

(d) work alone in domestic premises whilst the householder is not present.

1.5.2.3 Legislative requirements

Duties of Contractors

1 A general duty on every Contractor is to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all their employees.

2 All of the requirements listed below could have implications when considering the need or advisability for someone to work alone.

3 So far as is *reasonably practicable,* Contractors must:

(a) protect the health, safety and welfare at work of all their employees

(b) provide and maintain plant and systems of work that are safe and without risk to health

(c) ensure safety and absence of risks in the use, handling, storage and transport of articles and substances

(d) provide any necessary information, including information on legal requirements, to ensure the health and safety of their employees

(e) provide adequate supervision and training, as is necessary, to ensure the health and safety of their employees

(f) provide and maintain a safe and healthy place of work, with safe access and egress

(g) provide and maintain a working environment that is safe and without risks to health and is adequate with regard to welfare facilities and arrangements for welfare at work.

4 Certain additional duties have been placed on the Contractor including:

(a) to ensure, as *far as is reasonably practicable,* that the conduct of their activities does not endanger persons not in their employment who may be affected by operations under their control, for example, all contractors or the public.

Duties of employees

5 General duties on employees:

(a) to exercise reasonable care for the health and safety of themselves or others who may be affected by their acts or omissions at work

(b) to co-operate with the Contractor, as far as may be necessary, to enable them (the Contractor) to carry out their legal duties in health and safety matters.

The Management of Health and Safety at Work

6 These Regulations place a requirement on every Contractor to make a suitable and sufficient assessment of every work activity in order to identify any hazard that employees or any other person might encounter as a result of the work being carried out.

7 Once those hazards have been identified, it is then the Contractor's duty to put control measures into place in order either to eliminate the hazard or, where this is not possible, to reduce the risks of injury or ill health arising from the hazards, as far as is reasonably practicable.

8 The Contractor must provide employees with comprehensible and relevant information on any risks that exist in the workplace and on any control measures that are in place to reduce those risks.

9 Employees, in turn, have a duty to tell their Contractor of any work situation which they believe presents a risk to themselves or to others, or of any matter which affects the health and safety of themselves or other persons.

10 Also of importance with regard to lone working are the requirements on the Contractor to:

(a) establish contacts with external services, for example the emergency services

(b) provide employees with comprehensible and relevant information on any risks that exist in the workplace and on any control measures that are in place to reduce those risks

(c) assess employees' capabilities when allocating work to individuals

(d) provide adequate training for anyone involved in any aspect of lone working (including rescue).

11 Arising out of the risk assessment for lone working the Contractor may decide that there is a need to:

(a) develop a method statement for each job

(b) implement a Permit to Work system, encompassing or supplemented by a Permit to Enter.

1.5.2.4 Practical considerations

1 Before the job starts, the following factors must be considered as part of assessing the risks of carrying out lone working.

The job

2 Job factors that must be taken into account when considering whether the risks of lone working are acceptable include the following:

(a) Does the place of work and the job to be carried out present more unacceptable risks to the health and safety of a lone worker than it would for, say, a gang of two workers?

(b) Can the lone worker enter and exit from the place of work safely, including exiting quickly and safely in an emergency?

(c) Can all equipment, plant and substances used be safely handled by one person?

(d) Are there barriers to effective communication with the lone worker?

(e) If something goes wrong, is a prompt and effective rescue a realistic possibility?

3 There may be circumstances in which unplanned lone working takes place when, for example, one person decides to separate from workmates to investigate a fault or sort out a problem. Depending on the working environment, these situations have the potential to put the health or safety of the 'lone worker' at significant risk. The findings of the risk assessment should indicate the potential risks arising from one member of a team becoming separated from workmates.

4 If such a situation could arise, managers and supervisors must ensure that clear instructions are given about the need for 'team members to stick together'.

The person

5 The suitability of the person who will undertake the work has to be considered when deciding whether lone working is safe. Questions to be asked and satisfactorily answered as part of the risk assessment include the following.

(a) Given that there will be no direct supervision, has the person who will carry out the job received adequate training and instruction to do it safely?

(b) Does the person have sufficient experience to be able to recognise an unsafe situation developing which necessitates leaving the place of work?

(c) Does the person know how to inform others, and who to inform if an unsafe situation develops?

(d) Considering both routine work and a possible emergency situation, does the person have a medical condition that might make them unsuitable for lone working?

(e) Does the person require and possess a particular level of physical fitness to carry out the work?

(f) Is a young female or non-English speaking worker at a greater level of risk?

The risks

6 A wide range of work activities can be classified as lone working, not all of which present unacceptable risks. For example, it could be argued that a lone worker travelling to an otherwise unoccupied part of a highway construction site, in a serviceable and suitable vehicle, is at far less risk than a lone worker entering an underground chamber after normal working hours.

7 The findings of a thorough assessment of the risks arising out of proposed lone working will indicate whether it is safe to proceed.

8 An assessment of the risks arising from carrying out work which involves the following common construction activities might indicate that lone working is not acceptable:

(a) working at height

(b) working in any area which could become a confined space

(c) working in narrow, deep excavations, whether classified as a confined space or not

(d) working with, or close to, exposed live electrical cables or fittings

(e) working with, or close to, other sources of other potentially hazardous energy

(f) using any substance that could deplete the level of oxygen or otherwise result in reduced awareness or loss of consciousness

(g) any hot-works

(h) disturbance of sludge in any underground chamber, pipe etc.

(i) entering ductwork

(j) working over or near to water or other fluids in which a person could drown

(k) the operation of any equipment such as power saws, misuse of which could lead to severe bleeding

(l) the operation of any engine-driven equipment that emits toxic exhaust fumes

(m) the operation of construction plant.

Note: *The above list is not exhaustive.*

Control measures

9 The health and safety of anyone who is working alone should not be put at a higher level of risk than if working with other people.

10 This may require that extra risk-control measures are taken, for example:

(a) ensuring that the lone worker is competent to carry out the work

(b) supplementing the risk assessment with:

(i) a permit to work which clearly defines the limits of the work allowed and the time within which it must be completed, and/or

(ii) a method statement

(c) providing the lone worker with a means of communication

(d) implementing a 'check-in' system whereby either:

(i) the lone worker contacts another person at prearranged intervals, the frequency of checking-in depending upon the urgency of response if the lone worker fails to 'check-in'; or

(ii) the reverse of the above system in which someone such as a supervisor periodically contacts the lone worker

(e) supplying the lone worker with a manual alarm system or one which operates automatically by the absence of activity (see below)

(f) providing the lone worker with a 'travelling' first-aid kit and possibly (if indicated by the findings of the risk assessment) first-aid training

(g) establishing a trained rescue person or team and practising the rescue procedure.

Alarm systems

11 Automatic alarms, also known as 'man down' alarms, have been in use in hazardous industries such as petrochemicals for some time. This equipment also has its uses for lone workers in the construction industry. Although the alarm can be triggered manually by a lone worker who is in distress or danger, depending on the type, they can be automatically triggered by:

(a) a lack of motion for a pre-set period of time

(b) a tilt switch which typically operates after a short delay if the unit is tilted beyond 45° from the vertical.

12 Of course, if such a system is in use, it is essential that:

(a) the 'base station' where the alarm system is received is staffed continually whilst lone working is taking place

(b) the exact location of the lone worker is known

(c) a prompt rescue can be initiated by a trained rescue person or team, depending upon the circumstances.

Construction Site Safety
1.5.2 Appendix

Lone working checklist

1 Have the risks of lone working been assessed?

2 Do the findings of the risk assessment show:

(a) that there are any particularly hazardous aspects of the job that might make it unsafe for lone working?

(b) that lone working significantly increases the risks to the person doing the job?

(c) that particular skills, knowledge, training or instruction are necessary?

3 Will the lone worker be able to cope with all the physical aspects of the Job without assistance?

4 Do the physical characteristics of the place of work make it suitable for lone working and emergency evacuation?

5 Are the levels of risk acceptable?

6 Is a permit to work necessary?

7 Is a method statement necessary?

8 Can the person selected for lone working follow a method statement when unsupervised?

9 Is the lone worker competent to work without direct supervision?

10 Will the lone worker be able to recognise an unsafe situation developing?

11 If so, will they know what to do?

12 Is a rescue plan necessary?

13 Has sufficient instruction and training been provided?

(a) Will an effective method of communication between the lone worker and a supervisor/manager be established?

14 Is an automatic 'man down' alarm system necessary and if so:

(a) where will the base station be located?

(b) who will staff it whilst lone working is in progress?

15 Is it necessary to establish a rescue plan and team?

16 Is a 'check-in' system required?

17 Does the lone worker have a medical condition that might increase the risks to their health or safety?

18 Does the lone worker require a 'travelling' first-aid kit and first-aid training?

19 Is there a need to isolate electrical supplies or other sources of energy?

Construction Site Safety

1.5.3 Electrical Safety on Site

1.5.3.1 Key points

1 Electricity can be a killer; you cannot see it and may not know that an item of equipment is live until you touch it.

2 Buried cables, and those inside partition walls or other 'hidden places', are just waiting for the unwary to accidentally damage the cable and cause themselves serious injury or even death.

3 The electrical distribution systems found on site tend to operate in a harsh environment and must be treated with care and respect.

4 No-one other than a qualified electrician must alter the site distribution system.

5 Ideally, apart from mains-powered equipment in site offices, all other powered equipment such as electrical hand tools will run off a 110 volt supply.

6 The safest electrically powered tools and equipment are those that run off batteries.

7 Working on or near to live, exposed conductors poses obvious dangers. Competence is required and such work is usually carried out under a Permit to Work.

Note: Section 9 of the QCS covers mechanical/electrical equipment and Section 21 covers electrical works.

1.5.3.2 Introduction

1 Unlike most other hazards which can be seen, felt or heard there is no advance warning of danger from electricity; and **electricity can kill.**

2 Electricity and electrical installations on construction sites must always be treated with the utmost care and be under the control and supervision of experienced competent persons. Hazards arise through faulty installations, lack of maintenance and abuse of equipment.

3 Electric shock is a major hazard. The severity of the shock will depend on the level of electric current, and the duration of the contact.

4 At low levels of current, about 1 milliamp, the effect may be only an unpleasant tingle but enough to cause loss of balance or a fall. An electrical current of about 10 milliamps can cause muscular spasm and loss of control. Higher levels of electric current of 50 milliamps or above, for a period of about one second, can cause fibrillation of the heart which can be lethal.

5 Electric shock also causes burning of the skin at the points of contact.

6 *1 milliamp is a one thousandth part of an amp.*

7 **Fuses cannot be regarded as adequate protection against electric shock.** A fuse is intended only to protect equipment from damage. They are commonly rated at 3, 5, 10 or 13 amps for domestic and normal business use.

1.5.3.3 Causes of electric shock

1 Contact between a live conductor and earth.

2 Contact between phase and neutral conductors (as the body is likely to have less electrical resistance than any load).

3 The majority of electrical accidents happen because people are working on or close to equipment which is either:

(a) assumed to be dead but is, in fact, live

(b) known to be live, but workers have not received adequate training, lack adequate equipment or have not taken adequate precautions.

4 It cannot be emphasised too strongly that the installation, maintenance and repair of electrical services must only be carried out by a competent, qualified electrician.

5 Electric shock is not the only hazard. The very high temperature that results from electric arcing can produce severe and deep-seated burns. An electric arc also produces intense ultraviolet radiation which can damage the eyes (arc eye).

6 An electrical short circuit or the use of unstable or badly maintained equipment can ignite flammable materials, resulting in a fire or explosion.

1.5.3.4 Legislative requirements

The Management of Health and Safety at Work

1 These Regulations place a requirement on every Contractor to make a suitable and sufficient assessment of every work activity to identify any hazard that employees or any other person might encounter as a result of the work being carried out.

2 Once those hazards have been identified, it is - then the Contractor's duty to put control measures into place, to either eliminate the hazards or, where this is not possible, reduce the risk of injury or ill health resulting from those hazards, as far as is reasonably practicable.

3 The Contractor must provide employees with comprehensible and relevant information on any risks that exist in the workplace and of any control measures that are in place to reduce those risks.

4 Employees, in turn, have a duty under these Regulations to tell their Contractor of any work situation which presents a risk to the health and safety of themselves or to any other person who may be affected.

5 In the context of this module, the risk assessment should include consideration of:

(a) the possibility of anyone coming into contact with live electrical equipment at a dangerous voltage

(b) the control measures that must be put in place to ensure that no one is injured by coming into contact with live electrical equipment at a dangerous voltage, for example a Permit to Work system

(c) the training and competence of any person who may have to work in the vicinity of live electrical supplies.

The Provision and Use of Work Equipment

6 These Regulations require that a Contractor only supplies work equipment that is correct and suitable for the job and ensures that the equipment is maintained and kept in good working order.

7 Where the use of the equipment involves a specific risk to the health and safety of employees, the use of the equipment must be restricted to competent and specified workers.

8 Furthermore, these Regulations require that:

(a) all work equipment has adequate controls, emergency controls and where necessary, a control system, to enable it to be used safely

(b) each item of work equipment can be effectively isolated from all sources of energy

(c) the Contractor provides employees with adequate information, instruction, training and supervision to be able to carry out any work task safely and without risk to their health.

Construction (Design and Management) CDM

9 The hazard of exposure to live electrical conductors can in many cases be eliminated, or the residual risks reduced, by careful attention to design and planning aspects before construction work starts. Any residual risks must be controlled by good management and safe working practices during construction.

10 These Regulations place health and safety responsibilities on the client, designers, contractor and provide a framework for the management of risks, including electrical risks.

11 The client must ensure that all designers and all contractors appointed by the client, or likely to be, are promptly provided with all relevant information that the client has in relation to the health and safety risks arising from the project.

12 In the context of this section, this information could cover, for example, the existence of buried electrical services or live electrical circuits in a building that is about to undergo renovation.

13 The client must ensure that the Engineer promptly supplies the relevant information to the contractor and all designers.

14 Given the hazardous nature of electricity, it is difficult to see how identifying the location of live electrical services could be anything other than relevant.

15 These Regulations require that where there is a danger from electrical power cables they must be:

(a) suitably located (positioned) to prevent danger, periodically checked and clearly indicated by signs

(b) directed away from the area of risk, **or**

(c) made dead and where necessary earthed, **or**

(d) where neither of the above two options are *'reasonably practicable',* erect suitable warning notices **and:**

(i) barriers suitable to exclude work equipment which is not needed, **or**

(ii) suspended protection if vehicles need to pass below the cable, **or**

(iii) in either case other equally effective measures

(e) construction work that is liable to create a risk to health or safety from underground services must not commence unless all *reasonably practicable* steps have been taken to avoid damaging or disturbing them.

Electricity at Work

16 These Regulations apply to all situations involving electricity, at any place of work, and place legal obligations on both Contractors and employees.

17 The main points of these Regulations are, briefly, as follows.

(a) All systems shall be of such a construction so as to prevent, so far as is reasonably practicable, any danger.

(b) All work activity on or near a system, including operation, use or maintenance, shall be carried out, so far as it is reasonably practicable, so as not to give rise to any danger.

(c) Any equipment provided to protect people while they are at work on, or near, any electrical equipment shall be suitable for use and properly maintained.

Notes:

(i) (i) 'System' includes every part of the system or installation, all conductors and electrical equipment, whether the system is electrically alive or dead.

(ii) (ii) 'Electrical equipment' includes everything from overhead to underground cables with thousands of volts, right down to 6 volt circuits and even battery-powered hand lamps. The spark from the switch on a hand lamp could be a source of danger in an explosive atmosphere.

(iii) (iii) 'Danger' is the risk of injury to any person.

(iv) (iv) 'Injury' means death or any injury caused by electricity. This covers electric shock, electric burns, fires, arcing or explosions caused by electricity.

18 The strength and capability of electrical equipment must not be exceeded in such a way as may give rise to any danger.

19 All electrical equipment which may be exposed to the following must be constructed, or protected to prevent, so far as reasonably practicable, any danger arising from:

(a) mechanical damage

(b) the effects of weather, temperature and so on

(c) wet, dirty or corrosive conditions

(d) flammable or explosive dusts or gases.

Note: *'Technical knowledge and experience' means that the person must be competent to do their job. To be considered competent a person needs:*

(e) adequate knowledge of electricity

(f) good experience of electrical work

(g) an understanding of the system being worked on

(h) practical experience of that type of system

(i) knowledge of the hazards that might arise and the precautions that need to be taken

(j) the ability to immediately recognise unsafe situations.

Electricity supply

20 The supply of electricity on construction sites will normally be provided by one or both of the following:

(a) A public supply from the local electricity company.

(b) A site generator, where public supply is not practicable or is uneconomic.

Public supply

21 A public supply of electricity being provided depends on the following:

(a) written application being made to the local electricity company, as soon as possible at the planning stage

(b) the name, address, and telephone number of the main contractor and developer, giving the full site address and a location plan

(c) details of the maximum demand load (in kilowatts) which is likely to be required during construction

(d) details of the maximum final demand load (in kilowatts) which will be required when the job is complete

(e) dates when the supply is needed

(f) a discussion with electricity company staff to determine the necessary precautions to avoid damage or hazards from any existing overhead or underground cables

(g) the establishment of supply points (where incoming cables will terminate), switch gear, metering equipment and requirements for earthing.

Generators

22 Generators (even if for stand-by purposes) may be required, and will be powered by petrol or diesel engines. Attention should be given to the siting of such equipment in order to minimise pollution caused by noise and fumes.

23 Any private generating plant must be installed in accordance with BS 7375. You are advised to seek advice from the local electricity company.

24 If the generator will produce over 55 volts AC, it must be effectively earthed. A competent person should test the effectiveness of the earth.

25 The principle of low voltages and their advantages should be considered further where portable generators are used on site.

26 Not all portable generators available for use on site have the 110 voltage output centre tapped to earth. This is particularly true of generators which have dual voltage selectable. This is important as the whole concept of using 110 volts on site is that by centre tapping to earth, the maximum voltage to which anyone is exposed is only 55 volts. Most people can survive a shock of 55 volts. If the supply is not centre tapped to earth, anyone receiving a shock will be exposed to the full 110 volts.

27 The metal framing of the generating set should be bonded to the metalwork of the site distribution system, where there is one.

28 The use of generators in excess of 10 kVA may require advice from a specialist electrical contractor.

29 Overhead power lines

30 Generally, electricity supplies above 33,000 volts are routed overhead. Supplies below this voltage may be either overhead or underground.

31 Overhead lines are normally uninsulated and can be lethal if contact, or near contact, is made. Electric arcs may jump a considerable distance. Care should be taken when dumping, tipping waste, regrading, landscaping, or when in planned or unplanned storage areas, not to reduce these minimum clearances.

Working near overhead power lines

32 The local electricity company must be consulted before any work starts and a safe system of work must be devised and implemented.

33 Other suppliers may also need to be consulted, for example, Qatar General Electricity & Water

Corporation and other electricity companies.

34 For some jobs, it may be necessary for the electricity supplier to isolate or re-route overhead cables to enable the work to proceed.

35 Practical steps that can be taken to prevent danger from any live electrical cable or apparatus include the placing of substantial and highly visible barriers.

36 If access is only required from one side of a power line, then a barrier, on that side only, will suffice. If the overhead line crosses the site, barriers will be required on both sides of it. If there is a danger to people carrying metal scaffold poles, ladders or other conducting objects, the barrier should exclude both people and mobile plant.

37 Any ground level barriers should consist of either:

(a) a stout post and rail fence, or

(b) a tension wire fence, earthed at both ends, with flags on the wire. The fence is earthed in consultation with the electricity company, or

(c) large steel drums (for example 200-litre oil drums) filled with rubble or concrete, and placed at frequent intervals, or

(d) an earth bank, not less than 1 m high and marked by posts to stop vehicles, or

(e) substantial timber baulks, to act as wheel stops.

38 Fences, posts and oil drums should be made as distinctive as possible by being painted with red and white stripes. As an alternative, red and white plastic warning flags or hazard bunting should be used on wire fences.

39 There should be a general rule prohibiting the storage of materials in the area between the overhead lines and the ground-level barriers. Precautions are necessary even though work in the vicinity of the line may be of short duration.

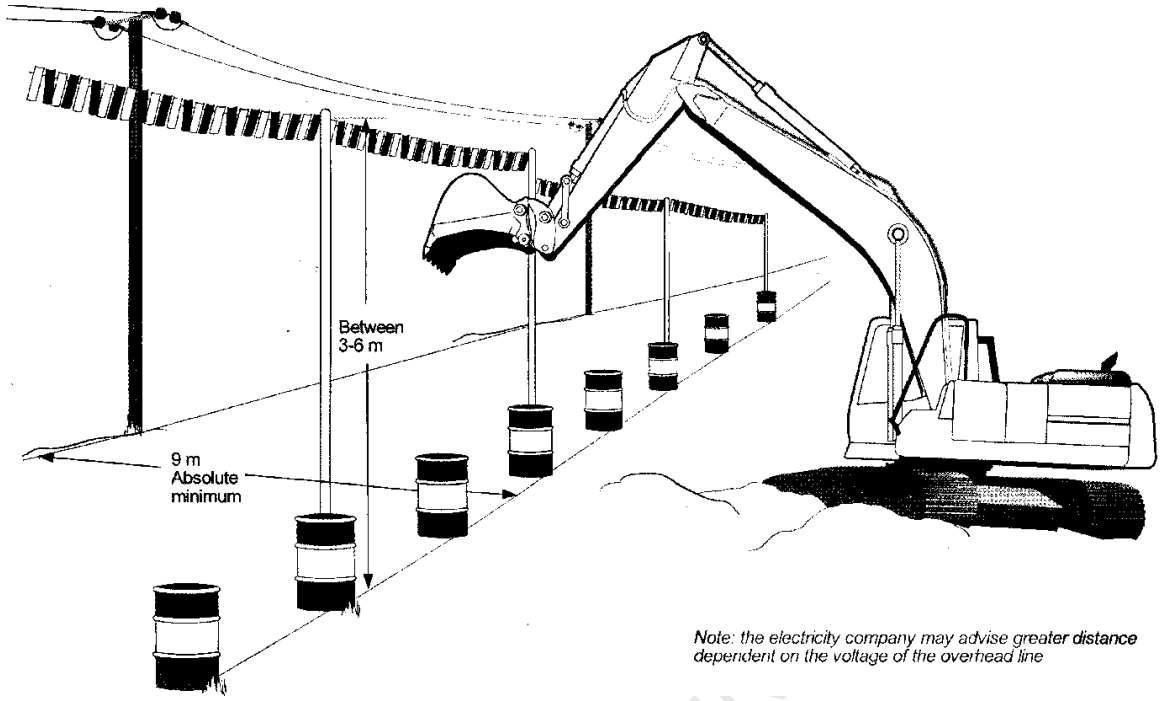
(a) Before doing any work on site, consult the local electricity company. They will normally arrange a site meeting and advise on heights, distances and other precautions.

(b) It must be assumed that all overhead lines and cables are live unless advised otherwise by the electricity company.

(c) All work should be carried out under the direct supervision of a responsible supervisor, appointed by the Contractor, who is familiar with the hazards likely to be encountered.

Working near overhead power lines

40 If mobile cranes or excavators are used, the minimum distance from the ground level barrier to the line should be 9 m if on wood or metal poles, 15 m if on pylons PLUS the length of the jib or boom.



(a) Ensure that safety precautions are developed and observed.

(b) All plant, cranes and excavators may be modified with suitable physical restraints to limit their operations, where applicable.

(c) Additional care may be needed as work proceeds because of reduced clearances.

(d) Electronic proximity warning devices may be fitted on crane jibs.

Note: *If any work takes place after dark, notices and crossbars should be illuminated. The height will be specified by the electricity company.*

41 Where it is necessary to work beneath live overhead lines, additional precautions will be required to prevent the upward movement of ladders, scaffold poles, crane jibs or excavator buckets.

Working in proximity of underground cables

42 Damage to live underground cables during excavation work is the cause of a number of accidents resulting in injuries and disruption of supplies. There have been occasions when such accidents have been fatal. The electricity company should be consulted before the commencement of any work that may result in the exposure of or damage to, underground electricity cables.

43 Technology such as ground penetrating radar has improved cable identification significantly and there is now very little excuse for hitting underground cables.

44 It is essential that all those involved, particularly machine operators, are aware of the hazards.

45 Before any excavation work starts:

(a) ensure that employees have proper and safe work procedures and are working under adequate supervision

(b) check with the electricity company that it is safe to start work

(c) obtain advice on the location and ownership of any underground electricity cables

(d) check plans to establish cable routes, as well as their depth and voltage

(e) use cable location devices where necessary and mark cable routes

(f) users need to be trained to use cable avoidance tools (CAT) effectively

(g) CAT will usually only locate energised cables and so a signal generator may have to be used in conjunction with the CAT to find the cable (CAT and genny as it is known).

46 During excavation:

(a) regard all buried cables as live. Do not assume that pot-ended cables are dead or disused

(b) dig by hand when nearing the assumed line of the cable

(c) do not use excavators and power tools within 0.5 m of the indicated line of the cable

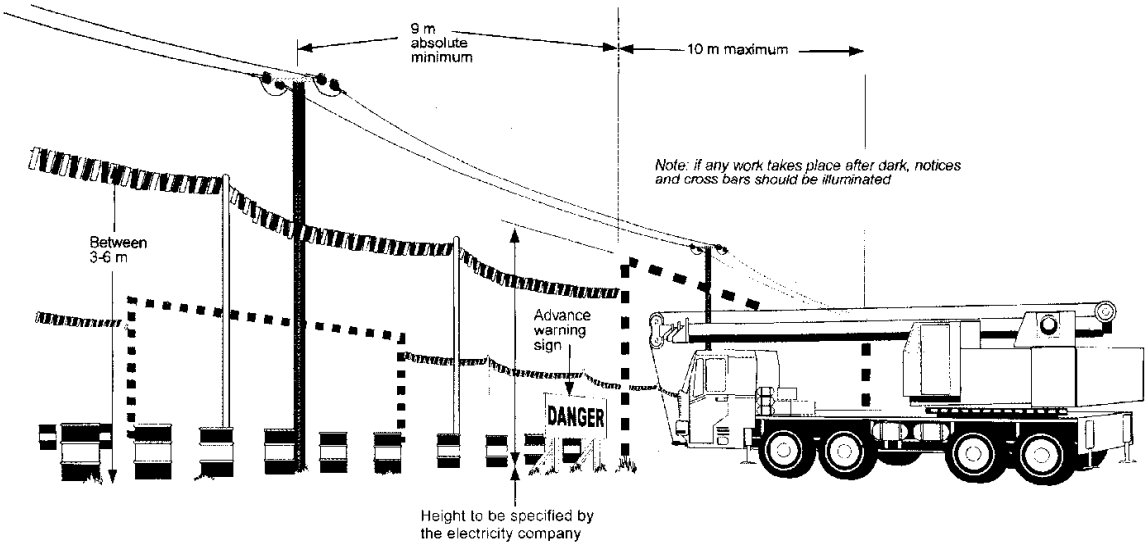
(d) if hand digging is not an option, the service must be isolated

(e) ensure exposed cables are supported and protected against damage. They should not be used as hand and footholds

(f) consult the local electricity company (Qatar General Electricity & Water Corporation) in all cases of doubt.

47 Many incidents occur where people are asked to hand dig through concrete, tarmac and other compressed surfaces, and have to resort to using bars and picks. Consequently, cables are hit and penetrated. Alternatively, they persuade the excavator driver to dig a bit closer to the cable to reduce the amount of hand digging that they have to do. It is important to understand and be aware of situations where these so called 'human factors' may make an incident more likely.

Traffic passing beneath overhead power lines



Site distribution

48 As a first general guide, all wiring should conform to BS 7671: Requirements for Electrical Installation, even though much of it will be temporary. Makeshift arrangements cause accidents and must be prohibited.

49 All switch gear should be freely accessible and capable of being locked in the 'off position.

50 **Wherever possible a reduced voltage system should be used.**

51 Site offices and other accommodation should be a standard installation to the current BS 7671: Requirements for Electrical Installation.

Distribution equipment

52 Electrical equipment must be manufactured to a standard which prevents, for example, the ingress of fingers, tools, dust or moisture as appropriate, depending upon the nature of the hazard. This is particularly important where electrical distribution equipment is to be sited outdoors, where the ingress of water and to a lesser extent, dust could be a problem.

53 Internationally, such equipment is assigned an IP (ingress protection) number. For example, equipment manufactured to:

(a) **IP 32 -** is protected against the ingress of solid objects over 2.5 mm, for example tools, and against the ingress of direct sprays of water up to 15° from the vertical

(b) **IP 54 -** is protected against the ingress of dust (no harmful deposits) and low pressure jets of water (limited ingress).

54 Electrical distribution equipment obtained from reputable suppliers or hire companies will conform to the necessary British or International standards.

Site accommodation

55 Site offices and welfare facilities are the only locations where electrical equipment that runs off a 230 volt supply should be in use. The electrical supply panel for such facilities must incorporate a residual current device (RCD) in each circuit.

56 The correct operation of each RCD must be confirmed weekly by operating the 'TEST' button.

57 The incoming electrical supply to site accommodation must be properly designed and be installed and commissioned by competent electrical contractors.

58 All portable electrical equipment must be electrical safety (PAT tested) at appropriate intervals as decided by a competent person. This includes:

(a) common types of office equipment, such as fax machines and photocopiers

(b) 'kitchen-type equipment', such as kettles, microwave ovens, and so on.

(c) small items, such as chargers for site radios and battery-powered tools.

59 All units for site use should comply with BS 4363 and installations with BS 7375. Plugs, sockets and couplers must conform to EN 60309-2.

60 BS 4363 recommends use of the following units:

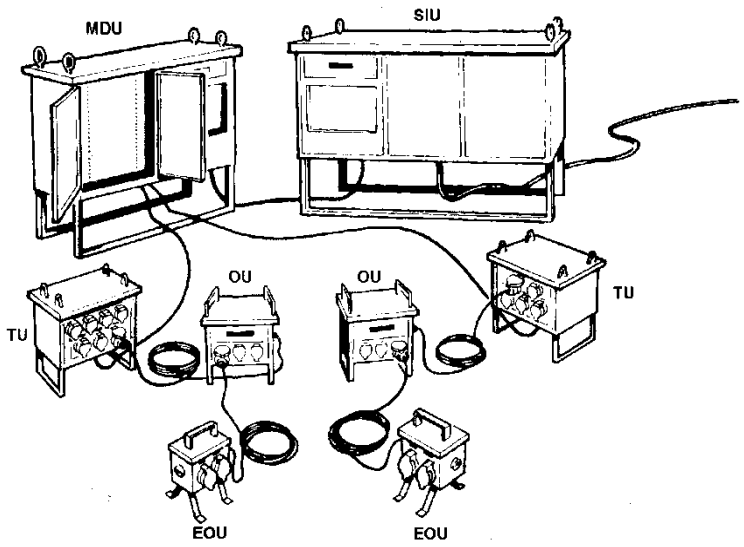
Supply incoming unit (SIU)

61 Ratings up to 300 amps per phase. These units include main switch gear and metering equipment.

Mains distribution unit (MDU)

62 For the control and distribution of electricity on site. 415 volt three-phase, 230 volt single-phase AC.

63 A combined supply incoming and distribution unit (SIDU) may be used in some installations.



BS 4363 units

Transformer units (TU)

64 TU 1 single-phase 230 volts - 110 volts TU 3 three-phase 415 volts - 110 volts

65 Transformer units are available with different outlet ratings, i.e. 16, 32 or 60 amps. Some - units have socket outlets switched through miniature circuit-breakers for added protection.

66 Such transformer units can be used for portable tools and plant, and general floor lighting.

Outlet units (OU)

(a) 110 volt socket outlet units

(b) 16 or 32 amp

67 Such outlet units can be used for portable tools, floodlighting and extension outlets. They are not usually protected by circuit-breakers.

Extension outlet units (EOU)

(a) 110 volt socket outlet

(b) 16 amp

68 Such units can be used for portable tools, local lighting and hand lamps. They are not usually protected by circuit-breakers.

Markings

69 All supply, distribution and transformer units should be marked with the warning sign shown below from BS 5378 Safety signs and colours.

70 A supplementary sign with the word DANGER, and indicating the highest voltage likely to be present, should be placed below the warning sign.

Earthing

71 All metal parts of the distribution systems and fixed appliances not carrying a current must be effectively earthed in accordance with BS 7430 Code of Practice for Earthing, to either:

(a) the metallic sheath and armouring of the incoming supply cable

(b) the earthed terminal supplied by the supply authority

(c) a separate earth electrode system.

72 Periodic maintenance, inspection and testing is essential.

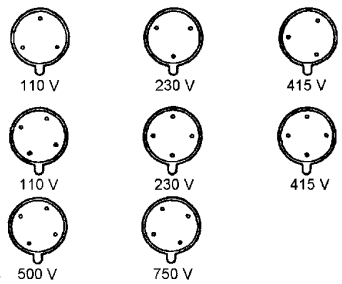
73 Earthing via water pipes or gas pipes is not permitted.

74 Monitored earthing systems are recommended for all transportable plant operating at any voltage above 110 volts and supplied with flexible cables. In these systems, a very low voltage current circulates continuously in the earthing circuit. If this circuit is broken or interrupted, the supply to the plant is automatically cut off until the earth path is made effective.

Plugs, socket outlets and couplers

75 Only components to EN 60309-2 should be used. This covers both single and three-phase supplies and is intended to prevent plugs designed for one voltage being connected to sockets of another. This is achieved by different positions of the key-way in plug and socket.

Examples



76 Accessories should be marked with the maximum rated operating voltage and current. Colour coding may sometimes be used.

Operating voltage (AC) at 50/60 Hz	Colour
25	Violet
50	White
110-130	Yellow
220-230	Blue
318-415	Red Black
500-750	

1.5.3.5 Cables

1 In all site offices, workshops, huts and similar premises, wiring, which is of permanent nature, should comply with BS 7671: Requirements for Electrical Installation.

Changes to electrical wiring colours

2 In order to bring about a complete standardisation Internationally, changes to cable core colours were introduced and have been effective since 1 April 2004. These changes were introduced by an amendment to BS 7671: Requirements for Electrical Installation and will affect all single-and three-phase circuit cables.

3 The new core colours are:

Neutral Blue (previously black)
Earth will remain Green/Yellow
Phase 1 Brown (previously red)
Phase 2 Black (previously yellow)
Phase 3 Grey (previously blue)

4 Many cables and flexes in the new colours are already in use, but this recent change further emphasises the need to use competent electricians for all cabling and wiring work, if electrical accidents are to be avoided.

5 More information on the changes can be found in a promotional leaflet that can be accessed at www.iee.org/publish/wireregs/cablecol.cfm

Cables used for site distribution

(a) Cables that carry more than 65 volts (with respect to earth) should have a continuous armour or sheath, which is effectively earthed. (This requirement does not apply to arc welding processes.)

(b) Where trailing cables are used, sheathing must be earthed in addition to the normal earth conductor.

6 All cables should have an overall protective sheathing. The three most common types in use are:

(a) tough rubber sheathing (TRS), resistant to wear and abrasion. Not used near solvents or oils

(b) polyvinyl chloride (PVC). For site office and permanent work. Not suitable for outside work at low temperature

(c) polychloroprene (PCP). This is the best all round type.

Buried cables

7 All buried cables should be:

(a) at least 0.5 m below ground

(b) protected with tiles or covers or placed in a duct

(c) in a trench marked to indicate their route.

Cables on the ground

8 The use of cables laid on the ground is dependent on the nature of work being carried out, and should be:

(a) only permitted for short periods

(b) provided with additional protection, such as a reinforced sleeve

(c) clearly marked, so as not to constitute a tripping hazard.

Suspended cables

9 Suspended cables are permissible on condition that:

(a) there is no tension or strain on connections

(b) they are adequately marked for protection

(c) they are supported on proper hooks, not nails

(d) spans over 3 m are supported by catenary wires on poles

(e) they are at a minimum height of 5.2 m above ground.

1.5.3.6 Installations

1 Installations should be in accordance with plans drawn up by a competent person.

2 Any work or alterations to the installation may only be undertaken by a competent person.

3 The installation should conform with BS 7671: Requirements for Electrical Installation, and BS 7375 Code of Practice for the distribution of electricity on construction and building sites.

General

4 All installations should comply with these Regulations as for permanent installations, with good workmanship and the use of correct materials.

Testing

5 Every installation should be tested in accordance with BS 7671: Requirements for Electrical Installation, before use on site, at three-monthly intervals or shorter periods if necessary.

(a) The record of any testing and inspections should be made by a responsible person on the appropriate certificates.

(b) Testing and inspections must include:

(i) a visual inspection

(ii) the continuity of final circuit conductors

(iii) the continuity of protective conductors

(iv) the earth electrode resistance

(v) the insulation resistance

(vi) polarity

(vii) the earth fault loop impedance

(viii) the correct operation of residual current devices and fault voltage operated protective devices.

6 Weekly inspections should be made of the whole system, including all portable electric tools. Records should also be kept of all these inspections.

7 Annual portable appliance testing of electrical equipment used in offices is recommended - especially for items with heavy usage, for example, kettles, microwaves, photocopiers.

Power requirements

8 The calculation for power requirements should be left to an experienced person or to the electricity supply company.

9 To enable the total site requirements to be established, a site demand table listing items of plant, equipment and general site requirements should be completed. (See Appendix 4. This appendix also contains a guide to voltages required for typical plant.)

10 When calculating the demand, it is permissible to allow a diversity factor (assuming not all appliances will be in use at the same time), and a figure of not more than 50% is generally acceptable. Care should be taken to ensure that items such as lighting and heating remain at their full rated value, because heaters used in huts and drying rooms, or for water and cooking apparatus, tend to be left on.

Work on site

11 The activities of contractors and others installing electrical equipment, lifts, heating, ventilation, and so on, must be carefully monitored to ensure that they do not jeopardise electrical safety or leave an installation in a dangerous condition.

12 Particular care is needed in respect of any alterations and extensions to existing installations, especially in the identification of circuits.

Use of mains powered equipment

13 Wherever possible, battery-powered or 110 volt powered equipment should be used for reasons of electrical safety. However, on rare occasions, it may be necessary to use mains (230 volt) operated equipment on site, possibly because 110 volt variants are not available. Electrical equipment used in site offices will invariably be mains operated. As previously stated, the use of low voltage equipment is preferred due to the potentially deadly nature of 230 volt equipment in the event of a fault.

14 Where the use of mains powered equipment is inevitable, additional safety precautions must be taken. The supply must be protected by the use of a residual current device (RCD).

Residual current devices

15 Under fault conditions, these devices detect an imbalance in the current in the circuit and disconnect the supply before the person at risk can receive a potentially fatal electric shock.

16 There are two types of RCD:

(a) Those that are fitted as part of an electrical distribution system and, for example, are found within the supply panel for a site office. This type of RCD can only be installed by

a competent electrician.

(b) Plug-in RCDs (commonly known as 'power-breakers') that are plugged into a mains supply socket and which have an in-built socket into which an individual mains powered electrical tool or other appliance is plugged.

17 Both types of RCD have a test button that simulates a fault and operates the device. The correct operation of the test button should be checked daily.

18 It should be noted that:

(a) RCDs do not reduce current flow or the voltage, only the time that the current flows (about 30 milliseconds), and thereby the severity of the shock

(b) RCDs are delicate devices and should be treated with care. Advice on suitable RCDs for construction sites should be sought from manufacturers or suppliers

(c) the use of a RCD does not give a 100% guarantee of safety

(d) the device does not have a fail-safe feature and will not give an indication if it is faulty.

19 It cannot be stressed strongly enough that every attempt should be made to use battery powered tools or 110 volt powered tools where practical and possible. The use of mains powered equipment, apart from situations like site offices, should be avoided wherever possible.

Portable and hand-held electric tools

20 All portable and hand-held electric tools should be selected according to the principles of risk control. For example, where there is a very high risk of electric shock due to site conditions, the use of pneumatic equipment will eliminate the risk.

Reduced voltage systems for use with portable and hand-held electric tools

21 A reduced low voltage system, i.e. virtually safe, which is recommended as the safest type of system for building and construction sites, is one where the phase to earth voltage does not exceed:

(a) 55 volts to earth in the case of a single-phase centre tapped to earth supply

(b) 63.5 volts to earth in the case of a three-phase neutral point earthed supply.

22 The maximum recommended voltage to earth for a reduced low voltage system is stated as 65 volts. Both of these systems will offer a phase to phase voltage of 110 volts for supplying power tools on site.

23 A reduced low voltage system will eliminate the risk of death from a phase to earth shock in the majority of situations. Other safer systems, for example, compressed air or battery power, should be considered when working in confined spaces or damp conditions.

Outputs of 230 volts or 110 volts

24 110 volt systems that are not centre tapped or neutral point earthed can be just as lethal as a 230 volt system in phase to earth faults. In certain situations, even reduced low voltages are not safe.

25 The maximum voltage for portable and hand-held electric tools should be 110 volt centre tapped to earth. Flexible cables should be kept as short as possible, frequently checked for damage and properly repaired as necessary.

1.5.3.7 Maintenance and testing

1 An appropriate maintenance schedule should be established for all portable electrical equipment and should include user checks, regular visual inspections, and combined inspection and electrical testing as necessary. It is recommended that 110 volt portable and hand-held tools should have the following inspection and testing facilities:

(a) User check Weekly

(b) Visual inspection Monthly

(c) Combined inspection and test before first use and thereafter three-monthly.

2 Insulating tape by itself is neither a legal nor satisfactory repair, either on conductors or the cable sheath.

3 Long leads which trail over the ground or floor and so create a tripping hazard must be avoided. Care must be taken in the use of cable drums or reels, as internal cable terminations may become loose. They can overheat and cause a fire. Drums and reels should be inspected regularly for signs of damage or wear.

4 All insulated or double-insulated tools manufactured in accordance with BS 2754, and with the recognised symbol attached, give extra protection against the danger of electric shock.

1.5.3.8 Fuses

1 Fuses can blow through ageing as the internal fuse wire sags and eventually breaks. However, fuses usually blow for other reasons; usually due to a fault in a piece of equipment. The reason should be investigated and rectified before a fuse is replaced. If a second fuse blows immediately the power is switched on, the equipment is defective and no further attempt should be made to use it.

2 The equipment should be quarantined if it is repairable or otherwise safely disposed of and replaced.

3 Nails, screws, wire or silver paper must never be used to replace fuses.

4 It is very dangerous.

1.5.3.9 Lighting

1 Lighting is needed for safety, productivity and security.

2 The colour and nature of any artificial lighting must not adversely affect, or change the perception of the colour of any safety sign.

3 Where the failure of the primary artificial lighting would create a risk to health or safety of the person(s) at work, secondary lighting must be provided.

4 There are many different types of lighting, each with its own most suitable application. Advice should be sought in order to obtain the best light for a particular place, considering such factors as colour rendition, humidity, flammable or explosive atmosphere.

Handlamps

5 Handlamps must never be run from a 230 volt supply. They should be used on 110 volts or lower, and preferably from a safety extra low voltage (SELV) supply.

6 Lamps should all be insulated or double-insulated to EN 60598.

7 The use of extra low voltage hand lamps, even down to 12 volts, does not give any protection against fire or explosion in flammable or potentially explosive atmospheres if the bulb is broken. In such hazardous areas, only lamps to EN 60079-14 should be used.

8 Special care is needed in sumps and pits, where petrol, LPG fumes or other flammable gas might collect. All electrical equipment should be BASEEFA approved.

9 In confined spaces, boilers, tunnels, cramped locations or other hostile damp or humid atmospheres, lamps supplied should work at 25 volts.

Levels of illumination

10 Illumination is measured in units of lumens or lux, which is the amount of light falling on one square metre.

11 Light meters are used to check levels of illumination. Illumination should be measured at the workplace, not at the light fitting.

12 There are certain factors which can affect the efficiency of lighting, such as:

(a) the amount of daylight available

(b) the cleanliness and maintenance of light fittings and reflectors

(c) reflection from walls and ceilings

(d) the distance of the light source from the workplace

(e) shadows thrown by equipment, materials, and so on.

13 When considering the level of illumination required at a workplace, it should be remembered that if the distance from the light source to the workplace is doubled, the illumination level will be reduced to one quarter (inverse square law). *For recommended levels for site lighting, see Appendix 2.*

The mounting of lights

14 Lighting should be:

(a) securely mounted at a height that will avoid damage to the lights whilst giving the required level of illumination

(b) positioned so as to prevent glare, dazzle or reflection

(c) able to change position as work proceeds

(d) adaptable, remembering that 50 to 100% more light is required for people over 40 years of age

(e) increased if necessary, because more light will be required in hazardous situations and when goggles are worn

(f) so positioned that it can be screened or shielded from reflective surfaces, on traffic routes, etc.

(g) treated as a heat source, with the possibility of burns or fire hazards, particularly with halogen lighting units.

Site lighting

15 For area lighting with floor lights or beam floodlights:

(a) all areas should receive light from at least two directions

(b) fittings should be mounted on poles; towers and high masts must be securely stayed

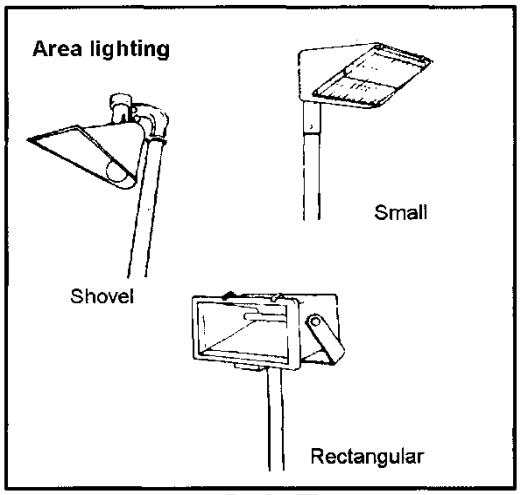
(c) fittings should usually be spaced at not more than two or three times the mounting height

(d) 230 volts is generally accepted for fixed floodlighting, mounted well above ground

(e) installations must be to BS 7375, equipment to BS 4363

(f) additional lighting should be provided in hazardous areas.

16 Dust and dirt on lights can absorb up to 20% of their output and cleaning is often cost-effective in maintaining adequate levels of lighting for both working and safety. However, there may be access issues to overcome.



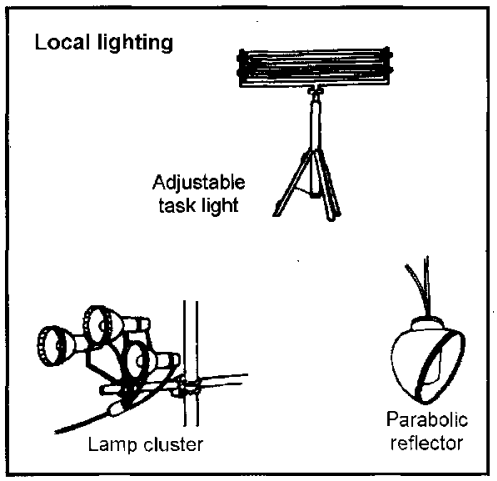
Local (task) lighting

17 This is usually of the tungsten filament type.

(a) It is used to supplement the general area lighting scheme.

(b) Small sources of light tend to produce shadows; they should be used with a diffuser or be hung in rows.

(c) Pendant fittings should be supported so as not to tension the supply cable. They should be of the festoon type only, with moulded-on lamp holders and protective guards.



(d) The common type of lighting used by operatives should be 110 volts reduced voltage.

(e) Care should be taken not to dazzle or cause a nuisance to anyone, including people outside the site boundary.

For a guide to the characteristics and types of electric lamp, see Appendix 3.

Dispersive lighting

18 This is used over working areas, walkways, ladder access and stairs.

19 Types include dispersive, cargo cluster, fluorescent trough, wall glass unit, bulkhead unit

tungsten or fluorescent.

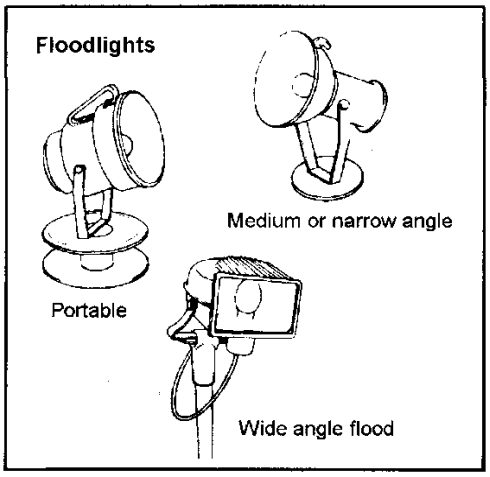
(a) Fittings should be similar to the industrial indoor type but waterproof.

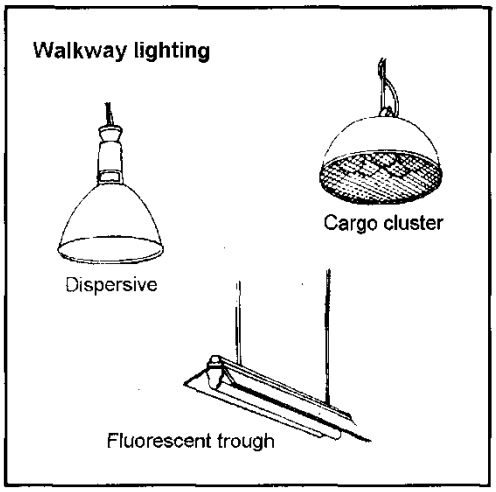
(b) They should be mounted centrally, overhead where possible.

(c) They should usually be spaced at one-and-a-half times mounted height, but the manufacturer's recommendations should be followed.

(d) They should be mounted as high as possible to give an even spread of light.

(e) Mains voltage (230 volts) should only be used where the installation is well protected and of a permanent nature. Reduced voltages should be used for regular sire work.





1.5.3.10 Permit to Work

1 Permit to Work systems are essential to ensure safe working where high-voltage electrical supplies, cables and equipment exist, particularly in installation, maintenance or construction work.

2 A Permit to Work system should form part of that 'safe system'. In the case of construction sites, Permits to Work are more commonly used whilst the site electrical distribution system is itself being worked on.

3 Permits to Work must only be issued by an appointed authorised person, using duplicate and numbered printed forms as the example shown (see *Appendix 5).* They must be signed by an authorised person and by the competent person who is to carry out (or be responsible for) the work described on the permit.

4 Most systems contain provisions for the physical locking off of switches, and the retention or display of keys or permits.

5 One copy of the permit must be retained for the duration of the work by the person to whom it is issued. Before apparatus is made live again, the permit must be returned for cancellation. At cancellation, it must be countersigned by both the holder and the authorised person.

6 The authorised person should keep a record in the job file of the issued permits and their cancellation.

7 Before work starts, the authorised person should ensure that the Permit to Work will cover the making safe from all possible sources of supply.

8 If the work is handed over from one competent person to another, the permit is to be endorsed by the authorised person and transferred to the second operative.

1.5.3.11 Dealing with electric shock emergencies

1 On a construction site, a plan should be prepared for potential emergencies, including electric shock.

2 The plan should include:

(a) posting notices in appropriate and prominent places publicising the emergency procedures

(b) training sufficient workers in the procedures to follow when treating an electric shock casualty, including first aid action

(c) instructing workers in the action to take in the event of someone receiving an electric shock. For example, switching off the electrical supply and calling the emergency services.

Construction Site Safety
1.5.3 Appendix 1

Safety checklist

Permit to Work

1 Are the instructions clear about who can grant permits and the time when a permit comes into operation or expires?

2 Who is the manager responsible for overseeing Permit to Work systems?

3 What is the procedure for co-ordinating the activities of different trades working on the same job?

4 What is the procedure for informing all contractors that a Permit to Work system exists?

5 Have all operatives been instructed and trained in safety procedures, such as Permit to Work systems, locking off and treatment for electric shock?

6 Have Permit to Work documents and procedures been checked and agreed by the Contractor and employee representatives to ensure all necessary safeguards have been provided?

7 Is the Permit to Work procedure regularly reviewed and updated?

Cables

8 Have all necessary precautions been taken where overhead lines exist close to the site?

9 Are distribution cables so positioned that they do not cause a hazard at openings, passages, ladders, stairs, and so on?

10 Have precautions been taken to ensure that cables lying on the ground have been protected from physical damage or wet conditions?

11 Have the necessary precautions been taken to ensure that cables do not hang directly from nails, which may cause insulation damage?

12 Are cables protected from the edges of sharp objects?

13 Have all possible precautions been taken to ensure that suspended cables do not carry any weight? Are they supported by rods or catenary wires?

14 Are all cables visible, with, if necessary, yellow and black or red and white plastic bunting strips attached?

15 Is there an adequate supply of extension cable for use on the site?

16 Are all junctions and repairs properly carried out by a qualified electrician?

17 Are electrical circuits used for the correct purpose (for example, lighting circuits must not be used for power tools, especially where lighting festoons are fitted with trailing leads)?

18 Are buried cables correctly protected by a 450 mm cover and cover tiles? Is the line of the cable also clearly marked?

19 Are cables capable of carrying the load required and are they adequate for their purpose?

Plugs

20 Are all industrial plugs to EN 60309-2, in good condition, not cracked or otherwise damaged?

21 Are splash-proof covers being used as necessary?

22 Are the correct plugs properly fitted to equipment?

23 Are all plugs being used suitable for the site conditions prevailing?

24 Have any plugs been forced into the wrong sockets (for example, by the removal of keys)?

25 When plugs have been fitted, have the correct connections been made, with the wire being correctly colour coded in line with British and International Standards.

26 Are cable grips being used and is the earth cable fitted with some slack, so that it is the last to be pulled out?

27 Have all possible steps been taken to ensure that there are no improvised junctions, nails, matches or silver paper, being used in place of the correct equipment?

28 Is the correct type of fuse with the proper rating fitted?

29 Have all made-up leads or extension cables been correctly assembled by a competent electrician?

Site accommodation

30 Has the incoming supply been installed by competent electrical contractors?

31 Is an RCD incorporated into each electrical circuit?

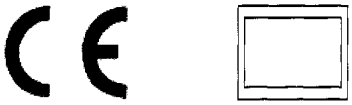
32 Is each RCD checked for correct operation on a weekly basis?

33 Is the use of 230 volt equipment restricted to office accommodation and welfare facilities?

34 Is a programme of PAT testing carried out on all portable 230 volt equipment?

Power tools

35 Are all power tools used manufactured to EN 50144-1 or double-insulated to (BS 2754) and CE marked?



36 Is the plug undamaged?

37 Are cable clamps secure?

38 Have checks been made to ensure that trailing leads are not cut or frayed?

39 Is the cable protected from excessive flexing by a rubber sleeve where the cable enters the tool?

40 Are all screws in place and secure?

41 Have the tools or machines been checked to ensure that there are no cracks or missing pieces?

42 Have checks been made to ensure that the nameplate is secure with details of:

Type Serial number

Voltage Volts AC/DC

Frequency (normally 50 HZ)

Current Amps

Speed RPM

Checklist for operatives

43 Are all machines and hand tools disconnected before any adjustment or work is carried out on them?

44 Are all machines disconnected when not in use?

45 Is the tool fitted with the correct type and size of plug?

46 Have checks been carried out to ensure that any colour codings are correct?

47 Are cables of an adequate rating for the tool that is being used?

48 Are checks carried out to ensure that no unofficial cables are being used?

49 Have instructions been issued to ensure that no makeshift repairs or maintenance are carried out?

50 Are all defects reported immediately to a competent person?

51 Is the machine kept clean and free from damp?

52 Are all connections correctly made, including waterproofing?

53 Are all operatives aware that they should never carry any tool or machine by its cable?

54 Have instructions been issued to ensure that no machine is started or stopped under load?

55 Do all portable tools have a current PAT test sticker?

Working near overhead power lines

56 Is everyone working on site aware that no work should take place:

(a) until the electricity company is consulted for advice

(b) within 9 m of overhead power lines on wood, concrete or steel poles, or

(c) within 15 m of overhead power lines on steel towers?

57 Are all personnel working close to overhead power lines aware that the distances mentioned above are measured horizontally at ground level from directly below the outermost conductor?

Note: *Electricity companies have different rules for the lateral swing of conductors in high winds and the distance of barriers may vary between companies.*

Precautions near live overhead power lines

58 Has an essential ongoing system of liaison between Contractor or contractor and the electricity company been established?

59 Where overhead power lines have not been diverted or made dead and therefore remain live, have all practicable steps been taken to provide adequate barriers.

60 Have adequate arrangements been made for the passage of tall plant at specific times where overhead power lines have been made dead?

Work beneath overhead power lines

61 On sites where work will take place below overhead power lines, have additional precautions, as necessary, been taken, as well as the provision of barriers with passageways?

62 Is all work carried out under the direct supervision of a responsible person, familiar with the hazards, after consultation with the local electricity company?

Passage beneath overhead power lines

63 If there is no work or passage of plant under overhead power lines, have barriers been positioned so as to prevent any close approach of any plant, equipment or personnel to within at least 9 m from the overhead power lines?

64 Does all plant passing under overhead lines use a defined passageway, protected by barriers?

Alterations to buildings

65 Have all electrical circuits been identified before any work is allowed to start?

66 Is there a plan to remove old wiring and equipment which is no longer required, as early as possible?

Commissioning new parts of the electrical installation

67 Has the Contractor prepared an agreed plant commissioning programme?

68 Are all the relevant contractors aware of this programme?

69 Is the programme regularly monitored?

70 Is each part of the installation that is being worked on securely isolated (lock, tag and try)?

Construction Site Safety
1.5.3 Appendix 2

Recommended levels for site lighting

Applies to both indoor and outdoor activities and relates to the value on the ground, floor or horizontal working plane. They may require adjustment according to district brightness.

Purpose	Governing factors	Design value lux
Security	Depending on the degree of risk	5-30
Movement and handling	Movement of people, machines and vehicles, handling of materials, walkways and access routes	20
Stores and stockyards	For stored goods	30
Site entrances	General access, vehicle and pedestrian	30
General work area	General rough work, site clearance	50
Craft work	Reinforcing concreting, shuttering erection, bricklaying, scaffolding	100
Fine craft work	Joinery, all work with power tools and circular saws, plastering, painting, electrical, plumbing, shopfitting, brickwork	300
Special work	Retouching paint, French polishing	500
Site huts	Rest rooms, locker rooms, toilets	150
Site offices	On desks and reference tables, general lighting of drawing office	500
Drawing offices on site	On drawing boards	750
Emergency lighting	For escape and standby purposes	5-70

Construction Site Safety
1.5.3 Appendix 3

Guide to the characteristics and types of electric lamp

Brief lamp characteristics	Tungsten filament (GLS)	Tungsten halogen (T-H)	Mercury vapour (MBF)	Fluorescent tubular (MCF)	Sodium vapour low pressure (SOX)	Sodium vapour high pressure (SON)
Wattage range	40/1500	300/2000	50/2000	6/85	35/180	250/1000
Voltage range	25/250	110/250	200/250	110/250	200/250	220/250
* Efficacy (Lumens Watt)	10-18	17-22	35-55	41-68	124-175	80-100
Colour rendering	Good	Good	Fair	Good	Poor	Good
Resistance to vibration	Poor	Fair	Good	Good	Good	Good
Normal life (hours)	1000	2000	7500	5000/7500	6000	6000
Restrictions on use or on position	None	Horizontal 4 degrees	None	None	For road lighting only	None

* The efficacy is the measure of effectiveness in converting electrical energy into usable light.

Construction Site Safety

1.5.3 Appendix 4

Electrical demand for construction sites

Plant 415 V3 phase	Portable tools 110V 1/3 phase	Site lighting 110V1 phase	Temp accommodation 230 V 1 phase

Type	kW	No	Total	Type	RW	No	Total	Location	Type	kW	Requirement	kW
Tower crane				Chasers							Lighting	
Hoist				Hammers							Heating	
Platform				Saw drills							Water heating	
hoist											Drying	
Compressor				Sanders							Cooking	
Pump 'A'				Vibrators							Power	
Pump 'B'				Air blowers							Printing	
Saw bench				Dehumidifiers							Fixed	
Batching plant											Floodlighting	
Total load				Total load				Total load			Total load	
Diversity factor				Diversity factor				Diversity factor			Diversity factor	
Demand load				Demand load				Demand load			Demand load	

For calculation purposes, check that only the formula: i x V = W is used

where i = current in amps

V = voltage

W = wattage

Typical electrical supplies used on construction sites

Volts	Phase	Derived from	Special provision	Application
415	3	Supply undertaking		Fixed and transportable equipment above 5 hp, e.g. crane, hoist, compressor, concrete mixer, and large scale personnel amenities
230	1	Supply undertaking		Site offices, personnel amenities and fixed floodlighting
110	3	415V ' transformer	Secondary winding phase to earth 64 V	Transportable equipment up to 5 hp, e.g. vibrators, pumps, site lighting other than fixed floodlighting, and hand tools
110	1	230V transformer	Secondary winding outers to earth 55 V	All portable and transportable tools up to 2.5 hp and site lighting
50	1	Transformer	Secondary winding outers to earth 25 V	Dangerous situations, tunnelling work, inside boilers, confined spaces
25	1	Transformer	Secondary winding outers to earth 12.5V	Dangerous situations, tunnelling work, inside boilers, confined spaces

Construction Site Safety

1.5.3 Appendix 5

Permit to Work on high voltage equipment

No.

Issued to ..... Job .....

I hereby declare that it is safe to work on the following H.V. apparatus which is dead, isolated from all live conductors and is connected to earth:

.....

All other apparatus is dangerous

SWITCHING AND ISOLATING. The apparatus is disconnected from all live conductors by the following operations:

.....

EARTHING. The equipment is earthed at the following points:

.....

DANGER NOTICES are posted at.....

AUTOMATIC FIRE EXTINGUISHING CONTROL has been rendered inoperative at.....

OTHER PRECAUTIONS.....

Signed ..... Date ..... Time ..... (Authorised person)

I hereby declare that I accept responsibility for carrying out work on the apparatus detailed on this permit and that no attempt will be made by me, nor by any person under my control, to carry out work on any other apparatus:

Signed ..... Date ..... Time .....

Note: After signature for work to proceed, this receipt must be signed by, and the Permit to Work retained by, the person in charge of the work until work is suspended or completed and the clearance section has been signed.

This is to certify that the work authorised above has been completed or stopped and that all workers under my charge have been withdrawn and warned that it is no longer safe to work on the apparatus specified on this Permit to Work and that gear, tools and additional earthing connections are all cleared. Automatic fire extinguishing control has been restored.

Permit to Work is hereby cancelled

Signed ..... Date ..... Time ..... (Authorised person)

Construction Site Safety
1.5.3 Appendix 6

High voltage safety

Identity of site.....

THIS IS TO CERTIFY THAT .....

is the person responsible on this site for ensuring that the rules for the safe operation of H.V. systems and the Permit to Work system are complied with in every respect.

Signed ..... Date .....

Status ..... Company.....

The authorised person(s) for H.V. switching, isolation, testing and earthing is (are):

……

……

……

……

Construction Site Safety

1.5.4 Working In and Around Excavations

1.5.4.1 Key points

1 Many deaths and serious injuries have resulted from the collapse of unsupported excavations.

2 These accidents could have all been prevented if the sides had been supported.

3 The type of support system must be selected or designed by a competent person.

4 There is no minimum depth at which an excavation must be supported; it depends on the soil/sand.

5 The installation, modification and removal of any support system must be carried out:

(a) by persons who have been trained and are competent to do so

(b) without putting the safety of these people at risk.

6 Generally, the longer that an unsupported excavation is open the more chance there is of it collapsing; ground that was previously stable can become waterlogged or dry out.

7 In some cases it will be possible to detect at an early stage that the sides of an excavation are becoming unstable, for example during the inspections carried out by a competent person.

8 There are other hazards associated with working in excavations, for example the presence of underground services, contaminated land, etc.

9 Excavations can become confined spaces under certain circumstances, necessitating the management of additional health and safety hazards.

Note: Section 2 of the QCS covers ground investigation and Section 12 covers earthworks.

1.5.4.2 Introduction

1 Almost all construction work involves some form of excavation, for foundations, drains, sewers, etc. These can vary greatly in depth and may be only a few centimetres deep or be very deep and very dangerous.

2 A relatively small collapse might involve about a cubic metre of soil, but a cubic metre of soil weighs over a tonne. A person at the bottom of a trench who is buried under this volume of material would be unable to breathe, due to the pressure on the chest, and could quickly suffocate and die.

3 Deep trenches look dangerous; however, trenches less than 2.5 metres deep are where most related deaths occur, in fact, most accidents occur in ground conditions with no visible defects; the trench sides seem clean and self-supporting.

4 Despite appearances, however, the removal of material causes pressure relief and introduces the conditions which lead to failure. Rainwater or hot, dry weather increase the chances of such failure. Surcharging the sides of an excavation also increases the likelihood of collapse.

5 Neither the shallowness of an excavation nor the appearance of the ground should be automatically taken as indications of safety.

6 An excavation may also be a 'confined space' and additional precautions will need to be taken.

1.5.4.3 Legislative requirements

The Management of Health and Safety at Work

1 Before carrying out any work, including excavation work, a risk assessment of the work to be done is required under these Regulations.

2 These Regulations place a requirement on every Contractor to make a suitable and sufficient assessment of every work activity in order to identify any hazard that employees or any other person might encounter as a result of the work being carried out. This includes other contractors and the public.

3 Once those hazards have been identified, it is then the Contractor's duty to put control measures into place in order either to eliminate the hazard or, where this is not possible, to reduce the risks of injury or ill health arising from the hazards, as far as is reasonably practicable.

4 The Contractor must provide employees with comprehensible and relevant information on any risks that exist in the workplace and on any control measures that are in place to reduce those risks.

5 Employees, in turn, have a duty to tell their Contractor of any work situation which presents a risk to themselves or to others, or of any matter which affects the health and safety of themselves or other persons.

Construction (Design and Management) CDM

6 With regard to excavations, these Regulations require that:

(a) all places of work are safe, with safe means of access and egress

(b) steps are taken to ensure any structure that has become unstable due to any construction work, including excavation, does not collapse

(c) steps are taken to prevent anyone being buried by a collapse of material

(d) the sides of excavations are supported or battered back where necessary to prevent collapse or dislodgement and fall of material

(e) steps are taken to prevent people, materials, spoil, vehicles, equipment or plant falling into, or causing the collapse of, an excavation

(f) steps are taken to prevent danger from damage to underground and overhead services

(g) excavations are inspected by a competent person and inspection reports prepared as specified

(h) each excavation has sufficient fresh air

(i) there is suitable lighting at places of work

(j) anyone who has to carry out excavation work or work in an excavation is provided with appropriate training and is competent

Risk assessments

7 Before carrying out any work, including excavation work, a risk assessment of the work to be done is required.

8 The risk assessment must consider the potential for the sides of an excavation to collapse, the potential for someone to be injured and the possible need for a support system. The person assessing the risk of collapse must be competent to assess the soil stability.

9 The risk assessments should seek to eliminate or control the risk at source, for example by specifying trenchless techniques or ensuring the sides are 'battered' or 'stepped' (sometimes known as 'benched)' thus making a collapse impossible.

10 The risk assessment must include consideration of the following hazards:

(a) collapse of the sides

(b) underground services

(c) contaminated ground

(d) fall of materials, persons, plant or equipment into the excavation

(e) confined spaces - poisonous or explosive atmospheres or lack of oxygen

(f) flooding

(g) overhead services

(h) moving plant - injury to persons

(i) lifting operations

(j) undermining adjacent structures or services

(k) surcharging the sides of an excavation. Control measures should include:

(l) protection of person(s) who are installing the support system

(m) safe exposure and, if necessary, support of underground services

(n) safe access and egress from the excavation

(o) adequate ventilation of the workspace

(p) dewatering the trench if necessary

(q) the need for inspections of the excavation by a competent person

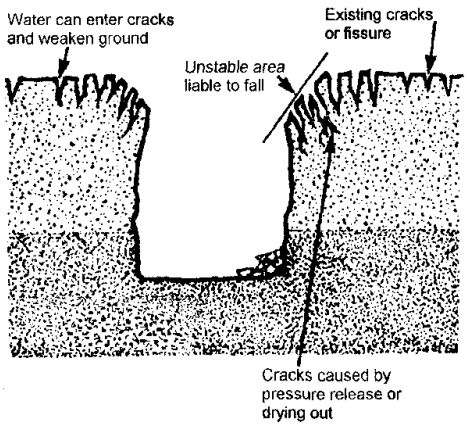
(r) the stability of adjacent structures or land

(s) guarding and lighting where necessary.

Soil stability

11 Excavation involves the removal of soil and rock, in lesser or greater quantities. Water is almost always present, even if only as moisture in the soil. This presents an additional hazard that must be considered.

12 Soil varies in its nature. Some soil, like fine sand, flows easily. Other soils, like stiff clay, are more cohesive. No soil, whatever its structure, can be relied upon to support its own weight and, if a trench or excavation cannot be made safe by battering or stepping the sides, some form of support will be required. Loose and fractured rock will also need some support.



Firm or stiff clay type ground

Trenchless techniques

13 This module highlights the potential dangers associated with any form of excavation. Readers should also be aware of the work techniques available to eliminate, or at least partially eliminate, the need for excavations and thus their associated hazards.

14 Thrust boring, directional drilling and pipe jacking are examples of such techniques. Some of the trenchless methods that have been developed still require the excavation of pits at either end of the 'trenchless run' in order to launch and retrieve the boring equipment.

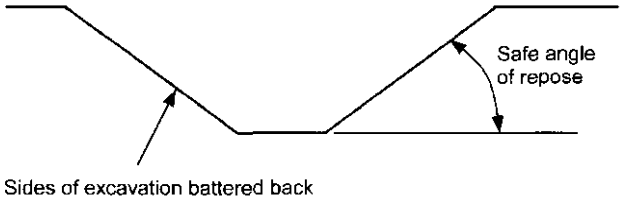
Battering or stepping excavations

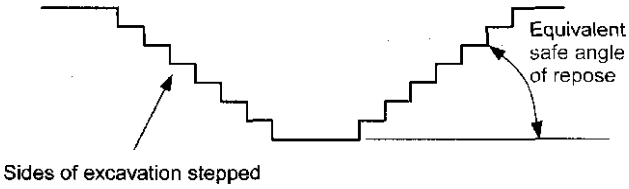
15 If battering the sides of an excavation, the angle at which the sides are cut will depend upon:

(a) the nature of the soil, which may be a mixture of materials

(b) the water content of the soil, including any increase or decrease whilst the excavation is open.

Refer to Appendix 4 - Angles of repose





1.5.4.4 Trench supports

General requirements

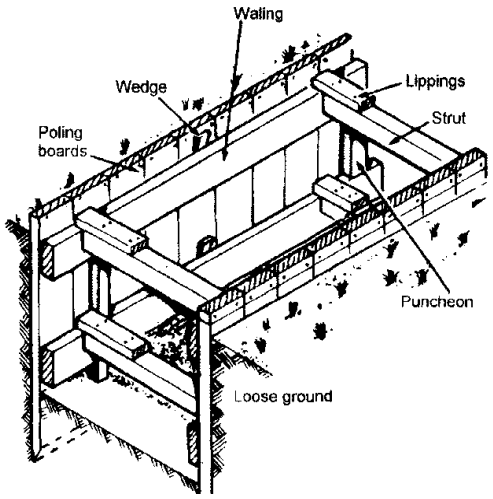
1 The need for adequate support will depend on:

(a) the type of excavation

(b) the nature of the ground

(c) ground water conditions

(d) surcharge of sides of excavation.



Close boarded excavation

2 Generally speaking, timbering or shoring is not required for trenches or excavations where there is no danger whatsoever of any material falling or collapsing or where excavations are so shallow that such a fall would not result in any injury.

3 For all other excavations or trenches, a survey of the type of soil or other materials that will be excavated must be carried out by a trained and experienced person prior to excavation. This will usually provide sufficient information for a suitable method of excavation and support to be determined.

4 Where large, complex or extensive excavations are concerned, a specialist engineer should decide how to proceed.

5 An adequate supply of support materials must be available on site ready for use before the excavation commences.

6 They must be sound, free from defects, of adequate strength, of good construction and properly maintained. Supports must be fixed securely to prevent displacement.

7 All supports should be erected, altered and dismantled under the supervision of a competent person.

8 It is essential that work is organised so that the person(s) installing any type of support system can do so without their safety being put at risk.

Types of support systems

9 All practical steps should be taken where necessary to prevent danger to any person from collapse of an excavation and from accidental fall or dislodgement of material from the side or roof or adjacent to any excavation.

10 Conventional timber shuttering or steel trench sheets and adjustable props should be used. The props may be mechanical (jacks or acrows) or hydraulic.

11 A temporary framework of supports, or a protective box or cage, may be needed to protect workers while they put in permanent timbering. A box or cage can be moved forward as timbering progresses.

12 In addition to the traditional systems of supporting excavations, several proprietary support systems are available. These include **shields** (also known as drag boxes), **trench-boxes** and **plate lining** systems.

Shields

13 A shield consists of two vertical plates which are permanently braced apart to provide a safe working area between them. Shields are designed for providing temporary protection for workers in a trench, rather than for providing permanent support for the trench sides. Shields are designed to be dragged along the trench as work progresses, therefore only localised protection from falling materials is provided.

Trench-boxes

14 The trench-box support system is modular and involves either lowering strutted, metal box sections into a pre-dug trench, or progressively digging the boxes in to provide continuous support as the depth of the trench increases.

15 The box sections are built up vertically and laterally to form a permanent support for the trench sides.

16 Boxes of this type can generally be extended in width and height to cater for various excavation dimensions.

Plate lining

17 The principle of a plate lining system is that metal plates are slid into position between vertical soldier posts, which have been installed previously at pre-set intervals. The soldier posts are strutted apart to counteract inward pressure from the trench sides.

Avoiding buried services

18 The use of any of these proprietary support methods can present problems when existing buried services cross the line of the trench being excavated.

19 A further method of supporting the sides of excavations, which combines proprietary and traditional technology, is the use of hydraulic waling frames. This system incorporates the lowering of a hydraulic frame into an excavation in which trench sheets have already been installed. The hydraulic frame is then jacked apart to provide support for the trench sheets. Each hydraulic frame, when in position, is disconnected from the hydraulic supply and left in the pressurised state. This method of support is better able than the other proprietary systems to cope with buried services that cross the trench because it leaves gaps between the trench sheets. Hydraulic frames that can be expanded in both length and width are available to cope with the excavation of manholes and pits.

Inspection and maintenance of support systems

20 All excavation work requires careful monitoring, particularly when trenches are first opened and sides are unsupported. Even when support work has been installed, constant vigilance is essential.

21 Small movements of earth, resulting in movements in the supports or timbering of no more than 6-12 mm, are usually the only sign of the progressive weakening in cohesive soils.

22 Such movements can easily pass unnoticed but they are signs that something is wrong.

23 Movements can be detected from slight distortion in the timbering, bowing of poling boards and walings, or signs of local crushing.

24 All timber must be regularly checked. Where timber remains in position for any length of time, it may dry out, shrink or rot.

25 The ground also may dry out and shrink, which loosens the timbering. Alternatively, it may absorb additional moisture, swell and displace the timbering. Soil may even leak into the excavation from behind the timbering, loosening it.

26 In close-boarded excavations, the support-work members must be kept tight against each other and against the soil face; wedges or telescopic struts holding them must always be kept tight. Raking, or angle, struts should all be regularly examined for signs of having been damaged or dislodged.

27 When loads are being moved into or out of the excavation by skip or bucket, care should be taken to avoid damage to struts or walls. Vertical boards, commonly known as rubbing boards, should be provided to avoid such damage.

28 During bad weather, spoil heaps tend to slump, and loose boulders or masonry may fall into the excavation. As a general rule, the distance between the edge of the trench and the bottom of the spoil heap must not be less than the depth of the trench.

29 Heavy vehicles should not be allowed near the edge of excavations unless the support work has been specially designed to permit it.

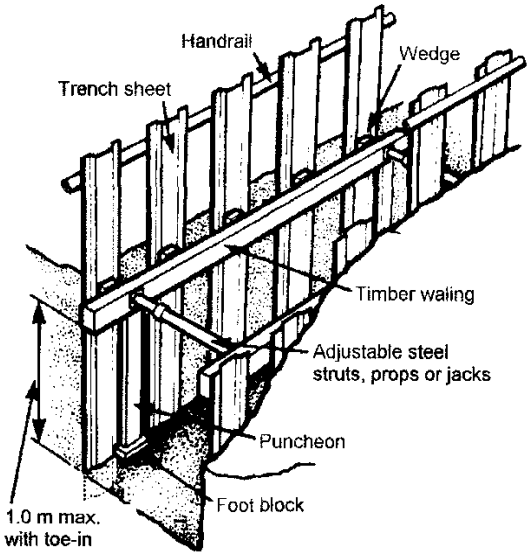
Adjacent structures

30 Care must be taken to see that excavation work does not jeopardise the stability of any adjacent structure. Precautions to protect workers and others must be taken before and during any excavation work.

1.5.4.5 Access

1 Safe means of getting into and out of an excavation must be provided. If a risk assessment identifies that ladders are a reasonable means of access or egress from an excavation, they must be suitable and of sufficient strength for the purpose.

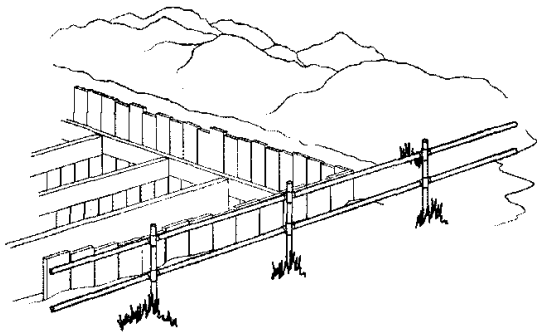
2 They must be on a firm level base, sufficiently secured so as to prevent slipping and must, unless a suitable alternative handhold is provided, extend to a height above the landing place of at least 1 metre (about 5 rungs), so as to provide a safe handhold. Climbing into or out of an excavation using the waling's, buried services and struts must be prohibited and specifically covered in the safe system of work and, if there is one, the method statement.



Open sheeting using steel sheets and jacks

1.5.4.6 Guarding excavations

1 Where necessary, suitable steps must be taken to prevent any person, vehicle, plant or equipment, or any accumulation of earth or other materials from falling into an excavation.



2 Barriers should also serve to keep materials, plant and equipment away from the edges of an excavation. Barriers may be removed to permit access of personnel, plant and equipment, but should be replaced as soon as possible.

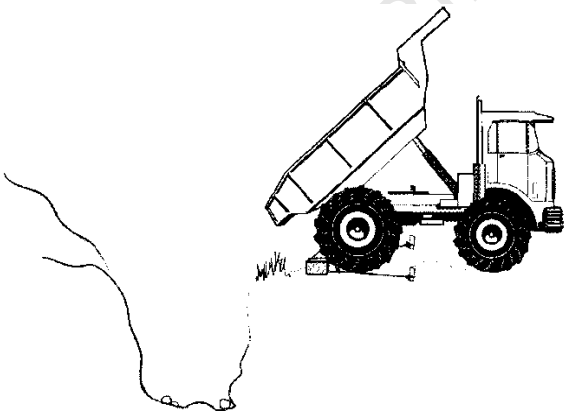
3 During darkness, the edges of an excavation should be marked with lights, especially where they are close to public thoroughfares. Battery-operated traffic lamps placed at suitable intervals are usually sufficient.

1.5.4.7 Vehicles and plant

1 Ideally, all vehicles and plant (except those which must approach an excavation, for example, for tipping or lifting activities) should be kept away from excavations. Traffic routes should be planned and set out accordingly.

2 When heavy loads (such as items of construction plant) are positioned close to excavations, additional pressure - known as surcharging - is placed on the excavation sides and on any form of support system that is in use. Where this cannot be avoided, it must be allowed for in the design of the excavation support system.

3 Where vehicles are used for tipping materials into an excavation, safety measures, such as well anchored stop blocks, should be used to prevent the vehicle overrunning the edge. These must be placed at a sufficient distance from the edge of the excavation to avoid the danger of the edge breaking away under the weight of vehicles.



1.5.4.8 Site lighting

1 There must be suitable and sufficient lighting at every workplace, the approaches to the workplace and on traffic routes. As far as possible, this should be natural lighting.

2 It is also good practice to ensure that attention is paid to the adequate lighting of access points, openings and lifting operations.

1.5.4.9 Ventilation

1 Excavations must be kept clear of suffocating, toxic or explosive gases. These may be natural gases like hydrogen sulphide, methane and sulphur dioxide, exhaust gases from nearby plant, or leaks from nearby pipes or installations. These can seep through the soil and can accumulate at the bottom of an excavation, below ground level.

2 Leakage of propane and butane from LPG cylinders is potentially very dangerous; the gases will sink to the lowest point and form an explosive concentration that cannot disperse naturally. In a similar way, leaking oxygen in an excavation can lead to oxygen enrichment which can lead to fire or explosion. Gases which are heavier than air can leak into an excavation causing air to be displaced, leading to asphyxiation.

3 For the purpose of dealing with these hazards, the bottom of a deep excavation should be regarded as a confined space.

Confined spaces

4 When an excavation is classified as a confined space, tests for toxic gas or oxygen depletion must be carried out before work starts, and continuously as work progresses. It is also recommended that the work should be subject to the issue of a Permit to Work certificate.

5 To ensure that every workplace or approach is safe and without risks to health, there must be a sufficient supply of purified air. The most common method of ventilation is to blow clean air into the excavation in sufficient volume to dissipate any gas and provide adequate breathable air.

1.5.4.10 Underground cables and services

1 No excavation work should be carried out unless steps have been taken to identify and prevent any risk of injury arising from underground cables or other underground services.

1.5.4.11 Inspection and reports

1 All excavations used to carry out construction work must be inspected by a competent person:

(a) at the start of every shift in which the work is to be carried out

(b) after any event likely to have affected the strength or stability of the excavation or any part of it

(c) after any accidental fall or dislodgement of any material.

2 The person who carried out the inspection must be satisfied that the work can be carried out safely and without risk to workers.

3 A report must be prepared by the person carrying out the inspection, giving the following information:

(a) the name and address of the person on whose behalf the inspection was carried out

(b) the location of the place of work inspected

(c) a description of the place of work or part of that place of work inspected, including plant and equipment or materials, if any

(d) the date and time of the inspection

(e) details of any matter identified that could give rise to a risk to the health or safety of any person

(f) details of any action taken as a result of any matter identified above

(g) details of any further action considered necessary

(h) the name and position of the person making the report.

4 The person who prepares the written report must write it before the end of the shift in which the inspection was carried out and provide a copy of the report within 24 hours to the person on whose behalf the inspection was carried out.

5 The report or a copy of it must be kept on the site until the work is completed and for a period of three months from the date of completion.

6 Not more than one written report in any period of seven days is required in respect of the inspection at the start of any shift. However, it is advised that a daily record of the inspection is kept, possibly in the site diary.

7 An example of an inspection report, which may be reproduced, can be found in Appendix 3 of this module.

8 Steps must be taken to protect workers from the fall of any material or object.

9 No material or object may be thrown or tipped from a height where injury may result. This includes scaffolding materials which should be lowered under control.

10 No timber or other materials are to be left with projecting nails.

11 Every workplace on a construction site must be kept in a reasonable state of tidiness and cleanliness.

12 Materials and equipment must be properly and securely stacked and stored.

13 Work equipment must be constructed or adapted so as to be suitable for the purpose for which it is used or provided. This includes any tools or items of equipment, for example, a shovel, podger or pile driving rig.

14 Contractors must avoid the need for employees to undertake any manual handling operations at work that will involve the risk of them being injured.

(a) Every client must ensure that the engineer and designer for any project carried out for the client is provided with any relevant information which the client holds, or could find out by making reasonable enquiries. For example, the client must provide details of underground services, ground conditions, etc, which could be found from making reasonable enquiries.

(b) The designer has a duty to eliminate or reduce hazards by design. This might mean locating structures to avoid underground services, or specifying techniques that minimise deep excavations.

(c) A health and safety plan must be prepared for every project and should include details of health and safety risks to any person carrying out construction work. This would include the risks from any excavation project.

1.5.4.12 Excavators used as cranes

1 Excavators, loaders and combined excavator loaders may be used as cranes in connection with work directly associated with an excavation, and any other application where this type of equipment can be used.

2 All work is subject to a suitable and sufficient risk assessment, subsequent control measures and capabilities of the work equipment.

3 The risk assessment should take account of the fact that when a machine is in the object handling mode (being used as a crane), it will be necessary for the slinger to approach the machine to hook the load on and off. This person will be in what is regarded as a hazardous area and much hearer to the machine than anyone would be in normal circumstances. The slinger is at risk of being struck by the load, bucket or excavator arm if the excavator moves or slews rapidly.

4 Excavator operators and slingers must be made aware of these dangers; effective communication and constant vigilance are essential.

5 The risk assessment must also establish " whether the machine is suitable for the proposed task. The weight of the bucket (if still fitted) plus the quick hitch must be added to the weight of the load to establish if the machine will be working within its safe working load.

6 Ideally, unless there are good reasons for not doing so, the bucket will be removed to improve

the machine operator's visibility.

7 The risk assessment must also address:

(a) the need for the lifting operation to be ideally segregated from other work activities taking place in the vicinity, particularly where it is necessary for the machine to travel with a raised load

(b) the ground conditions, particularly where a tracked excavator will carry out the lifting operation. Such machines have no means of levelling themselves and are therefore dependent upon the ground being sufficiently level to track across it and carry out the lifting operation safely.

8 The safe working load must be clearly marked on the machine and any lifting accessories, such as a quick hitch. A rated object handling capacity table, must be available in the cab.

9 If the rated lifting capacity for an excavator (or the backhoe of a backhoe-loader) is greater than 1 tonne (or the overturning moment is greater than 40,000 Nm), the machine must be fitted with:

(a) a boom lowering control device on the raising boom cylinder(s) (a safety check valve), which meets the requirements of ISO 8643, and

(b) an acoustic or visual warning device, which indicates to the operator when the object handling capacity or corresponding load moment is reached.

10 Chains or slings for lifting must not be placed around or on the teeth of the bucket. Accessories for lifting may only be attached to a purpose-made point on the machine.

11 Whilst BS 7121 may not specifically refer to excavators used as cranes, compliance would assist in the provision of safe systems of work.

Construction Site Safety
1.5.4 Appendix 1

Excavations Safety checklist

Before starting excavation work

1 Check that a site-specific risk assessment has been carried out.

2 For purposes of excavation, no ground should be considered good or safe until it has been investigated.

3 Prevent all access to the excavation by unauthorised persons, especially children. Backfill as soon as possible to reduce risks.

4 Check the soil types and decide which type of support work is required in consultation with a competent engineer or supervisor.

5 Check whether the excavation will affect adjoining roads, buildings or other structures, such as scaffolds.

6 Determine the positions of all public services, especially buried services, and ensure that they are adequately marked, supported or disconnected as necessary.

7 Always seek advice before excavating below existing foundations of adjacent or adjoining buildings. It may be necessary to provide shoring, i.e. raking or flying or both.

8 Provide an adequate supply of material for support work, along with barriers and correct traffic notices, before work starts.

9 Make provision for any side support system to stand proud of the existing ground levels. This prevents any loose material from falling into the excavation.

10 Check the need for, and provision of, adequate lighting.

11 Check that adequate and sufficient ladders have been provided for safe access to the excavation and that sufficient ropes for securing these items are to hand.

12 Determine the positions of bridges, temporary roads and spoil heaps.

13 Determine the methods of excavating before starting work, and the method by which it is intended to install and remove any support work.

14 Plan traffic routes to keep heavy plant and vehicles away from excavations, as far as is possible, except where they must approach the excavation for tipping and lifting activities.

15 Plan the safe backfilling of the excavation, using suitable materials.

16 Check that the excavator operator is competent.

17 Check that the excavator and equipment is in good repair and has been inspected.

Construction Site Safety
1.5.4 Appendix 2

Excavations Safety checklist

Whilst digging, working in, or reinstating an excavation

1 Ensure that only sound support material is being used.

2 Ensure that approved and safe methods are adopted for the installation of support work in excavations. A competent person should be in attendance at all times.

3 Ensure that all working surfaces are safe.

4 Install supports as soon as the excavation sides are trimmed. This should be done from a work cage, from ground level, or from inside existing supports.

5 Ensure that all support work is secure and that props and wedges are tight and properly maintained.

6 Check for signs of overstress in support work, any damage that may have been caused by plant and, when timber is used, make long-term checks for disease and defects, i.e. dry rot, shakes, etc.

7 Check for any water or soil which may be seeping through support work.

8 Check for signs of the earth peeling or cracking at unsupported faces.

9 Check that there are adequate ladders, that they are maintained, secured and used correctly.

10 When pumping, ensure that there are adequate sumps and that soil is not being drawn from behind support work.

11 Check for hazardous atmospheres.

12 Ensure that spoil heaps and other materials are kept back from the edges of the excavation.

13 Ensure that there are adequate barriers, notices and warning lights.

14 Check that the edges of excavations are provided with top and mid guard-rails at all places where there is a danger of persons falling a distance likely to cause personal injury.

15 Check that any bridges and gangways are fitted with guard-rails and toe-boards.

16 Ensure that stops for dumpers, and tipping lorries are well anchored.

17 Ensure that all passing traffic is kept well back from the edge of the excavation.

18 Ensure that the correct method of withdrawing support work is used; if for any reason it is considered unsafe to remove it, leave it in.

19 Ensure there is adequate separation between working plant and people.

20 Dumper drivers should dismount while the dumper is being loaded.

21 Ensure that appropriate protective clothing and protective equipment are being used.

22 Ensure that persons are wearing suitable ear defenders when piling or other noisy activities are taking place.

23 Ensure that machine operators have the best possible vision of the work which is in progress.

24 Ensure that services are marked, protected and adequately supported when exposed in excavations.

25 Ensure that any backfilling is carried out correctly and in a planned sequence, and maintained.

26 Ensure that each excavation is inspected by a competent person:

(a) before it is first entered

(b) at the start of each shift

(c) after any accidental fall of rock, earth or other material

(d) after any event likely to have affected the strength or stability of the excavation.

27 Ensure that a proper record of all inspections is made and signed by a competent person.

28 Remember that records of inspections may be kept on computer or in another electronic form, so long as it is possible to immediately produce a hard copy on request.

29 Ensure that the written report, or a copy, is provided to the person on whose behalf the inspection was made within 24 hours.

Construction Site Safety
1.5.4 Appendix 3

Report of inspection on *excavations, *cofferdams and caissons *(*Delete as appropriate)*

Inspection carried out on behalf of (name and address).....

.....

Inspection carried out by (name) .....(position) .....

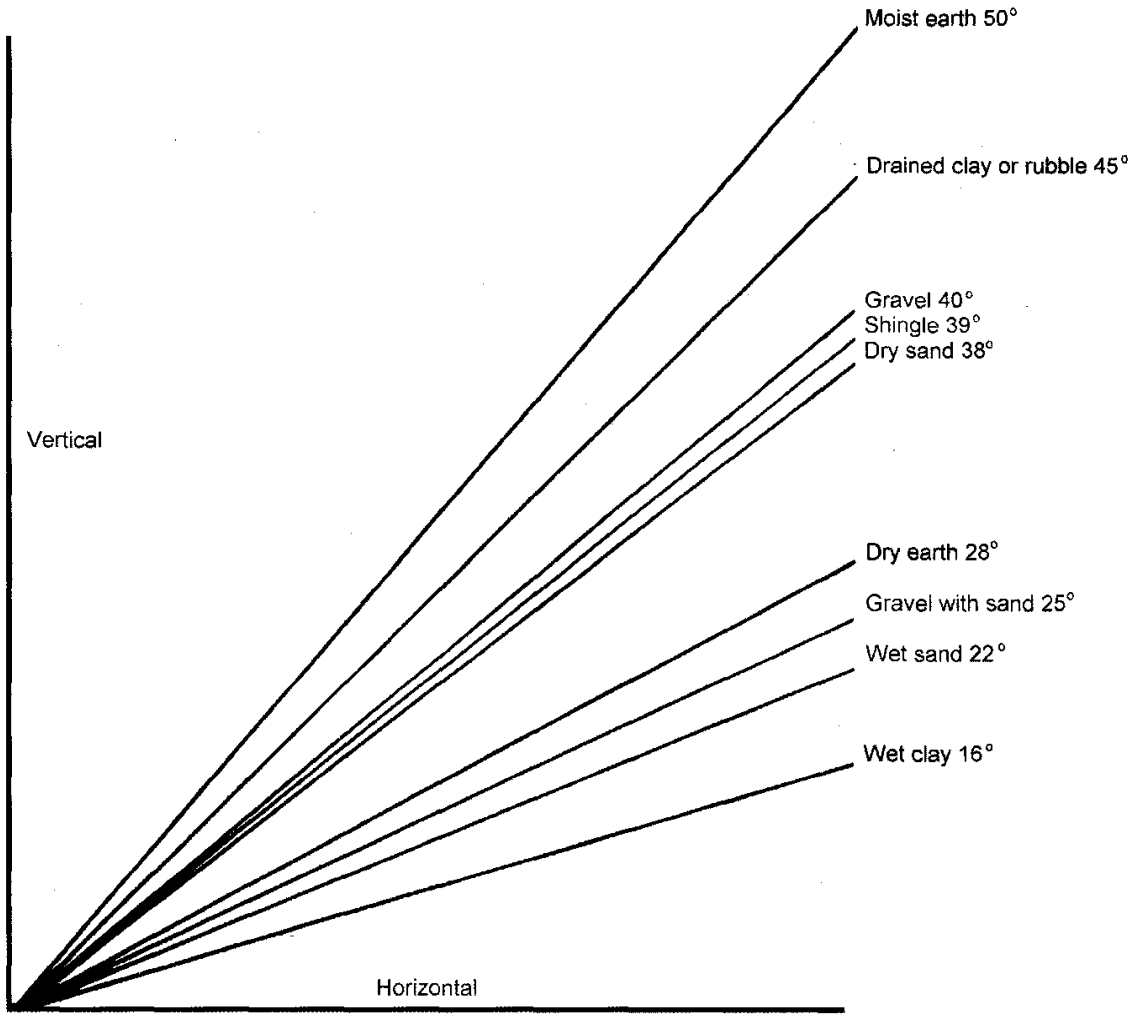
Address of site .....

Date and time of inspection	Location inspected	Description of place of work, or part inspected	Details of any matter identified giving rise to a risk to the health and safety of any person	Details of any action taken as a result of any matter identified	Details of any further action considered necessary

Construction Site Safety
1.5.4 Appendix 4

Angles of repose for different soil types

1 The graph below shows the angle of repose at which various types of soil will slide if unsupported. They represent the maximum safe angle of batter.



All angles are from the horizontal

2 This illustration shows typical **maximum** safe 'battering' or 'stepping' angles for certain types of soil. A competent person must be consulted on the safe angle for battering or stepping excavations. If in doubt, consult a geotechnical engineer.

3 Users of the above graph should be aware that:

(a) in many cases soil is a mixture of material and the above diagram must be interpreted with caution

(b) an increase in water content will affect the ability of some types of soil to be self-supporting. Bad weather, vibrations and other pressure could cause early failure

(c) Slip planes can form in seemingly solid materials, even some types of rock.

Construction Site Safety
1.5.4 Appendix 5

Requirements for excavators used as cranes

Requirements on manufacturer at time of supply			
Requirement	When object handling with a rated lift capacity of more than 1 tonne	When object handling with a rated lift capacity of less than 1 tonne	When not object handling
EC or Equivalent Certificate of Conformity	Yes	Yes	Yes
Hose burst check valve on boom lift ram	Yes	Not required	Not required
Rated object handling capacity table in cab	Yes	Not required	Not required
Fixed safe working load (SWL) marked on the machine or displayed in the cab	Yes	Yes	Not required
Acoustic or visual warning device	Yes	Not required	Not required
Lift point with SWL marked	Yes	Yes	Not required
Machine maintenance required by owner			
Six-monthly thorough examination of lifting gear	Yes	Yes	Not required
Four-yearly test and thorough examination	Yes	Yes	Not required
Twelve-monthly thorough examination	Yes	Yes	Yes
Weekly inspection of excavator	Yes	Yes	Yes

Records may be kept as a paper copy or by electronic means providing a hard copy is always easily accessible.

Construction Site Safety

1.5.5 Working in Confined Spaces

1.5.5.1 Key points

1 Working in confined spaces has the potential to be very hazardous unless the appropriate controls are put in place.

2 Many people have lost lives as a result of work in confined spaces not being adequately planned or organised, or safely carried out; many of them were would-be rescuers.

3 Ideally it will be possible to carry out the work without anyone having to enter a confined space.

4 Confined spaces are not just sewers and ducts; under these Regulations many other work areas could also be classified as confined spaces with issues including difficulty of access and egress, heat stress, etc. having to be considered.

5 A risk assessment must be carried out for all work in a confined space.

6 Where the findings of the risk assessment reveal there to be significant risks to health or safety, it may result in a method statement being written.

7 Any plan of the work must consider the method of rescuing the people in the confined space should the situation become unsafe.

8 Entry to a confined space should be controlled by a Permit to Work and, where considered necessary, a separate Permit to Enter.

9 Any training may need to be specific for the type of confined space - a sewer entry course may not be appropriate for someone who has to work in a hot roof space.

10 The use of respiratory protective equipment is common in confined space work and users must be face-fit tested and trained in its use, general care and maintenance.

1.5.5.2 Introduction

1 Every entry into a confined space is potentially hazardous due to the probable presence of hazardous gases, accumulation carbon dioxide, water or sewage accumulation etc.

2 Accidents are caused by a combination of factors arising from a lack of safety awareness, inadequate supervision and a lack of training. The situation is often made worse by heroic but ill-conceived rescue attempts, founded on insufficient planning and knowledge, which may lead to multiple fatalities. It is essential therefore, to be able to identify confined spaces and the hazards associated with entering and working in them.

1.5.5.3 Meaning of 'confined space'

1 A "confined space' can be either:

(a) a place which is substantially, though not always entirely, enclosed *or*

(b) a place where there is a reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby.

2 Some confined spaces are easy to identify, such as closed tanks, vessels and sewers. Others are less obvious but may be equally dangerous, such as basement-level boiler rooms or toilets, as well as open-topped tanks, vats, silos or other structures that become confined spaces during their manufacture.

3 Some places may become a confined space only occasionally, perhaps due to the type of work to be undertaken, such as a room during paint spraying, deep trenches where there is restriction of movement to a person / persons and where gas leaks could result is stagnation

of the gas. A confined space may not necessarily be enclosed on all sides; some confined spaces (such as vats, silos or deep excavations) may have open tops. Places not usually considered to be confined spaces may become confined spaces because of a change in the condition inside or a change in the degree of enclosure or confinement.

4 The expression 'confined space' could also refer to the following examples: ducts, vessels, boreholes, building voids, and enclosures for the purpose of asbestos removal.

1.5.5.4 Legislative requirements

The Management of Health and Safety at Work

1 These Regulations place a requirement on every Contractor to make appropriate and sufficient assessment of every work activity in order to identify any hazard that employees or any other person might encounter as a result of the work being carried out.

2 Once those hazards have been identified, it is then the Contractor's duty to put control measures into place in order either to eliminate the hazard or, where this is not possible, to reduce the risks of injury or ill health arising from the hazards, as far as is reasonably practicable.

3 The Contractor must provide employees with comprehensive and relevant information on any risks that exist in the workplace and on any control measures that are in place and need to be exercised, to reduce those risks.

4 Employees, in turn, have a duty to tell their Contractor of any work situation which presents a risk to themselves or to others, or of any matter which affects the health and safety of themselves or other persons.

5 Also of importance with regard to confined space working are the requirements on the Contractor to:

(a) ensure health surveillance for at-risk employees

(b) establish contacts with external services, for example the emergency services (rescue and medical services)

(c) provide employees with comprehensive and relevant information on any risks that exist in the workplace and on any control measures that are in place to reduce those risks

(d) supervisors and Foreman shall assess employees' capabilities when allocating work to individuals

(e) provide adequate training for anyone involved in any aspect of confined space working (including rescue).

6 Arising out of the risk assessment for confined space working will usually be a need for the Contractor to:

(a) develop a method statement for each job

(b) implement a Permit to Work system, encompassing or supplemented by a Permit to Enter.

Confined Spaces

7 These Regulations require Contractors to plan work so that entry to confined spaces is avoided so far as is reasonably practicable, for example, by doing the work from outside. They also require a safe system of work to be developed and implemented if entry to a confined space is unavoidable, and adequate emergency arrangements, which will also safeguard rescuers, to be put in place before work starts.

8 Duties to comply with these Regulations are placed on:

(a) Contractors in respect of work carried out by their own employees and work carried out by any person (for example, a subcontractor) insofar as that work is to any extent under the Contractor's control.

9 The key duty is a complete prohibition of any person entering a confined space to carry out any work for any purpose whatsoever, where it is reasonably practicable to carry out the work by any other means.

10 If entry into a confined space is necessary then a risk assessment by a competent person must be undertaken. The outcome of the risk assessment will then provide the basis for the development of a full and effective safe system of work, including rescue arrangements.

Construction (Design and Management) CDM

11 These Regulations place a legal duty on designers, when preparing their designs, to carry out design risk assessments and 'design out risk' so far as it is reasonably practicable to do so.

12 In the context of this section, designers should carry out their design work so that no-one has to enter a confined space during construction work, maintenance or cleaning of the structure or during its demolition.

13 Also, within the context of this section these Regulations place legal duties on contractors, including Contractors, with regard to:

(a) safe places of work

(b) excavations

(c) prevention of drowning

(d) prevention of risk from fire, explosion, flooding, asphyxiation and exposure to toxic fumes

(e) emergency procedures

(f) fresh air.

The Provision and Use of Work Equipment

14 These Regulations require that a Contractor only supplies work equipment that is correct and suitable for the job and ensures that the equipment is maintained and kept in good working order.

15 Where the use of the equipment involves a specific risk to the health and safety of employees, the use of the equipment must be restricted to specified workers.

Personal Protective Equipment

16 These Regulations require that the Contractor shall carry out a risk assessment and where a risk has been identified by a risk assessment and it cannot be adequately controlled by other means which are equally or more effective, then the Contractor must provide and ensure that suitable personal protective equipment (PPE) is used by employees.

17 In essence, PPE may only be used as a last resort after all other means of eliminating or controlling the risk have been considered and are found to be not reasonably practicable to implement. In practice, however, unless it is possible to carry out the work without entry into the confined space, the wearing of PPE will usually be necessary.

18 In deciding on the type of PPEs to be issued, the Contractor must take into account the risk

that the PPE is being used to protect against, and ensure that the PPE will fit the wearer and allow them to work safely. Where the use of RPE is necessary, face-fit testing to establish the suitability of the RPE for the wearer, would be required. If more than one item of PPE is being used, the Contractor must make sure that individual items of PPE are compatible and suitable for the task that is to be undertaken.

19 Whenever PPE is to be issued, the Contractor must ensure that employees have been given adequate and appropriate information, instruction and training to enable them to understand the risks being protected against, the purpose of the PPE and manner in which it is to be used.

20 Whilst the Contractor must ensure that personal protective equipment is supplied and used, the employee has a duty to properly use the equipment provided, follow the information, instruction and training that they have been given, and know the procedures for reporting loss or defect to their Contractor.

21 In addition to the more commonly used PPE, confined space working will often require the use of appropriate respiratory protective equipment (RPE) and rescue equipment such as a safety harness, Self-contained breathing apparatus (SCBA) and line.

1.5.5.5 Lifting Operations and Lifting Equipment

1 Access to and egress from many confined spaces is made by lowering or raising a person vertically through the entry/exit point, including during practice or actual rescues.

2 In these circumstances:

(a) safety harnesses and rescue lines must be regarded as lifting accessories

(b) the tripod hoist or other type of winch must be regarded as lifting equipment used for lifting persons

3 All such require inspection on a six monthly basis.

1.5.5.6 Dangers in confined spaces

Oxygen deprivation and suffocation

1 The air that we breathe contains around 21% oxygen and, at that level, people can work without difficulty. A falling level of oxygen will create an increasingly serious situation if breathing apparatus is not worn, or the level of oxygen otherwise restored. Generally, the following symptoms are experienced at the corresponding level of oxygen depletion:

(a) 19% tiredness (normal acceptable minimum level for working)

(b) 17% judgement (decision making) is affected

(c) 12% respiration is affected, fatigue experienced, flames are extinguished

(d) 10% light-headedness, increasingly difficult respiration

(e) 8% nausea, possible collapse

(f) 6% respiration stops, death in minutes.

Oxygen deprivation may be the result of:

2 the displacement of oxygen by gas leaking in from elsewhere, or the deliberate introduction of purge gas

3 the displacement of oxygen by a naturally occurring gas, such as methane

4 oxidisation, rusting or bacterial growth using up the oxygen in air

5 oxygen being consumed by people working and breathing, or by any process of combustion

6 welding and other 'hot works'

7 the prior discharge of a fire extinguisher containing carbon dioxide or other asphyxiating gas.

Toxic atmospheres

8 However much oxygen is present in the atmosphere, if there is also a toxic gas present in sufficient quantity it will create a hazard.

9 Some of the many toxic gases which may be encountered include:

(a) hydrogen sulphide, usually from sewage or decaying vegetation

(b) carbon monoxide from internal combustion engines, or any incomplete combustion, especially of liquefied petroleum gases (LPG)

(c) carbon dioxide from any fermentation or being naturally evolved in soil and rocks, or coming from the combustion of LPG

(d) fumes and vapours from chemicals such as ammonia, chlorine, sodium, and from petrol and solvents.

10 Whenever a toxic gas (or any gas, fume or vapour that may be hazardous to health) is thought to be (or known to be) present, then an assessment of the risk to health must be made. Appropriate control measures must be put into place to eliminate the hazard or control the risks.

11 Petrol and diesel engines create carbon monoxide, which is an extremely toxic gas.

12 Liquid petroleum gas-powered engines create an excess of carbon dioxide, which is a suffocating hazard. The use of any form of internal combustion engine within a confined space must be prohibited, unless a specifically dedicated exhaust extraction system is operative.

Flammable atmospheres

13 Some gases need only be present in very small quantities to create a hazard. A few of the major sources of explosive and flammable hazards are:

(a) petrol or liquefied petroleum gas, propane, butane and acetylene. These are explosive in the range of 2% in air upwards. The hazard is normally created by a spillage or leakage

(b) methane and hydrogen sulphide, which are naturally evolved from sewage or decaying organic matter. These are explosive in the range of 4% in air upwards

(c) solvents, acetone, toluene, white spirit, alcohol, benzene, thinners, etc. These are explosive in the range of 2% in air upwards. The hazard generally results from process plants and/or spillage

(d) hydrogen and other gases evolved from processes such as battery charging.

14 In an explosive or flammable atmosphere, a toxic or suffocating hazard may also exist.

Other causes of a hostile environment

15 Apart from the hazards dealt with above, other dangers may arise from the use of electrical and mechanical equipment, from chemicals, process gas and liquids, dust, paint fumes, welding and cutting fumes.

16 Extremes of excess heat and cold can have adverse effects and may be intensified in a

confined space. Consideration must be given to the timing of what would otherwise be considered 'standard' work. During hot weather, roof spaces and other types of confined spaces may reach temperatures which will lead to a dangerous increase in body temperature.

17 If work cannot be planned to avoid this, for example by starting early, then physical measures such as cooling and reducing the time spent working in the confined space must be introduced following an assessment by a competent person.

18 Further dangers exist in the sheer difficulty of getting into or out of, and working in a confined space. The potential hazard of an inrush of water, gas, sludge due to a failure of walls or barriers, or leakage from valves, flanges or blanks, must all be considered at the risk assessment stage.

1.5.5.7 Information, instruction and training

1 The information, instruction and training given to employees must enable them to carry out work safely and without risks to their health. The extent of training needed will vary according to circumstances and the type of space being entered. An entry into a deep confined space using breathing apparatus would require a full breathing apparatus and rescue course. However, training to enter a bund around a large diesel tank where the risks are less significant, such as fumes and possible drowning in diesel, would not require such an intensive course, and indeed adopting the use of breathing apparatus in this instance may be entirely inappropriate.

2 Training should involve demonstrations and practical or simulated exercises. It is important that trainees are familiar with both equipment and procedures before working for the first time in confined spaces.

3 Practical refresher training should be organised and available. The frequency with which refresher training is provided will depend upon how long it is since the type of work was last done, or if there have been changes to methods of work, safety procedures or equipment.

4 No person should enter a confined space unless they are trained and competent to do so safely. Persons assigned to work in confined spaces shall adapt practices and/or processes such as for example Risk Assessments to ensure that the confined space is safe to enter.

5 The training needs of each of the four categories of employee considered for confined space working should be considered. The categories are:

(a) supervisors

(b) employees entering confined spaces

(c) people employed as attendants or watchers outside confined spaces

(d) rescue teams.

6 Some of the roles identified may be carried out by the same person.

1.5.5.8 Safe working

1 Safe working in a confined space can only be achieved by the use of a Permit to Work system in which each step is planned and all foreseeable hazards are taken into account. Such a system, backed up by adequate rescue facilities, should enable work to be carried out safely.

2 At the planning stage it will be necessary to determine;

(a) whether an entry into the confined space is required, or whether an alternative method of doing the work exists (see **Checklist 1** at Appendix 1)

(b) if an entry is necessary, whether it can be carried out without the use of breathing

apparatus (see **Checklist 2** at Appendix 1)

(c) whether the entry must be made with the use of breathing apparatus (see Checklist 3 at Appendix 1).

3 In respect of (3) above, it should be emphasised that entry into a confined space using breathing apparatus should not be made routinely or undertaken as a matter of convenience, where the use of mechanical or forced ventilation would achieve a safe atmosphere.

4 If it is decided that the work can be done without anyone entering the confined space, provided that a safe system of work exists and the confined space has been isolated from potential sources of hazard, the work can proceed. It is important to avoid systems or plant being re-energised while work is proceeding and everyone involved should be advised accordingly.

5 Once it has been decided that people must enter a confined space, a preliminary meeting should be held with all concerned, and effective lines of authority and communication established in order to minimise any risk of subsequent misunderstanding.

6 The exact routine to be followed will vary, depending on the type of confined space to be entered. The provisions and precautions required for entry into a large empty surface water tank will obviously be different from those needed for entry into a narrow service duct containing pipes and valves, but the fundamental principle of a safe system of work applies to these and other cases. The risk assessment, as mentioned previously, will have identified many of the above points and should be used as the basis for developing the safe system of work. In addition, appropriate communication tools and mechanisms shall be used to ensure a safe system of work.

7 It is stressed that all personal protective equipment in general, and respiratory protective equipment in particular, must have been specified by a competent person who is clearly aware of all of the risks and circumstances surrounding its use.

8 If the fire and rescue service forms a part of the rescue plan, they must be given a warning that a confined space entry is to be made. This will give them the opportunity to assess the risks to their own staff entering the confined space and identify any equipment they might need.

1.5.5.9 Isolation

1 The confined space must be isolated from all possible external sources of danger to persons entering it.

2 A full Permit to Work system shall be used to record the location and types of isolation, and the hazards being guarded against. Inherent risks and control measures shall be appropriately identified in the permit or in the method statement that forms part of the permit.

3 Electrical isolation must never rely on a switch or fuse. The switch gear or fuse holder must be locked off and a warning notice applied.

4 Mechanical isolation of pipework should not rely on a single valve or on a non-return valve; these may let-by and create a hazard. Whenever possible, a section of pipe should be removed or a blank or spade should be put into a flange between the valve and the confined space and a warning notice displayed.

5 Paddles, stirrers or agitators, whether electrically or mechanically operated, should be physically disconnected by the removal of an operating arm, and a warning notice displayed.

1.5.5.10 Cleaning

1 There are a variety of methods of cleaning the inside of confined spaces to remove hazardous solids, liquids or gas. Cold water washing, hot water washing and steaming will remove many contaminants, while solvents or neutralising agents may be necessary for others. If hot water or steam is used, with or without a solvent, care must be taken to ensure that adequate ventilation exists for steam pressure and that condensation does not build up to unacceptable levels.

2 If steam is used or water is boiled in a confined space, account must be taken of the vacuum that can be created on cooling.

3 When steam or solvents are used, these may in themselves create a toxic, suffocating or flammable hazard. Even though a space has been well cleaned, it must not be entered until it has been monitored.

4 Great care must be taken if encountering any sludge or heavy deposits which may release toxic gases if disturbed.

1.5.5.11 Purging and ventilation

1 Air purging and ventilation can be carried out by removing covers, opening inspection doors, etc. and allowing ordinary air circulation, or by the introduction of compressed air via an air line. However, higher rates of air exchange can be achieved by the use of air movers, induction fans or extractor fans.

2 It is especially important that when an inert gas (such as nitrogen) has been used to purge or render inert a flammable atmosphere, the inert gas itself is properly purged with air.

3 When air purging is taking place, the flow of air should be of a sufficient volume and velocity to ensure that no pockets or layers of gas remain undisturbed.

Atmospheric monitoring

4 Depending on the circumstances, as a result the risk assessment, continuous atmospheric monitoring may well be necessary when any work is to be done that would expose employees to any substance hazardous to health.

5 Before an entry is made into a confined space, tests must be carried out to establish the levels of oxygen, toxic gas or flammable gas in the atmosphere.

6 The external atmosphere around the opening should be monitored first and if the results are satisfactory, internal monitoring should be carried out by lowering a gas monitor into the confined space before it is occupied.

7 If entry into the confined space is necessary to carry out the tests, breathing apparatus or other respiratory protective equipment must be worn.

8 Suitably trained and competent personnel may use simple, reliable and intrinsically safe instruments to measure oxygen and flammable gas levels. The accuracy of the instruments must be assured by periodic calibration.

9 A satisfactory oxygen content must not in itself be relied on to indicate safety since flammable, explosive or toxic gas may exist alongside oxygen and need only be present in minute quantities to create a serious hazard.

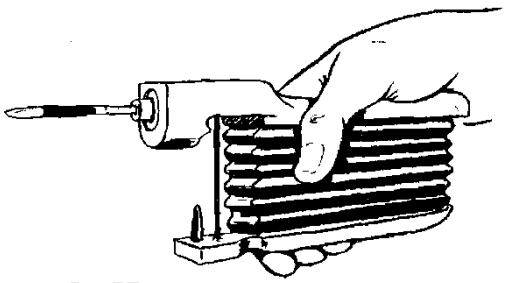
10 The tests applied should take account of what the space is known to have contained, including any inert gas used to purge a flammable atmosphere which may itself produce toxic hazards

or the risk of asphyxiation. Account must also be taken of hazards arising from other sources such as materials used for cleaning. Methane, hydrogen sulphide and carbon dioxide can all evolve naturally due to the decomposition of organic matter or, in some cases, by the effect of rainwater percolating through certain types of ground. It is necessary to test the atmosphere of a confined space at both high and low level as well as in any corners, etc. where pockets of gas may exist. Instances have occurred of carbon dioxide displacing oxygen at lower levels while a normal oxygen level continues to exist at higher levels of the same confined space.

11 The sense of smell must never be relied upon to detect gases. Some are odourless, and hydrogen sulphide, in particular, can paralyse the sense of smell to such an extent that even fatally high concentrations of the gas cannot be detected. In any case, the sense of smell varies from person to person and deteriorates with age.

Monitoring and testing equipment

12 Providing that the specific contaminant is known, tests can be carried out by competent persons using the individual detector tubes available for the detection of specific toxic and asphyxiant flammable or explosive fumes or gases.

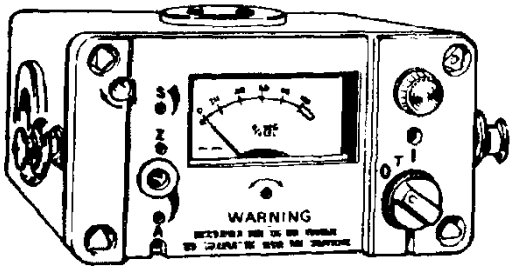


13 A wide range of portable gas detection equipment is available for flammable and toxic gases; some are specific to one gas (for example, hydrogen sulphide), while others can sample a range of different gases. Such instruments need to be properly calibrated.

Continuous monitoring

14 The initial monitoring and testing must establish that the confined space is safe to enter. Monitoring should then be carried out at intervals to ensure the continued safety of personnel. Tests should be repeated after any breaks, such as lunch or overnight, or after the time limit set out in a Permit to Work has expired.

15 It may be necessary to issue individual monitors to people working in a confined space, so as to give them an instant warning of low oxygen, or toxic or flammable gas hazards.



Competence of monitors

16 All atmospheric monitoring must be carried out by persons who are trained and competent to use the instruments and interpret the results. They must have sufficient practical and theoretical knowledge to enable them to make a valid judgement based on the results. They must be fully aware of their responsibilities in permitting an entry into a confined space.

Hazards of excess oxygen

17 An oxygen-enriched atmosphere is, in itself, a major hazard. Organic materials, such as oil and wood, become highly combustible and ordinary materials, like paper and clothing, will burn with exceptional ferocity.

18 An increase of only 4% oxygen is sufficient to create a hazard and this may occur inadvertently. In oxyacetylene and oxypropane processes, sometimes not all of the oxygen supplied to a cutting torch is consumed. Some may be released, increasing the atmospheric oxygen above the normal 21%. The oxygen enrichment of the atmosphere in a confined space also results from the practice of using oxygen to sweeten or enrich the atmosphere when it has become oppressive, stale, hot, fume-filled or otherwise unpleasant. This is a very dangerous practice and must be prohibited.

19 Another way in which the atmosphere may become oxygen-enriched is through leakage from torches or hoses during meal breaks or overnight. For this reason, they should be removed at each break time. The deliberate kinking or nipping of an oxygen hose while changing a torch does not usually cut off the supply completely and can result in the release of substantial quantities of oxygen.

20 If excess oxygen is discovered, the space must be quickly evacuated and ventilated until normal levels of oxygen are regained.

1.5.5.12 Selection of personnel

1 Care is required in selecting the right people to work in confined spaces, since conditions can be difficult. They must be physically fit, agile and, most importantly, not be claustrophobic. People who suffer from asthma, bronchitis, or other respiratory conditions, or whose immune system has been suppressed, must be assessed by a medical practitioner as to their suitability to work in confined spaces.

2 Other health conditions which might indicate that a person is not suitable for working in a confined space, or that further checks need to be made before it is allowed, are:

(a) high blood pressure

(b) partial or complete deafness

(c) lack of mobility through joint problems

(d) diabetes

(e) depression or other mental illness

(f) defective eyesight (which is not corrected by wearing glasses)

(g) sensitivity of the skin to some substances

(h) taking some types of medication.

3 Stamina is also required. The wearing of any form of respiratory protection tends to lead to an increase in respiration and a higher use of energy; the amount of work which can be done in confined spaces is less than that expected under normal conditions.

4 When respiratory protection is to be used, it should be remembered that facial hair and spectacles often prevent a respirator from fitting properly and thus achieving the assumed

degree of protection.

5 Face-fit testing should be carried out to ensure that the chosen mask fits the wearer. This can be achieved quantitatively using a 'Portacount' for half or full face masks or qualitatively using bitter/sweet solutions for half or disposable masks.

1.5.5.13 Communications

1 Adequate and effective communications must exist between those inside and those outside the confined space, so that, in the event of an incident, a warning can be given and the space evacuated or those inside rescued. The system needs to be 'fail safe', ensuring that if a reply is not received or a scheduled call not made, the procedure for rescue starts immediately.

2 When a confined space is relatively small, such that the person entering it cannot move far from the entry point and there are no other factors that could hinder effective communication, the method of communication may be relatively simple such as a pre-arranged system of tugs on the safety rope, which must be fully understood by all involved. However, if the nature of the confined space, the job to be carried out and other factors necessitates the 'entry person' travelling some distance from the entry point, a more elaborate communication system might be required.

3 Factors that could hinder effective communication and may need to be considered in the risk assessment are:

(a) the level of noise inside or outside the confined space, which may or may not be associated with the confined space work

(b) the physical nature of the confined space or the presence of substances that could reduce visibility

(c) the distance between the point of entry and the place of work

(d) the presence of workers with little or no understanding of English, although it could easily be argued that such a situation should not arise in connection with working in confined spaces.

4 Depending upon the findings of the risk assessment, prior communication with the emergency services regarding the location and nature of the work, might be considered necessary.

5 All types of respiratory protection affect verbal communication to some degree and, whatever method of communication is chosen, it should be tested and proved outside the confined space before entry is made.

1.5.5.14 Work equipment

1 Due to the potential for a flammable or explosive atmosphere in confined spaces, selecting tools and other work equipment with which the work can be carried out safely is essential.

2 If there is any possibility of flammable gas existing in a confined space, all tools must be of a non-sparking material and all lighting and electrical equipment must carry BASEEFA* or equivalent approval. Smoking and naked lights must be strictly prohibited and care must be taken to avoid the generation of static electricity with the consequent risk of sparks.

* *British Approvals Service for Electrical Equipment in Flammable Atmospheres*

1.5.5.15 Fire safety

1 Hot works must not be carried out in a confined space unless atmospheric testing has confirmed that flammable or explosive gases are not present and the findings of a risk assessment show that it is otherwise safe to do so.

2 Where there is still a residual risk of fire, appropriate fire extinguishers may need to be kept in the confined space at the entry point.

3 Where 'hot works' are being carried out inside a confined space, the operative carrying out the work must also have a suitable and serviceable fire extinguisher at the place of work. In the event of a fire, the local fire service should be called in case the fire cannot be contained or extinguished.

1.5.5.16 First aid

1 Appropriate first-aid equipment and trained first aiders should be provided and available for emergencies and to provide first aid until professional medical help arrives.

1.5.5.17 Rescue

1 The arrangements for the rescue of persons in the event of an emergency, both in terms of trained persons and equipment, need to be suitable and sufficient. The arrangements must be in place before any person enters or works in a confined space.

2 Where there are no qualified in-house emergency rescue services, the external emergency rescue services should be informed of the area and type of work taking place in a confined space.

3 Proper and effective rescue training is quite hard and arduous and is not to be undertaken lightly. Persons selected for such training need to be physically fit and able to adapt to situations as they arise during a rescue.

4 If a person is **injured** in a confined space which has been certified safe to enter without respiratory protection, an entry can be made to rescue and remove them straight away.

5 When a person **collapses** in a confined space and the cause is not known, irrespective of whether or not the confined space was certified fit for entry without respiratory protection, no one must enter unless they are wearing breathing apparatus. The collapse may have been due to a deterioration in the atmosphere within the confined space. The first duty of any rescuer is to ensure that they do not become a casualty themselves.

6 Each year, would-be rescuers who are insufficiently trained or equipped die by going into confined spaces where a person has collapsed.

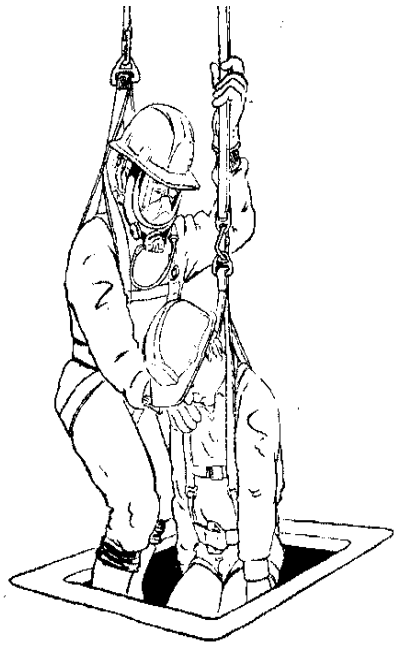
Rescue equipment

7 Every person entering a confined space wearing breathing apparatus must also wear a safety harness. The harness must be attached to a lifeline, attended by a person outside the confined space.

8 The harness must be one that is suitable for confined space rescue in that it must enable an unconscious person to remain in an upright position whilst being hoisted (see the following illustration). An unsuitable harness will allow the unconscious person to bend at the waist, making recovery through a narrow opening difficult or impossible.

9 This equipment forms part of a safe system of work for any entry into a confined space. Properly used, it may enable a rescue to be carried out successfully without the need for a rescuer to enter the confined space.

10 Rescue equipment must include some means of lifting or pulling a person up from a confined space, since it is virtually impossible for the average person to achieve this solely by muscular effort. There are a variety of tripods, winches, blocks and tackles which, when used in conjunction with a safety harness, enable a person to be lifted quickly and safely out of a confined space.



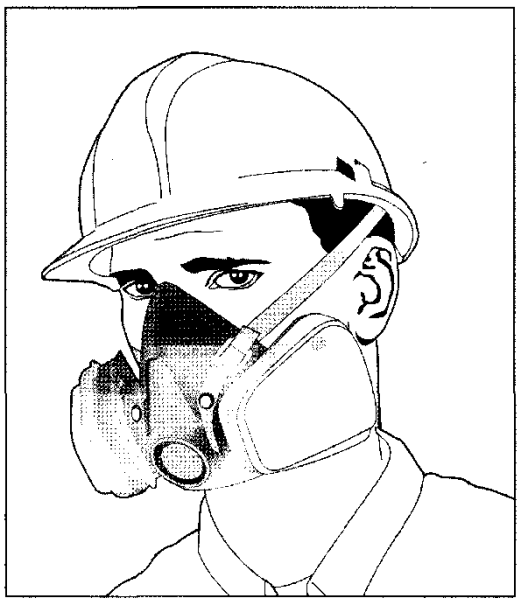
Dependent on circumstances, rescue equipment may have to include first aid

11 This would mean testing and inspection in accordance with the schedule drawn up by the competent person. In practice, harness, lines and accessories such as carabiners should be subjected to a formal thorough examination, by a competent person, every six months and checked by the user weekly and before each use. Tripods, hoists and other lifting devices need to be load tested every six months in the same way that a scissor lift used for lifting people would.

12 Dependant on circumstances, rescue equipment may have to include first aid equipment, oxygen or resuscitation packs and rescue breathing apparatus. A secure line of communication to the emergency services may also be required.

1.5.5.18 Respiratory protective equipment (RPE)

1 Respiratory protective equipment must be selected by a competent person, be 'CE' marked and be suitable for the type of hazard against which it is to protect the wearer.



2 A wide range of types of respiratory protective equipment is available from various manufacturers. The equipment functions on the basis of two distinct principles outlined below.

By purifying the air breathed

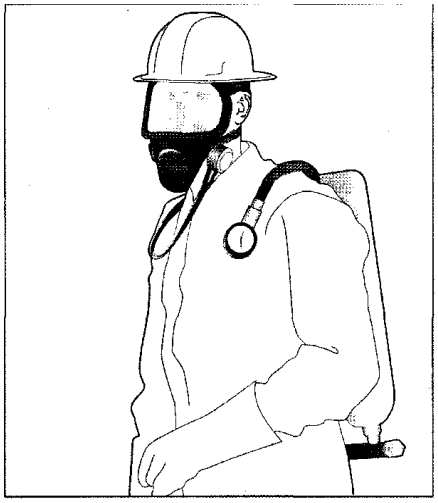
3 The air inhaled is drawn through a filter or medium that removes the harmful substance or pollutant. The nature of the filtering agent depends on the type of pollutant to be dealt with. These types are commonly called *respirators.*

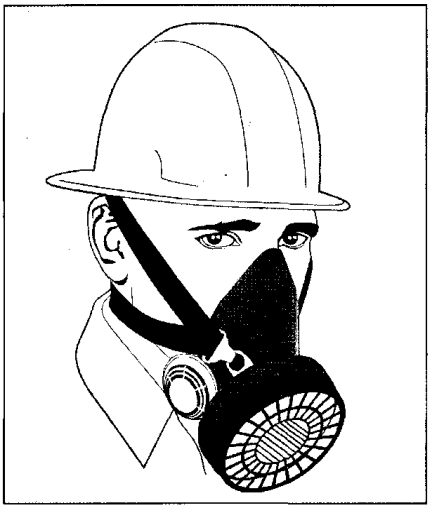
4 The simplest form of respirator is the 'dust mask', a preformed cup made of filtering material which fits over the nose and mouth to filter out nuisance dust. These masks give no protection against harmful or toxic gases or fumes and the protection factor of the mask may not offer adequate protection against the level of airborne dust that can be experienced in a confined space.

5 More complex types have filter cartridges that may be general for various types of dust or fume, or specific to a particular substance.

By supplying clean air

6 The air can be supplied straight through an air line via a pump or compressor or, alternatively, the person may carry compressed air in cylinders.





7 These types are known as *breathing apparatus.*

8 An alternative type of breathing equipment is the self-rescue set. This comprises a small compressed air bottle, the necessary hoses and valves and a face piece. Self-rescue sets can be carried by operatives who enter confined spaces in which the air is initially safe to breathe.

9 Should the air quality deteriorate, the face piece is placed over the nose and mouth and the air valve opened. The air bottle supplies fresh air to the operative whilst an escape from the confined space is made. The air bottle of a self-rescue set has a duration of typically 15-20 minutes.

10 The chart reproduced from BS 4275 at Appendix 2 details the different types of respiratory protective equipment and the system of classification. Whilst BS 4275 has now been withdrawn, it is considered that the chart still offers good guidance on general principles of selecting appropriate respiratory protective equipment.

11 Care must be taken to select the correct type of protection for the conditions. Respirators (as opposed to breathing apparatus) do not protect against oxygen deficient atmospheres and should not be used in any atmosphere dangerous to life. Respiratory protective equipment should not be used unless all other methods of control or protection have been examined and it is established that the use of RPE is the only reasonably practicable solution.

12 Respirators can only be used for protection against the gases or dusts for which they are specifically intended. It is important to note that dust masks and canister and cartridge respirators have a limited period of usage before becoming clogged with the contaminant. They may also have a limited shelf life, indicated by a *use-by* date.

1.5.5.19 Permits

Permit to Work

1 Every entry into a confined space must be made under a Permit to Work, whereby a competent person must be satisfied that all necessary precautions have been taken and provisions made

to secure the safety of those entering the confined space, before signing the Permit to Work. The signed Permit thus gives an assurance that work may safely take place.

2 Appendix 3 to this module shows an example of a Permit to Work. The content may be varied to meet individual requirements.

3 Permits should only be issued by named authorised persons, who must sign them. Such persons must be competent, have authority and possess sufficient practical and theoretical knowledge and actual experience of working conditions to enable them to judge whether everything necessary has been done to ensure the safety of personnel. It is quite common for several authorised persons to sign a Permit to Work, each certifying that they have taken the necessary actions with regard to their own area of responsibility, for example, electrical isolation, atmospheric testing. Where a Permit to Work system involves the use of padlocks and keys, for example for locking-off electrical isolators or other sources of energy, the keys must stay with an authorised person until such time as the Permit is returned for cancellation.

Permit to Enter

1 Depending upon the nature of the confined space and the inherent risks of carrying out the work, some Contractors may choose to run a separate Permit to Enter system.

2 An example of when such a system might be used is where all preparatory work is carried out to meet the requirements of the Permit to Work and then the Permit to Enter is issued when final pre-entry checks of the atmosphere have been carried out.

3 Such a system would cover situations where:

(a) a single Permit to Work covers the duration of the whole job, but

(b) successive shifts of workers are each authorised to enter the confined space under a newly raised Permit to Enter.

1.5.5.20 Access and egress

1 Where it is practical, a safe way in and out of the confined space should be provided and, wherever possible, allow quick, unobstructed and ready access, such as a fixed, vertical ladder inside an underground chamber that terminates just below the entry/exit point at ground level.

2 The means of escape must be suitable for use by the individual who enters the confined space so that, ideally they can quickly escape in an emergency. However, it must be accepted that in many cases the entry/exit point will be of a restricted size that will not necessarily allow an easy escape route in an emergency, particularly if the person who is escaping is wearing a compressed air cylinder. The means of achieving a prompt escape or rescue must be considered in the risk assessment.

3 Suitable means to prevent access, for example a locked hatch, should also be in place when there is no need for access to the confined space. There should be a safety sign that is clear and conspicuous to prohibit unauthorised entry alongside openings that allow for safe access.

1.5.5.21 Conclusion

1 For work to be done safely in a confined space, great care has to be taken over the detail of each step of the procedure. Common causes of accidents are:

(a) poorly trained and equipped workers

(b) the failure to put in place adequate emergency arrangements before work starts

(c) the failure to carry out an initial check of air quality

(d) the failure to set up a safe system of work, including continuous air monitoring, based around a Permit to Work system

(e) the failure to follow an established safe system of work

(f) the incorrect use of respiratory protective equipment

(g) the use of the incorrect type of respiratory protective equipment

(h) the failure to use safety harnesses and lifelines

(i) ill-conceived and badly executed rescue attempts.

2 All such accidents are avoidable. If an accident does occur, it demonstrates that a breakdown has occurred in the supposed safe system of work.

Construction Site Safety
1.5.5 Appendix 1

Checklist 1 -Work in a confined space without entry of persons

1 Ensure that entry into the space is totally prohibited.

2 Ensure that the isolation of services and processes is carried out as necessary.

3 Wash, clean, and purge the workplace, as appropriate, for work to be done.

4 Ensure that there is a safe system of work for the people concerned.

5 Ensure that other people know that work is going on.

6 Authorise work to start only on the issue of a Permit to Work.

Checklist 2 - Entry into a confined space without breathing apparatus

7 Follow a safe system of work.

8 Put in place adequate emergency arrangements before work starts, which will also safeguard rescuers.

9 Initiate a Permit to Work which includes the requirements of a Permit to Enter unless separate permits are raised.

10 Withdraw the space from service.

11 Isolate the workplace from electrical, mechanical, chemical, heat and all other sources.

12 Check that no inward leakage of gas, fumes, steam or liquids is possible.

13 Clean, drain and purge the workplace as necessary for the type of work to be carried out and entry to be made.

14 Test the atmosphere for oxygen, flammable gas, toxic gas, etc.

15 Carefully check any sludge or deposit that may harbour gas, fumes or liquids.

16 Carry out a COSHH assessment, if necessary.

17 Arrange for any checking to be carried out remotely.

18 If necessary, clean, purge and ventilate the workplace again until the atmosphere is safe to enter.

19 Ensure that all tools and equipment are safe to use in the area.

20 Check the provision of protective clothing, harness, lifelines, rescue equipment and rescue personnel.

21 Ensure that rescue personnel are trained in the use of the equipment and capable of using it.

22 Ensure that the fire and rescue service is informed of the location and nature of the work, where appropriate.

23 If appropriate, ensure that the external emergency rescue services are informed of the location and type of work being carried out.

24 Brief all personnel on what is to be done and arrange communications.

25 Issue the Permit to Work which

26 authorises entry and fixes a timescale within which the work must be completed.

27 Constantly monitor the workspace and communications.

28 If the task is completed within the timescale, advise all concerned, cancel the Permit to Work and return the space to service.

29 If the work is not completed in time, withdraw all staff, cancel the Permit to Work and consider how best to proceed.

Checklist 3 - Entry into a confined space with breathing apparatus

30 Follow a safe system of work.

31 Put in place adequate emergency arrangements before work starts, which will also safeguard rescuers.

32 Initiate a Permit to Work.

33 Withdraw the space from service.

34 Isolate the workplace from electrical, mechanical, chemical, heat and all other sources.

35 Check that no inward leakage of gas, steam or liquids is possible.

36 Clean, drain and purge the workplace as necessary for the type of work and entry.

37 Test the atmosphere for flammable gas, toxic gas, oxygen, etc.

38 Decide which type of breathing apparatus is to be used.

39 Ensure that the personnel involved have a current valid certificate for the type and use of breathing apparatus.

40 Ensure that all tools and equipment are safe for use in the work area.

41 Check the provision of protective clothing, harness, lifelines, rescue equipment and rescue personnel.

42 Ensure that rescue personnel are adequately trained in the use of rescue equipment and are capable of using it correctly.

43 Ensure that the fire and rescue service is informed of the location and nature of the work, where appropriate.

44 If appropriate, ensure that the external emergency rescue services are informed of the location and type of work being carried out.

45 Brief personnel on what is to be done and arrange communications.

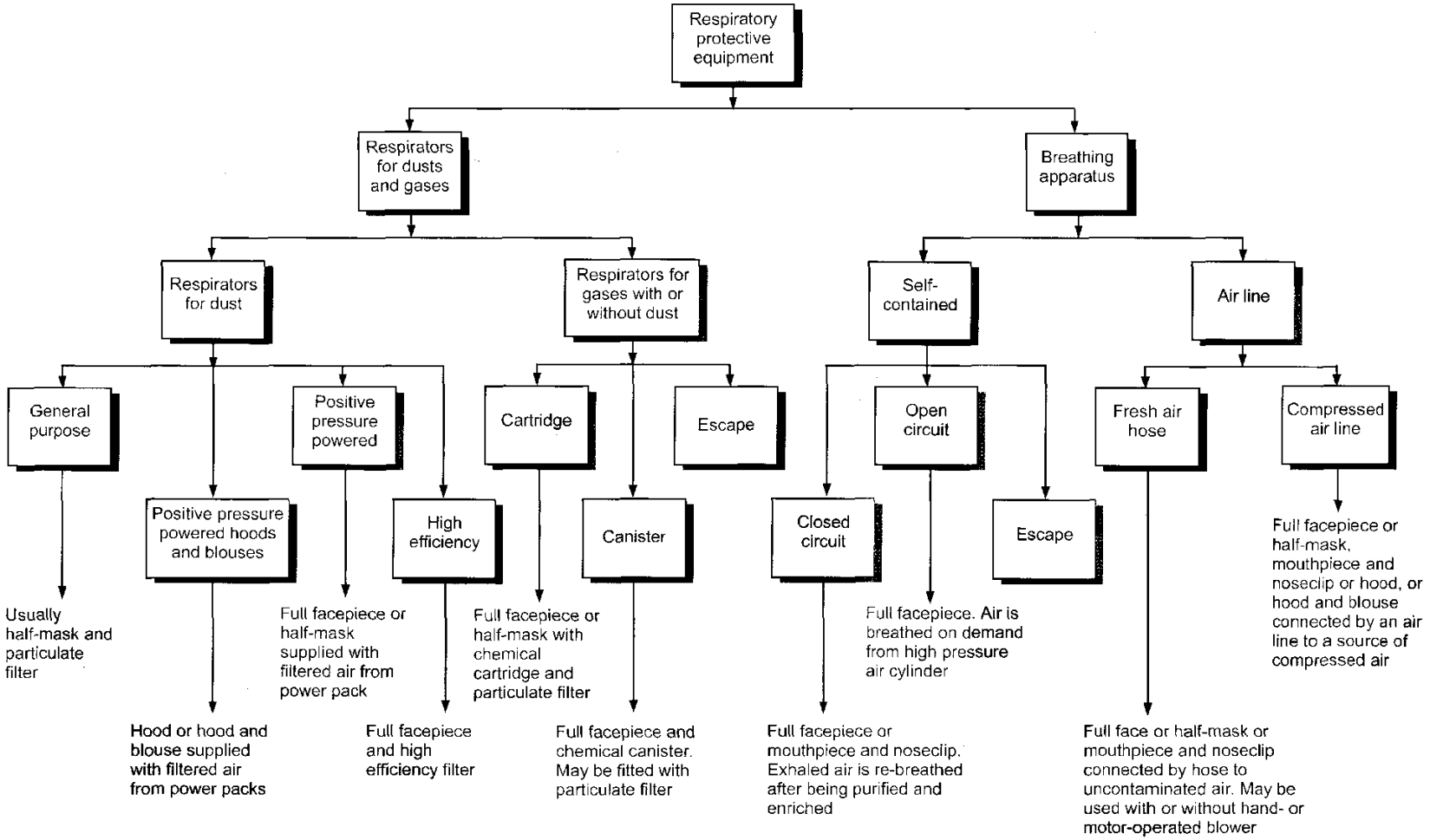
46 Issue the Permit to Work which authorises entry and fixes a timescale within which the work must be completed.

47 Constantly monitor the workspace and communications.

48 If the task is completed within the timescale, advise all concerned, cancel the Permit and return the space to service.

49 If the work is not completed in time, withdraw all staff, cancel the Permit to Work and consider how best to proceed.

Construction Site Safety
1.5.5 Appendix 2
Classification of types of respiratory protective equipment



Construction Site Safety

1.5.5 Appendix 3

Possible Layout for a Permit to Work Certificate

<table>
<tr><td colspan="2">PLANT DETAILS (Location, identifying number, etc.)</td><td rowspan="2">ACCEPTANCE OF CERTIFICATE</td><td rowspan="2">I have read and understood this certificate and will undertake to work in accordance with the conditions in it

Signed Date Time</td></tr>
<tr><td colspan="2">WORK TO BE DONE</td></tr>
<tr><td>WITHDRAWAL FROM SERVICE</td><td>The above plant has been removed from service and persons under my supervision have been informed

Signed Date Time</td><td rowspan="2">COMPLETION OF WORK</td><td rowspan="2">The work has been completed and all persons under my supervision materials and equipment withdrawn

Signed Date Time</td></tr>
<tr><td>ISOLATION</td><td>The above plant has been isolated from all sources of ingress of dangerous fumes, etc.

Signed

The above plant has been isolated from all sources of electrical and mechanical power

Signed

The above plant has been isolated from all sources of heat

Signed Date</td></tr>
<tr><td colspan="2"></td><td>REQUEST FOR EXTENSION</td><td>The work has not been completed and permission to continue is requested

Signed Date Time</td></tr>
</table>

<table>
<tr><td>CLEANING AND PURGING</td><td>The above plant has been freed of dangerous materials

Material(s): Method(s):

Signed Date Time</td><td>EXTENSION</td><td>I have re-examined the plant detailed above and confirm that the certificate may be extended to expire at

Further precautions:

Signed Date Time</td></tr>
<tr><td>TESTING</td><td>Contaminants tested Results

Signed Date Time</td><td colspan="2">THE PERMIT TO WORK IS NOW CANCELLED. A NEW PERMIT WILL BE REQUIRED IF WORK IS TO CONTINUE</td></tr>
<tr><td colspan="2" rowspan="2">I CERTIFY THAT 1 HAVE PERSONALLY EXAMINED THE PLANT DETAILED ABOVE AND SATISFIED MYSELF THAT THE ABOVE PARTICULARS ARE CORRECT

*(1)THE PLANT IS SAFE FOR ENTRY WITHOUT BREATHING APPARATUS

(2) BREATHING APPARATUS MUST BE WORN

Other precautions necessary:

Time of expiry of certificate:

* Delete (1) or (2)

Signed Date Time</td><td colspan="2">Signed Date Time</td></tr>
<tr><td>RETURN TO SERVICE</td><td>I accept the above plant back into service

Signed Date Time</td></tr>
</table>

Construction Site Safety

1.5.6 Safety in Demolition

1.5.6.1 Key points

1 Demolition can be dangerous and should be left to competent persons. Almost all demolition projects will encounter asbestos.

2 Planning and supervision is vital to ensure a successful completion of demolition..

3 Ensure that appropriate survey has been undertaken.

4 Ascertain if the structures are stable before starting and that instability can be avoided unless planned.

5 Ensure written risk assessments and method statements are developed, communicated and understood by all involved in any kind of demolition works.

6 Salvage or soft stripping is hazardous and must be planned and controlled to avoid the risk of falling objects or collapse.

1.5.6.2 Introduction

1 Safe demolition is a very complex and technical skill. It is also potentially very dangerous if carried out by Contractors who are not fully aware and competent in demolition techniques.

2 Information, planning, responsible implementation and controls are the essential elements for safe and successful demolition projects.

3 Whether demolition is required for a small building or for a complex factory site, permanent or temporary structures, one must be aware of the hazards and risks. These need to be identified, assessed and effectively controlled to reduce the potential for injury to persons and damage to property.

1.5.6.3 The Management of Health and Safety at Work

1 These Regulations place a requirement on every Contractor to make a suitable and sufficient assessment of every work activity. This is to identify any hazard that employees, or any other person who might be affected, may encounter during the work and to put control measures into place. These measures will aim to remove the hazards, or reduce the risks to health and safety arising out of those hazards, as far as is reasonably practicable.

2 The Contractor must provide comprehensive and relevant information on risks that exist in the workplace and on any control measures that are in place, ensuring these are fit for purpose and monitored for ongoing safety.

3 Employees including workers have a duty to tell their Contractor of any work situation, including near misses, which presents a risk to the health and safety of themselves or of any other person who might be affected.

4 Where specific health hazards are identified, the Contractor must offer health surveillance to the at-risk employees. Given the nature of demolition and the potential hazardous substances that may be encountered, this duty could be particularly relevant to demolition contractors.

1.5.6.4 The Provision and Use of Work Equipment

1 These Regulations cover equipment used in demolition. They require that a Contractor supplies work equipment that is safe, correct and suitable for the job, and that the equipment is maintained. Selection of the equipment shall be based on risks and aimed at minimizing the exposure of a person directly or indirectly.

2 Demolition has traditionally involved some work being carried out at height, which has in the past been the cause of deaths and injuries to demolition operatives. Due to advances in demolition techniques, and the increasing size and reach of the machines used, there is no longer such a need to work at height. However, where work at height is carried out, it must be done in a safe manner.

3 Under these Regulations, falling object protection is required for the machinery being used. A demolition specification excavator must have a cab guard, as it is foreseeable when working overhead that material could fall onto the cab. The use of reinforcing bars as make-shift retaining pins for attachments would be contrary to these Regulations.

4 It is common to see mobile crushers used in the demolition process to process the demolition arising for reuse as part of the next use of the site. These machines pose great risks to the untrained. Issues such as machinery guarding and clearing blockages, as well as noise and vibration, must be considered.

5 The Contractor appointed by the client to carry out demolition works shall provide the full sequence of the works, detailing risks and mitigation. The sequence of the demolition shall be communicated and/or discussed with the operatives involved.

1.5.6.5 Work at Height

1 These Regulations require Contractors to:

(a) avoid the need to work at height where reasonably practicable

(b) select the most appropriate work equipment when work at height cannot be avoided

(c) (as far as is reasonably practicable) prevent falls

(d) reduce the distance and consequences if there is a fall

(e) where harnesses are being used, ensure emergency recovery arrangements are in place

(f) ensure that all work at height is based upon a risk assessment and carried out safely.

2 Where the use of work equipment involves a specific risk to health and safety, the use of the equipment must be restricted to competent, specified workers authorised to carry out the task.

3 The use of demolition machines, and in particular ultra high reach machines, is an important part of the strategy to reduce the need for employees to work at height during demolition activities.

1.5.6.6 Personal Protective Equipment

1 These Regulations require that where a risk has been identified by a risk assessment, and it cannot be adequately controlled by other means which are equally or more effective, the Contractor must provide and ensure that employees use suitable personal protective equipment.

2 In essence, personal protective equipment (PPE) may only be used as a last resort after all other means of eliminating or controlling the risk have been considered and are not practicable.

3 Whenever PPE is to be issued, the Contractor must ensure that employees have been given adequate and appropriate information, instruction and training to enable the employees to understand the risks being protected against, the purpose of the PPE and the manner in which it is to be used.

4 Whilst the Contractor must ensure that personal protective equipment is supplied and used, the employee has a duty to properly use the equipment provided, follow the information, instruction, and training that they have been given, and know the procedures for reporting loss or defects to their Contractor.

5 These Regulations require that the Contractor provide employees with adequate information, instruction, training and supervision to be able to carry out any work safely and without risks to their health.

1.5.6.7 Construction (Design and Management) CDM

1 CDM applies to all demolition and dismantling work, as defined in BS 6187, regardless of the project's size or duration.

2 Every contractor undertaking demolition operations must appoint one or more competent person(s) to plan and supervise the work. Under CDM it is a requirement that any duty-holder who puts 'another person' to work on a construction site, for example a contractor engaging the services of a demolition contractor, must ensure that the person is competent to do what is required of them.

3 The client has to ensure that there are adequate welfare arrangements and health surveillance for those involved. The demolition contractor is therefore expected to control and co-ordinate all aspects of health and safety regardless of the size of the project.

4 The National Federation of Demolition Contractors (NFDC) and the Institute of Demolition Engineers (IDE) can provide information regarding the competence required for particular projects.

5 CDM requires the following:

(a) The demolition or dismantling of a structure or part of a structure shall be planned and carried out to prevent danger so *far as is reasonably practicable,* or reduce the danger to as low a level as is *reasonably practicable.*

(b) The arrangements for carrying out demolition or dismantling work shall be recorded in writing, prior to the commencement of the work.

1.5.6.8 CDM duty-holders

1 The **client** is responsible for the provision of information such as Type 3 asbestos surveys/service information and must appoint various other duty-holders. The client must also ensure that adequate welfare facilities are provided, and not permit work to start until there is evidence of adequate health and safety management systems and planning.

2 The **designer** is responsible for making the client aware of the client's responsibilities under these

Regulations as well as the design of the project. Many duty-holders can have designer responsibilities as outlined in CDM.

3 The Engineer is responsible for the co-ordination of health and safety design and planning aspects for projects, including:

(a) identifying and collecting pre-construction information

(b) informing the client if there are gaps in the pre-construction information, which need to be addressed (for example additional surveys)

(c) distributing relevant parts of the pre-construction information to contractors to enable them to tender for, or prepare to carry out, the work

(d) generally managing the flow of information between all parties

(e) preparing the health and safety file

4 The Engineer is also to advise - the client on the competency and resourcing of contractors and to ensure that the Contractor's health and safety plan is adequately developed prior to the work starting on site.

5 The minimum lead times for the project must form part of the information pack. This is a very important development as, historically, the mobilisation period imposed by clients for this sector of the industry has been too short to allow for adequate planning. Engineers must themselves be competent; demolition and asbestos issues may be too specialist for many who normally perform the Engineers role and they should be prepared to take specialist advice.

6 The **Contractor** must ensure that the client is aware of their duties and is responsible for the overall construction phase, taking into account health and safety issues and the development of the health and safety plan.

7 Contractors and other workers must all work together as a team to achieve high standards in health, safety and welfare on site. The contractors, which normally include utility companies, must co-operate with the Contractor by obeying site rules, and so on.

1.5.6.9 The health and safety plan and the health and safety file

1 The health and safety plan provides a focus for the construction phase of a project.

2 Relevant pre-construction information, relating to the health and safety hazards associated with the work, including sequence of activities (where essential) should be provided by the client regardless of the size of the project.

3 In the context of this section, such information is likely to include:

(a) the location and physical state of any asbestos where its presence has been identified by a comprehensive invasive asbestos survey (Type 3 as defined in MDHS 100

(b) the results of structural surveys

(c) plans identifying the location of underground services

(d) the possible presence of contaminants, for example:

(i) poly chlorinated biphenyls (PCBs) in old electrical transformers

(ii) the residual contents of tanks and pipelines

(iii) the location and nature of contaminated ground

(iv) other information which is required to ensure that the work can be planned safely.

4 After being appointed by the client, the contractor must use the pre-construction information provided by the client to develop the construction phase plan to the satisfaction of the client, as advised by the Engineer.

5 The health and safety plan must be:

(a) completed prior to any work commencing on site

(b) reviewed and amended as often as is necessary for the duration of the project.

6 The health and safety file is a record of information for the client or end user of the premises. It tells those who might be responsible for the structure in future, of the risks that will have to be managed during any maintenance, repair or renovation. Generally, for demolition work the health and safety file will contain information such as details of:

(a) any services, which have been capped or discovered and worked around

(b) the presence of any voids and details of any areas that may have been filled

(c) the actions taken to remove or treat contaminated land

1.5.6.10 British Standard

1 BS 6187:2000 is the British Standard for Demolition. It recommends good practice methods for the demolition (both partial and whole), as well as decommissioning, of sites including buildings and structures. It takes into account safety, health and issues which affect protection of the environment.

1.5.6.11 Definitions and terms used by the demolition industry

1 **Competent person in demolition:** someone who has practical and theoretical knowledge, with actual experience, of the type of demolition which is taking place on the site. This person is generally accepted to be on site full time as the person responsible for the demolition activity.

2 **Demolition;** the deliberate pulling down, destruction or taking apart of a structure or a substantial part of a structure. It includes dismantling for re-erection or reuse.

3 **Exclusion zone:** an area where people are fully (sometimes partially) excluded during a demolition activity. This zone should be determined by a competent person, detailed in the health and safety plan, and may need to be defined by physical barriers on site.

4 **Facade retention:** where the outer wall of a building or structure is retained in its original position during the demolition phase. It is usually supported by a facade retention system, internal or external.

5 **Fan:** a protective screen fixed to scaffolding to contain falling debris during demolition. Any fan must be designed to withstand the intended load.

6 **Felling:** the deliberate collapse of a structure in such a way that the debris falls in a predetermined area.

7 **Hot work:** the application of heat (including the use of tools that can produce an incendiary spark). It generally uses oxygen and propane gas cutting equipment.

8 **Propping and shoring:** a system of temporary supports to prevent movement.

9 **Safe working spaces:** areas where demolition work is taking place, often protected by physical barriers (e.g. machines protected by ROPs, FOPs and MOPs as applicable).

Machine-mounted attachments

10 **Brock:** a trade name for a range of remote control excavators, which can carry most demolition attachments.

11 **Combination Cutter:** a tool which can crush concrete and also cut steel reinforcing bar.

12 **Demolition ball:** a cast steel ball (drops or pendulum swings in line with the jib) used to demolish a structure (slew balling should be avoided; this technique is very rarely used now).

13 **Grapple:** a powered claw for handling waste and recycled material.

14 **Impact hammer:** a large breaker, mounted on an excavator, and usually powered by hydraulics (occasionally by compressed air).

15 **Pulveriser:** hydraulically powered jaws for crushing concrete. It may be hand/machine/ crane mounted.

16 **Pusher arm:** an extension to an excavator, which enables it to carry out high reach demolition.

17 **Shear:** powered jaws for cutting metal.

18 **Rotator:** an attachment fitted between the tool and the end of dipper arm of the excavator, which allows the tool to be turned. Essential for most work in restricted sites.

1.5.6.12 Asbestos considerations

1 Control of Asbestos:

(a) state that all asbestos containing materials should be removed prior to demolition so far as is *reasonably practicable*

(b) require that the necessary planning actions and notifications are carried out.

2 The management process should be based upon the information from an Asbestos survey, carried out before contractors are invited to tender for the demolition. This should include a drawing of the building footprint (all floors) and a list of the approximate amounts and locations of asbestos-containing materials found.

3 From the survey, an inventory of asbestos containing materials should be made and ticked off when they are removed. This should prevent creating risk during soft strip and demolition.

4 There are many occasions when asbestos containing materials are only revealed during the demolition.

5 Machine drivers need to be trained in basic asbestos recognition so that they can stop work and take advice if they discover suspicious materials.

1.5.6.13 Planning for demolition

It cannot be emphasised too strongly that demolition is dangerous and must be left to the experts.

Planning and supervision are of paramount importance.

1 Before any work starts, the implications of the demolition to be carried out must be determined, for example:

(a) What is the age of the building(s) and what was (were) the previous use(s)?

(b) What was the type of construction and what were the materials used?

(c) How much is to go?

(d) Are floor slabs or piles involved?

(e) Where are the separation points?

(f) Are there any dangerous substances in, around or under the buildings which are to be demolished, e.g. asbestos, lead paints, flammable liquids, unidentified drums or packages, etc.?

(g) Is the building on contaminated land?

(h) Are there any site restrictions?

(i) Are there people and adjacent properties that may be affected by the proposed working hours?

(j) Will people be affected by noise or vibration emanating from the site?

(k) You may need to carry out a dilapidation survey of the adjacent buildings and or highways.

2 Once these things have been determined, decisions should be taken as to what are the acceptable or unacceptable methods to carry out the demolition.

3 Three important final questions remain.

(a) How should the job and site be left safe?

(b) What is the time scale for the job to be carried out and is it sufficient for the demolition to be carried out safely?

(c) What is the sequence of demolition that would be adopted, for e.g. the sequence shall

identify on the sections of the structure, whether the top or base would be the starting point, which structures should be brought down first to minimise the impact on the machinery and personnel, and so on?

1.5.6.14 The selection and appointment of a demolition contractor

1 The Contractor, in selecting a demolition contractor, should satisfy themselves of the contractor's competence, knowledge, ability and resources to carry out the work safely.

2 Expertise is vital.

1.5.6.15 Essential elements of a demolition health and safety plan

1 Some or all of the following points may be covered in the risk assessment and method statement for the proposed job.

1.5.6.16 Project information

1 Names, addresses, contacts and telephone numbers should be detailed indicating the project managers, quantity surveyors, architects, structural engineers, safety personnel etc.

1.5.6.17 Scope of work

1 An explicit and concise opening paragraph should be included, outlining the extent of work along with any other related activities, e.g. asbestos removal, facade retention, etc.

1.5.6.18 Existing environmental information and drawings available

1 Where available, construction drawings should have been supplied to the contractor, along with information on the former use of the site or buildings to be demolished. This information (if any) physical or chemical hazards are on the site or in the buildings, e.g. underground tanks and/or potential chemical or biological hazards or contaminated land.

1.5.6.19 Risk assessment and special hazards

1 Having gathered all available information and visited the site to assess the work involved, along with identifying all known hazards and confined spaces, the contractor's appointed person on site should ensure that risk assessments, and assessments for asbestos, COSHH or noise are made. Method statements shall then be drawn up.

2 Consideration must be given at an early stage to control the access for workers and any visitors, and ensure separate access and egress for vehicles, plant and machinery.

3 Finally, assess the impact that the site environment will have on any people who might be affected by the activity, such as neighbours or members of the public.

1.5.6.20 Programme

1 The programme time allocated must be adequate to allow the demolition work to be carried out safely. This should detail the correct sequence of the works with any stop and review points.

2 Where the programme has unavoidable interfaces with other trades or contractors on site, this must be recognised as a potential area of risk. Good communications, planning and management are therefore essential to ensure high standards in health and safety.

1.5.6.21 Services

1 Before any work starts, all utility companies should be contacted by the Contractor and sent a site plan, showing the footprint and extent of the planned demolition, and requesting the disconnection or isolation of the appropriate service (i.e. electricity, gas, water, telecommunications or other cables).

2 These requests should be made in good time and be acknowledged in writing by the relevant utility, with confirmation that the services have or will be isolated or disconnected.

3 Where such disconnection is not possible, any pipes or cables should be clearly identified, marked and protected to ensure that they are not disturbed during the works.

4 If overhead power lines are present, care needs to be taken, particularly where machines, cranes or excavators with high reach are to be used. Adequate control measures should be put in place (e.g. warning goalposts).

1.5.6.22 Contractors

1 Competent contractors should be carefully selected and appointed. Their activities should be detailed in the health and safety method statement and incorporated into the health and safety plan.

2 All contractors must be adequately supervised, controlled and made aware of any site rules and emergency procedures.

1.5.6.23 Plant and equipment on site

1 Confirmation that personnel operating the machinery and equipment have been trained in their safe and proper use for the types of machine being operated) should also be kept readily available.

2 All plant, machinery and any associated equipment should be properly isolated and secured at the end of each shift.

1.5.6.24 Site signage and security

1 The demolition area must be clearly defined by both physical barriers and adequate signage.

2 The demolition zone and exclusion areas may vary quite dramatically during the different activities which will take place on the site and must be properly maintained and controlled.

3 Typical signage on demolition sites includes the following text:

Danger – demolition in progress - No un-authorised access

Safety helmets must be worn at all times

[Organisation's contact details]

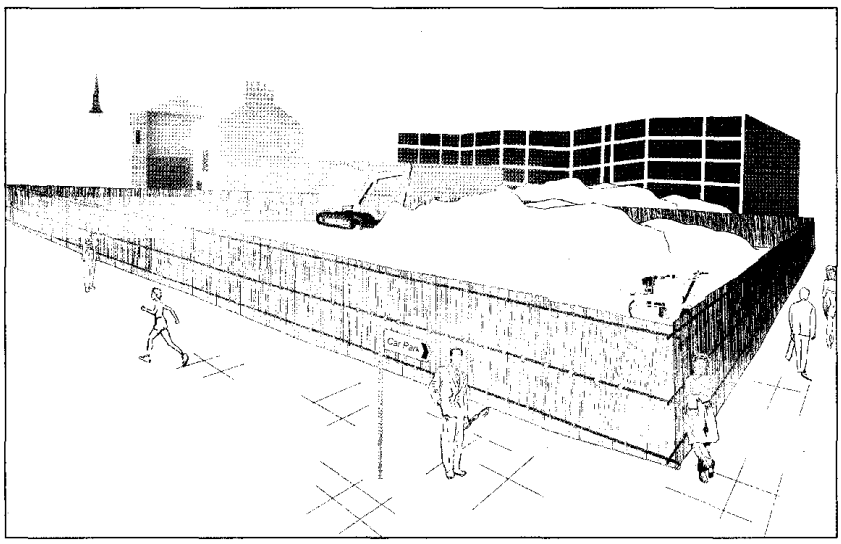
4 Typical physical barriers may include the following:

(a) existing walls with adequate secured hoarding to a minimum of 1.8 (but preferably 2.4) metres high, sheeted in plywood or corrugated iron sheeting

(b) an existing access scaffold with hoarding around the base as above

(c) temporary ready fencing securely bolted together.

5 Where there is the likelihood of trespassers or vandals, 24-hour security arrangements may have to be implemented.



Site fully enclosed by a physical barrier

1.5.6.25 Protection of people

1 The hierarchy of risk management must be applied, i.e. where possible avoid the risk, then reduce, manage and control to an acceptable level of protection.

2 Where demolition is being carried out above or unavoidably close to the public, adequate protection must be provided, e.g. fully sheeted scaffold with either 'Monarflex' or debris netting. If necessary, also provide scaffold fans and walkways.

1.5.6.26 Access and egress

1 Safe access and egress, both to the site and the workplace, must be clearly defined and maintained at all times for use by personnel, equipment, vehicles and emergency services.

2 Where practicable, pedestrians should be segregated from vehicles, plant and equipment movements.

1.5.6.27 General site safety

1 Adequate procedures for action in the case of an emergency should be developed, implemented and communicated to all on site.

2 Adequate fire-fighting equipment must be available at all times, especially when any hot work is being undertaken.

3 A telephone or another form of communication must always be available on site to summon emergency services as necessary.

1.5.6.28 Welfare

4 The Contractor is responsible for ensuring that there are adequate and maintained welfare facilities. Welfare requirements should ensure that all involved in the project are made aware of heat stress and/or work stress. Ensure that the operators of equipment’s are of the risks associated with the type of demolition works.

1.5.6.29 First aid

1 An assessment should have been carried out by the demolition contractor.

2 This will confirm the adequacy or otherwise of the company's arrangements for first aid. Any shortcoming identified by the assessment must be rectified.

3 On a demolition site it is envisaged that the minimum requirement will be a trained first aider or a number of trained emergency aiders, all with access to adequate first-aid facilities.

1.5.6.30 Scaffolding and access equipment platforms

1 All access scaffolding or equipment must be fit for its purpose, properly designed, constructed of sound material and not so overloaded as to risk a collapse.

2 Scaffolding that is to be fitted with fans, debris netting or sheeting must be designed to take into

account wind loadings and the changing conditions on site (e.g. the partial removal of structures which will affect the wind loading and ties). It is essential to ensure that the scaffold contractor fully understands the intended demolition method so that they can decide on the placement of scaffold ties.

3 Whenever scaffolding is provided as a means of access to the workplace, the contractor should ensure that the completed scaffolding has a handover certificate before allowing any of their personnel to work on it. Alterations to scaffolding must only be carried out by specialist competent persons.

4 It is the responsibility of the Contractor that scaffolding is inspected regularly and that suitable records of inspections are kept.

5 Mobile tower scaffolds should be erected in accordance with the manufacturer's instructions by trained personnel only.

6 In line with good practice, access should be by stair towers; however, ladders that are used for access to working platforms should be:

(a) free from defects and not painted

(b) placed on a firm footing

(c) used at an angle of approximately 75° (1 part out at the base to 4 parts up)

(d) securely fixed at the top

(e) extend at least five rungs (1 metre) above the working platform unless an adequate, separate handhold is provided.

7 Where the demolition work requires that a progressive dismantling of the scaffolding takes place, attention must be paid to the remaining scaffold's stability, for example the adequacy of the remaining working platforms, ties and bracing.

8 After each time that the scaffold is modified and before it is next occupied, it must be inspected by a competent person to certify that it is still safe to work on, and a record of the inspection made

9 Where self-propelled mobile access platforms are used, Contractors must ensure that the operator is properly and adequately trained.

10 Additionally, care must be taken to ensure ground conditions are acceptable for these platforms.

11 Where the work requires employees to work from cradles (and/or suspended baskets) attached to a crane, a dead man's handle should be fitted with the ability to be power lowered only.

1.5.6.31 Fall-arrest equipment

1 Operatives must receive training in the inspection and safe use of safety harnesses, worn at all times when working in such equipment. These harnesses must be secured to an anchor point in the equipment. The harness and lanyard must be inspected each time they are worn. This is very important for anyone involved in hot works which could result in damage to a harness or lanyard.

2 With the progressive nature of demolition projects, harnesses are commonly used to prove a quick solution to a difficult access problem. It is vital that the following basic check is performed to avoid selecting an anchor point that is simply too close to the ground. The wearer needs to

allow for:

(a) their height

(b) the length of the lanyard

(c) the extended length of any fall absorption device.

3 In many instances this will mean that a minimum of a 5.5 m 'fall distance' is required to enable a fall to be safely arrested. This needs to be factored into the plan for working at height. It does not mean that harnesses may not be the safest way to do the work; just that restraint lanyards or work positioning harnesses, as opposed to fall-arrest equipment, are more appropriate in some circumstances.

4 There is significant concern regarding how long someone can survive if they do fall whilst wearing a harness and are suspended in it. Unless they are rescued immediately they are likely to suffer from a potentially serious medical condition known as 'suspension trauma'. Before work starts an effective rescue plan must be developed, which would ensure that someone who has fallen is rescued as soon as is practical and certainly within 10 minutes.

1.5.6.32 Structural engineers

1 The expertise of a structural engineer shall be used in the following cases:

(a) in the design of a facade retention scheme

(b) where there is doubt over the building's stability

(c) where there is doubt about the proposed method of demolition

(d) where there is doubt about the capacity of the building to take loadings.

2 It is good practice to consult a structural engineer at the planning stage of demolition to avoid uncontrolled collapse.

1.5.6.33 Methods of demolition

1 This section gives an outline of the types of demolition techniques commonly employed.

Risk assessments, method statements and sequence

2 The key to a successful demolition is to ensure the appropriate risk assessments and method statements have been developed to identify the correct sequence of carrying out the work. These must be fit for purpose, clearly communicated and understood by the persons using them.

Partial demolition

3 Partial demolition is often carried out where refurbishment is being undertaken and can include facade retention. In any demolition, daily or, if required, more frequent checks should be carried out to confirm the stability of the remaining structure.

4 If at any time during the demolition the structure appears or becomes unsafe, all workers should be withdrawn until actions have been taken to remove any danger.

Complete progressive demolition

5 Progressive demolition is generally carried out in the reverse order to construction, and often follows the soft strip-out phase.

6 This is the most commonly used method of demolishing structures and should be detailed in the health and safety plan.

7 In high-rise buildings where a floor-by-floor demolition is being carried out, danger points should be recognised such as:

(a) structural stability

(b) on floor loadings

(c) falling debris

(d) maintaining clear access and egress

(e) risk of fire hazards

(f) the need for secure edge protection.

Demolition by deliberate collapse

8 Demolition by deliberate collapse can be achieved by pre-weakening the structure, followed by explosives, remote mechanical demolition or pulling, using a wire rope.

9 When explosives are being considered, only fully qualified explosive engineers should be used.

Manual demolition techniques

10 Manual demolition techniques are used when other methods of demolition are not suitable or possible.

11 Some of the types of tools or operations that can be used in manual demolition are:

(a) hand tools

(b) breakers, compressors or hammers

(c) concrete nibblers or hydraulic pulverisers

(d) stitch drilling

(e) drilling and hydraulic bursting

(f) drilling and expansive pastes

(g) oxygen and propane cutting equipment

(h) diamond cutting and sawing

(i) steeple jacking.

General precautions

12 For brick or concrete structures:

(a) identify any pre-stressed or post-tensioned concrete beams that may be present within the

structure and determine a safe method of demolition

(b) wherever practicable, carry out demolition in the reverse order to construction

(c) maintain tools in good condition, and use them safely

(d) use compressed air or portable electric power tools, from a 110 volt supply

(e) make operatives fully aware of the safe procedures

(f) in addition to site induction, ensure task and tool box talks are prepared, delivered and understood at key stages of the work.

13 *As far as is reasonably practicable,* employees should not work above each other and care must be taken to ensure that debris does not drop into other working areas.

14 If lift shafts or other formed openings are used to drop debris down, the openings must be adequately protected by either suitable guard-rails and toe-boards (with no gap between guard-rails and toe-boards exceeding 470 mm) or by other substantial, effective barriers. It may not be possible to guard an opening where plant such as a 'bob cat' is being used to bulldoze arising's into a shaft or chute. In such cases a safe system of work must be developed which is sufficiently robust to:

(a) stop the item of plant falling into the chute or shaft

(b) control when materials will be loaded and unloaded to stop materials being tipped onto someone below

(c) protect other workers from falling down the shaft.

15 It is still acceptable to use window openings as a means of removing debris from upper floors under certain conditions. The opening would need to be protected so that operatives cannot fall whilst throwing the debris out and the landing zone must be completely protected so that materials cannot fall on anyone. Typically the area will be fenced off with mobile fence panels and then the material loaded with an excavator into a hook bin container. If the structure has more than two storeys, consideration should be given to creating an enclosed drop zone within a scaffold chute.

16 With regard to falling materials and exposed edges, where necessary danger areas (exclusion zones) must be created.

Oxy-propane cutting equipment

17 Oxy-propane cutting equipment:

(a) should be inspected and tested for leaks before use

(b) cylinders should be secured in an upright position

(c) hoses should be secured with crimped fittings not jubilee clips

(d) flashback arresters should always be fitted between cylinder gauges and hoses

(e) operatives must be trained in the safe use of the equipment and wear the appropriate PPE (e.g. goggles and gloves).

18 Whenever oxy-propane cutting equipment is used, the correct fire-fighting equipment should always be available. All operatives should be trained in the safe use of fire extinguishers.

19 Hot work should generally be stopped for an agreed period before leaving site, typically one hour before finishing, to avoid the potential of fire.

Mechanical demolition techniques

20 Machinery used should be fit for purpose, used in safe working spaces, adequately protected (e.g. by ROPs and/or FOPs) and operated by authorised competent persons.

Remote control demolition

21 This utilises specialised equipment, often in hazardous or aggressive environments (e.g. nuclear installations). The use of 'Brock' type machines is becoming more common and they offer possible solutions to the difficulties of complying with the problems of noise and vibration experienced during hand demolition.

Using a 360° excavator with multi-functional attachments

22 This type of demolition is commonly used to demolish low buildings, or is used after other height reduction techniques have been carried out.

23 To avoid physical injury from movement of the parts of the building being demolished, the machine should work in its own zone and be guided by a signaller. The signaller should always be in visual contact with the machine driver when positioned close to the machine.

24 Whilst the machine driver is isolated from noise and dust, the signaller is not and may need to wear PPE depending on the findings of the risk assessments for the work being done, for example if an impact hammer is being used.

25 The height of the wall or building to be demolished should not normally be greater than the attack (maximum) reach of the machine.

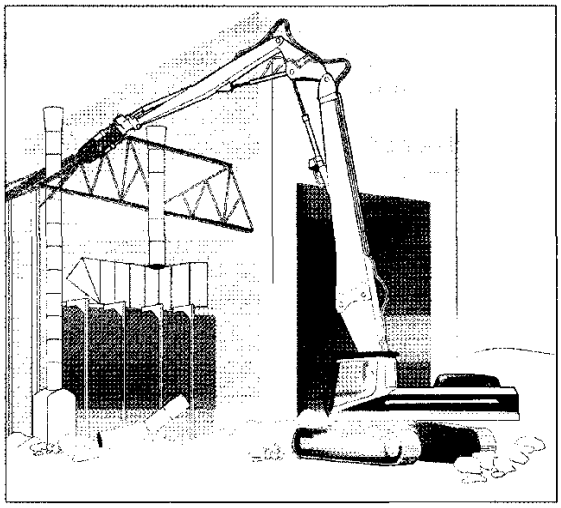
26 In some circumstances, it is possible to create a ramp for the machine to sit on to increase the reach using rubble from previous demolition. Care must be taken to ensure that there has been sufficient compaction to avoid the machine sitting on an unstable base.

27 If the ramp is being created within a building, it is very important to keep the ramp separated from the outside walls to avoid surcharging them. In some very limited circumstances, undermining or undercutting when the machine cannot reach the top of the building may be acceptable. Any contractor selecting this method must implement a safe system of work that ensures:

(a) the stability of the structure is maintained

(b) the protection of the driver from falling material.

28 With regard to the second bullet-point, it is likely that a combination of methods, such as pre-weakening, will be employed to ensure the direction that the material will fall is controlled.



Super high reach 360° excavators

29 Typically these machines have a reach between 15 and 50 metres plus the length of the fitted attachments for crunching concrete or shearing steels. The recommended working height for this type of machine is 75% of the maximum reach.

30 These sophisticated machines are often fitted with variable width tracks, which usually make them much heavier, giving increased ground-bearing pressure and reduced working envelopes. It is vital that any voids and ducts located where the machine will track are discovered and adequately filled. In terms of ground conditions, these machines should be considered more as a crane or piling frame in terms of stability, rather than an excavator.

General precautions

31 Before using the demolition equipment, steps must be taken to ensure that the building is completely empty and that all services are isolated.

32 Because of the danger of debris falling onto the excavator and its driver, the machine should have a fitted cab guard and, as an added precaution, should be fitted with shatterproof glass.

Demolition ball

33 Demolition using a ball is extremely rare due to the advent of super high reach machines. When a ball is used, the crane equipment must be heavy duty and only drop or pendulum (e.g. in line with the jib) balling techniques should be employed.

34 When a ball is employed, regular (e.g. hourly) inspections of the equipment must take place, paying particular attention to the attachments and shackles.

Bridges or steel structure demolition

35 The demolition of bridges, pylons, masts, etc. requires specialised planning and techniques.

General precautions

36 An assessment by a structural engineer should be undertaken to see if the structure could be safely broken down into small component lifts.

37 A comprehensive safe working plan must be developed providing a safe means of access, using a competent crane hire company and experienced slingers and signallers.

Environmental considerations

38 Noise, dust, fumes, vibration and fire control need to be properly addressed before and during the demolition operation. Consideration should be given to the following points.

Noise

39 The contractor must ensure that a noise assessment has been carried out and that, where possible, people are kept out of the danger area.

40 Any machinery which is to be used in the demolition process should, as far as possible, be fitted and used with soundproofing equipment (e.g. exhaust silencers).

41 Where it is necessary for people to work within the area of noisy operations, adequate hearing protection must be provided and used as necessary. If the upper exposure action value is exceeded, or likely to be exceeded, hearing protection must be worn and hearing protection zones clearly indicated.

42 Where the findings of a risk assessment indicate that the hearing of any employee is at risk due to noise exposure at work, health surveillance, including hearing checks, must be provided.

43 British Standard BS 5228 gives advice on the provisions for noise control on demolition sites.

Dust

44 Nearly all demolition activities create dust and many require a COSHH assessment.

45 Taking simple precautions, such as the following, ensures the dust nuisance can be reduced to a minimum.

(a) Implementing techniques that reduce dust generation.

(b) The use of light water sprays both before and during demolition are very effective. However, consideration should be given to any potential run-off contaminants that may be produced and to the proximity of demolition work to electrical services and drains.

(c) Where demolition is being carried out inside a building and water sprays are inappropriate, local ventilation, using air movers and filters, can help to alleviate dust levels.

(d) Dust masks, as any other personal protective equipment, should be used only as a last resort. Where any mask is used, the wearer must be face-fit tested for the mask.

Asbestos

46 A comprehensive ' invasive asbestos survey must be undertaken prior to the demolition being started and preferably before contractors are invited to tender for the demolition.

Fumes

47 A cutting torch, used on steelwork, may produce toxic gases such as nitrogen dioxide. If a phosphate coating is present, phosphine may be produced. If a chlorinated solvent has been used, sulphides may be formed which have no smell until high toxic levels are present. Additionally, toxic metal fumes may be given off.

48 Attention is drawn particularly to lead (lead painted steelwork), cadmium (cadmium bolt heads) and zinc.

49 Before any hot work cutting is allowed, available information or paint samples may be required for analysis, a COSHH assessment should be undertaken, and the necessary control measures implemented.

Vibration transmission

50 Vibration from demolition operations can cause damage to adjacent property and injury to personnel working on site or, in extreme cases, to members of the public. Exposure to vibration must be controlled.

51 The following points should be given consideration.

(a) Attempts should be made to establish the presence of any existing sources of vibration and whether vibration monitors are needed in sensitive locations.

(b) Where buildings adjoining those to be demolished are being retained, separation should be carried out using hand tools rather than machinery.

(c) Necessary precautions should be taken or alternative equipment considered to alleviate the risk of hand-arm vibration syndrome (HAVS), e.g. 'vibration white finger' from continued use of vibrating tools.

52 With regard to the last point, the exposure time for most demolition hand tools is extremely short, and the contractor will need a robust policy which includes health surveillance to carry out hand demolition using demolition picks.

Fire and explosion risks

53 Where flammable liquids, gases or vapours have been used, or were released in a building which is under demolition, any equipment, tank or pipes, etc. which could have contained such substances must be purged and tested for explosive gases prior to work taking place. Any work should be done under a Permit to Work system.

54 General hot work, using oxygen and propane cutting equipment, should be carried out only by operatives trained in its safe and proper use, wearing the appropriate personal protective equipment, i.e. goggles, gloves, overalls.

55 If the occasional burning of debris, such as wood or paper, is allowed on site, the fire must be as small as possible, well away from buildings, roadways, fuel stores, and kept under constant supervision.

56 All fires must be completely extinguished at least one hour before work stops for the day and checked again, to ensure there are no glowing embers before operatives leave the site.

57 Adequate fire-fighting equipment must be available, with fire points containing extinguishers in prominent and well-marked areas adjacent to the demolition operations.

Recycling

58 Demolition works should therefore be reviewed carefully to identify what wastes will be produced, what actions will be taken to deal with these wastes.

59 In addition to removing recoverable items from demolition operations, it is becoming increasingly common to crush the resultant brick and concrete into a sub-base material for future construction purposes.

(a) Crushing on site should only take place when environmental conditions permit such actions. Environmental emissions (noise, fumes and dust) are required to be recorded at least three times daily on a check sheet. Operations should cease if there are excessive emissions which cross the site boundary.

(b) All materials to be recycled should be checked for any contaminants and dealt with in the correct manner to the required specification e.g. 6F2.

(c) Operatives working on the crushers must be properly trained (both general training on the use of crushers and specific training in respect of the equipment being used).

(d) Serious consideration must be given to the need for machinery guarding on crushers. A daily check sheet should be completed by the operator, which confirms that all guards are in place and the emergency stops are working.

(e) Robust safe systems of work are required to deal with blockages. These often happen because the operator loading the crusher simply feeds in lumps that are too big, or because during the demolition process the machine driver did not sort the materials well and large lumps of timber have entered the stockpile.

(f) All crusher operators are likely to require hearing checks and monitoring as the noise levels are normally high.

(g) Even with the dust suppression systems operational, it is unlikely that disposable masks will offer a high enough level of protection. A risk assessment will be required to determine the type of RPE. Face-fit testing may be required following this.

(h) In many circumstances the operator acts as a picker. On some machines it is an accepted practice that the operator wears a full body harness and is attached to a strong point by a restraint lanyard to avoid them being pulled into the machine and crushed.

Removal and disposal of materials

60 Before any materials are removed from site, both vehicular access to, and egress from, the site must be agreed. Where applicable, bog mats and wheel washing facilities should be provided to ensure that debris is not carried onto the highway. Depending on the nature of the material, consideration should be given to covering lorries to prevent dust and debris.

61 Daily records must be kept of materials taken off site.

Common errors and assumptions

62 Demolition is not an exact science and if the job does not look or sound right there may be a problem. If you have any doubts about the job, or how it can be safely carried out, request further clarification before proceeding.

Daily inspection by the site supervisor and/or Contractor

(a) Provide daily briefings to the workforce on complex projects.

(b) Check for continuing safe working practices.

(c) Ensure access and egress routes are properly maintained.

(d) Ensure the site is kept tidy.

(e) Ensure the site is, as far as possible, free from any piles of combustible rubbish.

(f) Ensure that sufficient signs are available and clearly visible to warn of hazardous areas and activities.

(g) Check the contractor's operatives are continuing to wear suitable protective equipment.

(h) Check the progress and sequence of the job to ensure that it is being carried out in compliance with the health and safety plan.

(i) Check that an approved safe system of work is being followed.

The key to a successful and safe demolition project is to plan, implement, monitor and maintain a safe system of work.

DEMOLITION IS

DANGEROUS,

TECHNICAL

AND ONLY FOR THE EXPERTS

PLANNING AND SUPERVISION ARE PARAMOUNT

Construction Site Safety

1.5.7 Safety in Piling

1.5.7.1 Safety in Piling

1 Piling operations can give rise to different hazards dependent upon the type of piling being undertaken. Certain hazards are, however, generally common on all types of piling and the following gives both the general precautions to be taken and the special precautions relating to the different types of piling.

Note: Section 4 of the QCS covers technical aspects of piling operations.

1.5.7.2 General precautions

1 For all types of piling it is essential that a working surface designed to support the plant & equipment safely when working and moving, is provided. Failure of the Working Platform (piling mat) accounts for 30% of dangerous occurrences involving piling equipment. Any such failure is potentially fatal. It is important that the responsibility for design, construction and maintenance of the working platform is established and agreed, before work commences. Piling contractors will provide details of their equipment to assist contractors in constructing suitable access and working surface in the piling area. Piling contractors are to ensure that their access and work area remains suitable and in good order.

2 Prior to piling, all underground services in the area should be located and marked where they cannot be rendered safe. It is important to consult the services authority in the area on these matters. A check should also be carried out to ensure that there are no cellars, underground watercourses, ground conditions or made up or soft ground, etc., which could create hazards during the operation. Consideration must also be given to potential instability, which may be caused by the weather.

3 Where the site is contaminated, consideration must be given to the type of piling used and additional welfare facilities provided.

4 Piling contractors should be requested to provide an appropriate written method statement to the contractor. It is essential that induction training and information specific to the method statement is provided to piling and site operatives.

5 Particular attention should be given to planning activities concurrent with piling including identifying safe working distances and pedestrian and traffic access routes.

6 All persons working on piling operations must wear safety helmets and footwear. Ear and eye protection must be provided and worn where necessary.

7 When piling from a pontoon or adjacent to water, personnel should wear self-inflating life jackets. Rescue equipment (e.g. a safety boat and lifebuoys with lifelines attached) must be kept ready for immediate use and enough men must know how to use it.

8 Where fluid concrete is used provision for the washing out of static plant and delivery vehicles must be made, as you must protect watercourses against pollution.

9 Rated capacity indicators / limiters (RCI/L) are not required to be fitted on piling rigs when used for normal piling operations. Likewise, an RCI/L - is not required when a rig is being used to erect another rig,provided that the weight of components is accurately known and does not exceed 75% of the safe working load (SWL) of the rig. However, if a rig with a SWL of more than one tonne is used for general lifting operations, such as the loading and transport of materials on site, it must be fitted with an RCI/L.

10 Machine operators must be trained, competent, medically fit and authorised by the contractor to operate the machine.

11 Piling rigs are classed as lifting equipment and therefore require a thorough examination after assembly and before being put into service at a new site or in a new location and at least every 12 months. Inspections should also be carried out at suitable intervals. Accessories for lifting (lifting gear) require a thorough examination at least every 6 months.

12 Piling rigs and cranes should only travel on slopes at gradients approved by the machine manufacturer and "slew pins" must be used in these circumstances to reduce the risk of overturning.

13 Guards must be fitted to the dangerous parts of the rig.

1.5.7.3 Use of Cranes with piling

1 It is important to differentiate between cranes and piling rigs.

2 Cranes are widely used conventionally for load handling in association with piling activities. Some techniques (e.g. sheet piling) also use cranes to install piles.

(a) Piling rigs are either purpose made machines or cranes specially adapted for piling by the fitting of masts / leaders and / or sub assemblies to power boring equipment.

(b) Cranes must be selected and used in accordance with BS 7121 or equivalent international standard.

(c) Cranes, which have been employed on piling duties, should be subjected to a thorough examination before being returned to general lifting operations.

(d) Any crane used for raising or lowering people must be fitted with a dead man's handle and the descent must be effectively controlled; the latter is currently achieved by power lowering. Properly constructed man carrying cages, designed to prevent crushing and falls of people that are unable to spin or tip, must be used. The cages should be regularly and carefully inspected. Any item of lifting equipment used to carry persons must be thoroughly examined by a competent person at six monthly intervals.

1.5.7.4 Materials handling

1 Piles and other materials should be stacked safely on ground of equal bearing ability, with safe access for subsequent removal and use in mind.

2 Circular objects should be chocked to prevent rolling.

3 Where there are marked lifting points they should be used. Never lift bundles by their security ties, use the correct sling.

4 Flat and bundled items (e.g. sheet piles, bundles of reinforcement) must be lifted with the correct lifting accessories and spacers placed between layers so that chains etc. can be safely removed after setting down.

5 Hand tag lines should be used for long or bulky items which are likely to spin, especially in windy conditions.

1.5.7.5 Piling Techniques

Driven piling - other than sheet piling

1 Specialist piling rigs incorporating a leader or mast which guides the pile driving hammer and driving head are used. Piles are fitted to the driving head, pitched at the required position by the rig and driven to the required depth. No spoil is generated. Piles may be extended to meet technical criteria.

(a) All machinery should be in good condition and no lifting equipment should be used unless there are current records of thorough examination and where appropriate, testing of the equipment in existence.

(b) All control levers on the piling rig should be clearly marked to indicate their purpose and mode of operation.

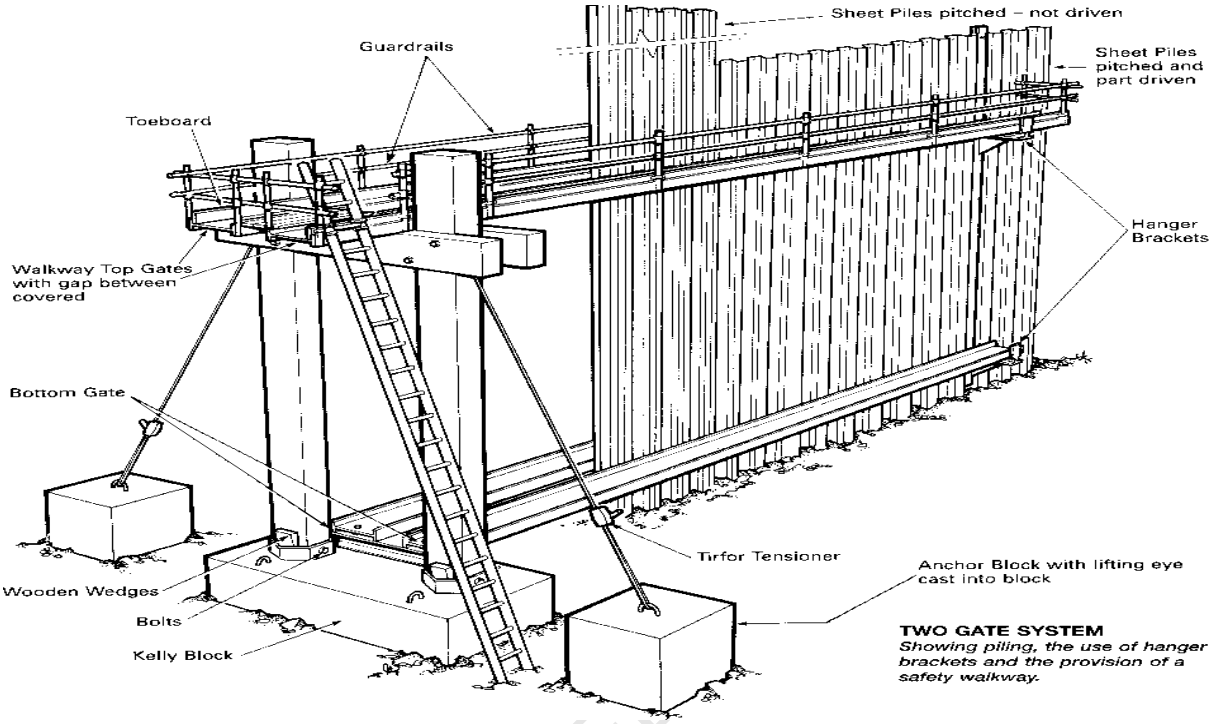
(c) Persons not directly involved must stand well clear at all times when the rig is operating.

(d) Hearing protection will be required.

(e) When piles are extended by welding, full precautions for temporarily securing the additional length and welding must be observed.

(f) When piles are extended using proprietary jointing systems the manufacturer's safety and technical procedures must be followed.

(g) Where persons have to approach the rig mast and the raised hammer for alignment and, or maintenance purposes the hammer must be secured to prevent its unintentional release.



Driven sheet piling

2 The Contractor must consider the following simple factors in connection with the sheet piling process:

(a) how the piles are held in position during driving, – how the piles are to be threaded,

(b) how the first pile is secured whilst the second is threaded, the overall scheme to devise a system to prevent the falls of persons and materials.

(c) Piles can either be held in position during driving using a special leader arrangement attached to the crane or piling plant or, alternatively, a gate system may be used.

Gate systems

3 A supporting system should be chosen which is appropriate for the operation, e.g. where short runs of sheet piling are required and accuracy is not the main criteria', then a single gate system may be used.

4 A single gate system is made up of a simple frame of either timber or steel gates supported by block a suitable distance above ground level. A shallow guide trench is normally dug to assist with the location of the sheet piles.

5 The "gate support system" shown is a two-gate system, made up from timber H-frames, set in concrete

6 Kelly Blocks. These H-frames are then spanned by RSJs (gates). If the gates are over 2m high, or over any potentially dangerous area, they must not be used as working platforms unless fitted

with toe boards which rise at least 150mm and main guardrails at least 950mm above the walkway. Additionally, intermediate guardrails, or other rigid barriers, must be fitted so that there is not an unprotected gap of more than 475mm in height in the means of protection against a fall. Where such protection cannot be provided, access to slinging points must be gained by ladder and NOT by means of the gates.

7 Permanent ladder access must be secure and extend above the gates sufficiently to provide a safe handhold. (A distance of 1.05m is recommended).

8 If using a cantilever system, a tie-back should be used where possible, as well as kentledge to provide safe anchorage and stability of the frame.

9 When piling is progressing and temporary piles are used to support the gate system, it is advisable to use purpose made brackets and bolt them to the piles. Any welding necessary should be carried out by competent welders.

10 When constructing Kelly Blocks, reinforcement should be placed in the concrete base. Vertical RSJs should have a good "key". Vertical timber should not be cast into the block but should be wedged and bolted. Where doubt exists over the stability of Kelly Blocks, guy lines should be used. Lifting eyes should be cast into the blocks.

11 When using Kelly Blocks, it is essential to ensure that these are temporarily landed on an adequate foundation to prevent subsidence and overturn during piling operations. This is particularly applicable during works in rivers, etc.

Pitching sheet piles

12 If shackle holes have to be burned in the pile, sharp burrs should be removed to prevent damage to shackle pins.

13 Remote release shackles should be used where possible and the sheet pile must not be lifted vertically without first checking that the pin is properly engaged through the sheet. The length of the operating rope must be less than the length of the pile and the rope should be secured around the pile to prevent snagging, or being caught in the wind and becoming inaccessible.

14 If piles are too heavy for a remote release shackle and work cannot safely be carried out from a ladder, a lifting cage should be provided to gain access for unscrewing the shackle.

15 If a special lifting eye is to be welded to the pile for angled pitching, the weld should have a factor of safety of at least 2.

16 Long sheet piles should be pitched with a pile threader following the manufacturer's guidance for use. Where this is not possible, a pile pitching cage should be used. The cage should hang from an adjacent pile, the operatives wearing safety harnesses hooked to the adjacent pile before the crane hook is removed from the cage.

17 When sheet piles are being pitched it is essential to take particular care to ensure the stability of the first few piles, but especially the first pile. This may be achieved by fixing the pile to the gate at two points so that it cannot move within the plane of the gate. This action will also ensure that the pile is stable if an effective toe-in is not achieved due to hard/stony ground conditions.

18 When feeding sheet piles through top and bottom gates, use wood blocks or a bent bar. Never use a straight pinch bar, as fingers can easily be trapped.

19 Additional precautions are required for work carried out from ladders, e.g. Clutching: the ladder must be placed in the valley of a previously placed pile; the ladder must be footed and, when at the top of the ladder and both hands are required for clutching, a safety harness must be worn and secured to the pile using a girder grip.

20 Wedging: the ladder must be placed against the RSJ and footed; wedges should be pre-positioned on the RSJ A 4lb lump hammer should be used as this can be swung with one hand. If two hands are required, a safety harness must be worn, with the lanyard wrapped around the RSJ or connected to a girder grip.

21 The work method must not be changed without the approval of the contractor responsible for the piling operation. If windy conditions make the handling of the sheet piles difficult, work must stop until the responsible person has been consulted and a safe method of continuing the work has been devised.

Piling Hammers

22 The recommendations of BS 5228 Pt. 4: Code of practice for noise control applicable to piling operations, should be closely followed.

23 Hammers, and in particular all clamping bolts, should be regularly inspected and a record kept.

24 Use guide rope when positioning a hammer.

25 Stand clear when starting and operating.

26 ALL personnel should be at ground level during pile driving.

27 Should the piston of a hammer jam, the trip-lever should be pulled to the open position before removing the hammer from the pile.

28 Damaged high-pressure airlines or high voltage cables, feeding the hammer, can present a serious hazard to persons working in the vicinity of the operation.

29 Therefore it is important to keep supply lines/cables under constant observation to avoid damage by trapping or from sharp objects.

Double acting air hammers

30 All hose couplings should be properly manufactured and matched. The joining of rubber pipes to brass spigots should be by clamp and not hose clips.

31 Ensure that the oil bottle/filter lid is secure.

Internal drop hammers

32 Always place a swivel between the hammer and hoist rope.

33 Attachment of a hoist rope should always be done using a properly matched anchor and pear;

the dead end of the rope should be secured to itself using a bulldog clip or other approved means.

34 Intermediate linking shackle pins should be secured.

35 Hoist ropes should be inspected regularly during piling operations and a record of inspections kept

Helmets and inserts

36 Pile helmets or crowns must be well constructed, strong enough and free from defect. Should packing or spacers be needed, they should be drilled, tapped and screwed, to secure in place, and then be welded. Remember that any welds to a solid cast helmet will eventually crack.

Pile extraction

37 Where pile extraction is necessary, due allowance should be made for the frictional forces occurring between the pile and ground, in order to determine the correct size of crane and extractor.

38 It is good practice to use a tag line between hook and adjacent pile to prevent the extractor swinging out of control should the pile snap.

39 Care should be taken when lowering extracted piles to ensure that the load on the crane hook is kept vertical.

40 Where a crane is used to extract piles it is common practice for the rated capacity indicator to be disconnected to prevent damage. This is a legal operation in that the crane is effectively a "piling rig" whilst this work is taking place. However, the competent person for lifting operations must ensure that the machine remains within its safe working capacity throughout the operation. The RCI/L must be promptly connected before any other lifting work is attempted.

Rotary Bored piling

41 This technique involves specialist piling equipment that bores a hole which, depending on ground conditions may be lined (cased). Relatively short rotating boring tools are used which are withdrawn from the ground fully loaded with spoil. Once the tool is above the ground the rig is commonly slewed off the bore and the spoil is discharged. Reinforcement bars and concrete are placed in the hole and any temporary casing is extracted to complete the process.

(a) Personnel not directly involved with the activity should be kept clear at all times, particularly from the boring and spin off (spoil discharge) areas.

(b) Fixed guarding to Rotary Bored Piling Augers is not practicable due to the nature of the equipment. A controlled zone must be identified at each pile location and can be defined as a zone at 2m radius from the centre of the auger. A banksman must be in attendance at all times while the piling rig is active and must be given authority and responsibility to ensure only authorised persons are permitted within the zone. No person is permitted within the zone while the auger is rotating (this precludes manual cleaning of the auger). Should any manual intervention be required the auger must be stopped. An excavator can be used within the zone for the purposes of clearing spoil but only under the banksman’s supervision.

(c) To remove spoil from the auger the loaded auger should be carefully slewed off the pile position to the discharge point in a controlled manner. When the auger is being spun off it

should be as close to the ground as possible to minimise the spread of spoil and the auger spin speed should be only sufficient to empty the tool so as to minimise the spread of spoil.

(d) Spoil from bores should be kept clear of access to the borehole.

(e) Open bores must be fitted with a cover or other suitable protection to prevent people falling into them. Common practices include leaving the casing 1m above working platform level and the auger or other boring tool in the borehole.

(f) Freshly completed piles must be marked individually or in blocks to minimise trip hazards from reinforcement and soft concrete. They should be backfilled as soon as technically possible, remembering that soft spots must remain highlighted for the safety of people and plant stability.

(g) In the majority of circumstances there is no need for a person to enter a pile bore/shaft and this should be avoided. Remote means of inspection and sampling the sides of shafts should be used wherever possible.

(h) Where entry into a pile bore / shaft is unavoidable the recommendations of British Standard BS 8008 or equivalent must be followed.

42 All persons entering the controlled zone must be properly informed and instructed on the risks associated with this operation. The banksman must be trained on slinger signalling matters. The banksman must be identified.

43 The guard forms a “natural” resting position for the banksman, this position is away from the auger.

Auger guarding and mechanised cleaning

CFA (Continuous Flight Auger) Piling

44 With this technique specialist piling rigs screw an auger into the ground the full depth of the pile bore. Concrete is then pumped through the hollow auger stem and spoil is removed as the auger is withdrawn. Reinforcement is placed in the bore after concreting.

(a) The majority of rigs used for this type of piling have a certain amount of guarding achieved by extending the gate (guide), which is used to maintain the position of the augers. However this gate does need to be opened to allow the piling rig to achieve its full depth and to facilitate the rigging of the augers and the gate will not allow work immediately adjacent to structures, especially in corners.

(b) A controlled zone must be identified at each pile location and can be defined as a zone at 2m radius from the centre of the auger. A banksman must be in attendance at all times while the piling rig is active and must be given authority and responsibility to ensure only authorised persons are permitted within the zone. No person is permitted within the zone while the auger is rotating (this precludes manual cleaning of the auger). Should any manual intervention be required the auger must be stopped. An excavator can be used within the zone for the purposes of clearing spoil but only under the banksman's supervision

45 All persons entering the controlled zone must be properly informed and instructed on the risks associated with the CFA piling operation. The banksman must be trained on slinger signalling matters. The banksman must be identified. Providing this procedure is strictly adhered to then this may be adopted as an alternative approach to the guarding of CFA augers when mechanical means of guarding is not reasonably practicable.

(a) Mechanical or automatic auger cleaning devices should be used.

(b) All control levers on the piling rig should be clearly marked to indicate their purpose and mode of operation.

(c) When ropes are subject to heavy wear, they must be frequently inspected and changed as necessary.

(d) Similarly, the auger section joints and their wedges must be inspected on a daily basis for excessive wear.

(e) Freshly completed piles must be marked individually or in blocks to minimise trip hazards from reinforcement and soft concrete. They should be backfilled as soon as technically possible, remembering that soft spots must remain highlighted for the safety of people and plant stability.

Tripod bored piling

46 A tripod is set up over the pile position and various tools are used to advance boring. These are raised and dropped by a rope winch attached to the tripod. Casings are driven to line the bore, their depth varying with ground conditions. Spoil is removed as boring progresses. Reinforcement and concrete is placed before the casings are withdrawn.

(a) Each tripod leg must be identity marked and every tripod and winch marked with its safe working load (SWL). Identity marks must correspond with the examination records.

(b) Ropes should be secured with suitable fastenings, e.g. bulldog clips. Where appropriate, properly constructed saddles or hard eyes should be used.

(c) Knots must not be tied in any rope used for lifting.

(d) The tripod legs must not be overspread or overloaded. The base plates should be adequate and secured to prevent any accidental movement of the rig.

(e) Only the correct pins should be used in the sheerleg's (tripod).

(f) All parts of the winch should be effectively guarded, although it is acknowledged that access to the winch drum is required to enable the rope to be pushed across the drum during a gear change.

(g) Constant attention must be paid to the condition of rope, which should be changed as soon as it becomes necessary.

(h) When a rope/chain block is being used to extract the casings, the capacity of the block must not exceed the capacity of the rig.

(i) Under no circumstances must there be less than 2 full turns of the rope on the winch drum at any time.

Other techniques

47 There are many other piling techniques. Specialist suppliers should be contacted for alternative safe working procedures.

Construction Site Safety

1.5.8 Safety in Formwork/Falsework

1.5.8.1 Formwork/Falsework and reinforced concrete structures

1 Falsework is any temporary structure used to support a permanent structure during its erection and until it becomes self-supporting. This definition applies not only to in-situ concrete construction, but also to precast concrete structures, structural steel erection, and even such items as brick arches, indeed, any construction method where the permanent structure may have a period of instability, requiring support in the erection process.

Note: Section 5 of the QCS covers use and handling of concrete.

1.5.8.2 Standard solutions

1 Falsework covers an extremely wide range of temporary support methods and BS 5975 recognises that, in simpler and more commonplace situations, e.g. support of floors and beams involving light loadings and low height support (within the range of standard props) standard solutions can most likely be used instead of individual designs.

2 Standard solutions are given in B5 5975. However, unless the job falls within the limitations of the particular standard solution, further design will be required.

1.5.8.3 Causes of failure

1 Whatever category the work falls into, it is generally accepted by competent international authorities that the causes of failure fall into a number of well-defined areas:

(a) Incorrect estimation of loads to be supported.

(b) Design error, or loading programme changes after design completed.

(c) Inadequate detailing and/or execution of points of load transference.

(d) Inadequate horizontal lacing and diagonal bracing to resist lateral loads.

(e) Inadequate foundations.

2 Within the above scope, it must be recognised that failure often does not result from one specific error or inadequacy. More likely it will be due to an accumulation of errors, not in themselves critical, which combine to erode the factor of safety to the point where failure occurs.

1.5.8.4 Design

1 The design of temporary works such as falsework comes within the scope of these regulations. Whether the falsework design is provided by standard solutions or by individual design, the parameters on which the design is to be based need to be clearly established. In this respect, it must be recognised that the loads imposed on falsework do not only arise from the permanent structure. Many will occur as a result of method and plant decisions.

2 BS 5975 covers with the preparation and contents of the design brief in detail.

3 The main risks are:

(a) people falling during erection and striking of formwork and assembly of the steel frame collapse of the formwork

(b) materials falling while striking the formwork

(c) manual handling of shutters, reinforcing bars etc

(d) being struck by the concrete skip

(e) silica dust and hand-arm vibration from scabbling operations

(f) awkward postures and working positions for steel fixers

(g) dermatitis and cement burns from wet concrete.

4 Many of these risks can be reduced or removed by design and careful planning:

(a) designers should consider the manual handling risks when detailing size and length of the reinforcing bar;

(b) fixing reinforcement steel in prefabricated sections in factory conditions and craning it into position so that work can be done on benches to reduce the need for bending down. Alternatively, using long-handled tools can reduce the need to bend over

(c) using formwork systems that have edge protection and access designed in

(d) minimising the need for scabbling by using retarders; and

(e) using concrete pumps instead of cranes and skips.

5 The Contractor is to ensure that:

(a) a method statement has been agreed before work starts, and that it is followed.

(b) guard rails or other suitable barriers to prevent falls are put in place as work progresses.

(c) workers have safe access to the work -- it is not safe to stand on primary or other open timbers.

(d) a safe means of access is used. Many formwork systems have purpose-designed fittings to allow access platforms to be fitted and they should be used (see Figure 29).

(e) climbing up vertical sections of reinforcement or up the outside of column formwork is not permitted. A tower scaffold can provide safe access to columns (see Figure 30).

(f) equipment is in good order before use. Do not use substitutes for the manufacturer's pins in adjustable props.

(g) the formwork, falsework and temporary supports are checked, properly tied, footed, braced and supported before loading, and before pouring walls or columns.

(h) workers are protected from wet concrete (provide gloves and Wellington boots and proper washing facilities) and silica dust (provide respirators or avoid the need to scabble by using a retarder).

(i) loads are spread as evenly as possible on the temporary structure. Do not place large loads of timber, reinforcing bars or wet concrete in a localised area -- spread loads evenly.

(j) it is known when back-propping is required and how soon the new structure can be loaded; and there is a planned safe dismantling procedure.

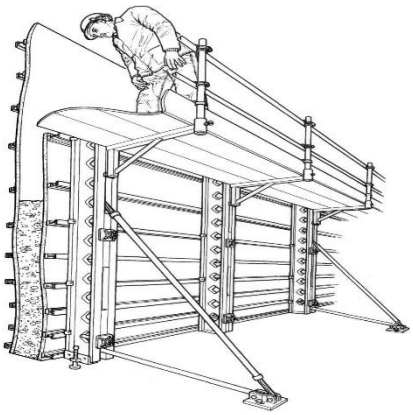


Figure 29: A formwork system with multipurpose fittings

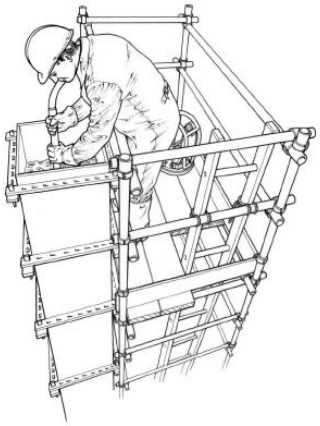


Figure 30: A tower scaffold provides a safe means of access to the columns

Construction Site Safety

1.5.9 Explosives

1.5.9.1 Introduction

1 This subsection aims to give general guidance to Site Managers on the acquisition, keeping, transfer, storage, transportation and use of explosives in the construction industry. In addition, it is anticipated that the information will enable Sub Contractor's method statements and risk assessments to be assessed. Further guidance on the use of explosives is provided in BS 5607:1998 "Code of Practice for safe use of explosives in the construction industry". Advice on the explosives used in cartridge operated fixing tools is given in BS 4078 Part 1.

Note: *Section 2, Part 1.5 of the QCS covers explosives.*

1.5.9.2 Appointments

1 Before any work involving explosives is planned and carried out the person responsible for the site, for example the Principal Contractor, must appoint someone with sufficient knowledge and experience to oversee this work. Even when a sub contractor will carry out the blasting the appointed Supervisor must satisfy him or herself that the planning, documents and implementation are satisfactory as this is obviously a high-risk operation. Similarly, the business actually carrying out the work with explosives must ensure that Supervisors and Shot firers are competent to carry out their work. The competence and training of Shot firers is dealt with later in the section.

1.5.9.3 Preliminary survey

1 Before any work involving the use of explosives is started, a detailed survey should be made of the site and its adjoining areas. Where earthworks, tunnelling or demolition are involved, relevant information may be obtained from British Standards BS 6031, BS 6164 and BS 6187 respectively.

2 Special attention should be given to the character and structure of the geographical strata to ensure that they are not likely to transmit ground vibration to areas where it is likely to cause damage. The affect on utilities, including underground and over-ground services, should be carefully considered.

Notifications

3 Prior notice of the intention to use explosives should be given to all those who may be affected. For example, the water; gas, electricity and telephone authorities, the police and airports.

Documentation

4 Eplosives may be acquired, or stored only by persons who hold a valid Explosives Certificate. This is usually referred to as the "acquire and keep" certificate. An Explosives Certificate may be issued for both acquisition and storage of explosives or for acquisition only. Certificates permitting acquisitions only should be obtained where it is intended to use explosives on the day they are delivered to site. An Explosive Certificate is not required for the acquisition or storage of cartridge operated tool cartridges which carry the following UN numbers: 0275, 0276, 0323 or 0381.

5 In addition to the explosives certificate the person ordering or taking delivery of explosives must be competent to do so and have received the relevant approvals from the competent authorities.

Storage

6 Guidance on the methods of storing and types of construction required for a store for explosives may be obtained from the competent authority. In addition, advice may also be obtained from the manufacturer of the explosives which are to be used. The storage facilities will be inspected and therefore it is important that the guidance and advice is complied with.

7 The movement of explosives into and out of the store must be recorded, and there must be a formal procedure for accepting delivery of explosives and for checking that they conform to the contents of the advice note. It is essential to ensure that detonators are stored separately from other explosives. The loss of any explosives must be reported to the police. No person may transfer explosives to another person unless he is satisfied that the transferee has an Explosive Certificate certifying him to be a fit person to acquire explosives. This does not prohibit employers from giving explosives to their employees, but it does mean that a Principle Contractor must check that a Sub-contractor has an Explosives Certificate before providing the Sub-contractor with explosives.

8 Explosives stores must be kept clean and free from grit.

9 Rubber Overshoes must be kept in each store and worn by people who are not wearing rubber soled footwear and have to enter the store. No iron or steel implements should be taken into explosives stores and no naked lights or other means of ignition should be taken within 25m of them.

10 The issuing of explosives should be restricted to persons who have been authorised in writing by the Site Manager.

Transport

11 Regarding the transport of explosives on public roads, various duties on operators of vehicles include:

(a) the requirement for vehicles to be suitable, having regard to the type of explosives and quantity of explosives carried; quantity limits for various types of explosives are also imposed,

(b) restrictions on the carriage of loads of mixed explosives,

(c) the requirement for the marking of vehicles and containers, except where small quantities of certain types of explosives are carried,

(d) the requirement for written, specified information about the load to be kept on the vehicle,

(e) the requirement to take all reasonable steps to ensure safe and secure carriage,

12 Vehicle operators must ensure that drivers have received adequate instruction and training on dangers which may arise, action to be taken in an emergency and on their duties. Drivers must attend an approved course, on successful completion of which they will be awarded a Vocational Training Certificate. Drivers must carry these certificates.

13 Finally, where explosives are carried on the public roadway, the safe system of transport must be prepared by a person with training and knowledge of the health and safety implications of carrying

explosives. This requirement will normally apply to the supplier who should be organised so that he delivers directly to the explosive store on the day when blasting is taking place.

14 Further transport of explosives on site must be in a vehicle provided solely for this purpose and be under the control of the shot fired. The vehicle should be clean internally and carry a red flag to indicate the presence of explosives. Detonators should be separated from explosives by at least 1m during carriage; explosives which have already been fitted with detonators must not be carried in any vehicle. Detonators should be kept in a suitable container, with no metal parts that will come into contact with the detonators; it should be kept locked until access is required. Explosives should be protected from the weather during transit. "No Smoking" restrictions and a ban on the use of CB radios and mobile telephones in the immediate vicinity must be strictly observed.

15 When explosives are being transported on site, only sufficient explosives for the work in hand should be drawn from the explosives store, and the vehicle carrying the explosives should go directly to the shot holes.

16 When explosives are brought on to a site where there is no lawful storage facility, (as outlined under "Documentation"), liaison may be necessary between the explosives engineer making the delivery and site management on such matters as emergency arrangements and the provision of safe parking away from obvious sources of ignition and other dangerous goods.

Mixing on site

17 Before explosives mixtures are manufactured on site an application for an application for approval is required. In addition, a small amount of record keeping is required.

18 The actual mixing process itself is very simple although the manufacturers advice should be sought as to the provision and use of suitable equipment and the appropriate mixing ratios. Some further guidance on this subject can be found in BS 5607:1998.

Use of explosives

19 Suitable and sufficient steps must be taken to ensure that nobody is exposed to risk of injury from the use of explosives in construction work. In addition, persons undertaking the drilling of shot holes must be protected from the dangers associated with work at edges from which there is a risk of falling, dust from the drilling process, unguarded dangerous parts of machinery and the rupture of large diameter compressed air hoses. These are normally chained at the coupling to prevent them snaking about in the event of a burst.

Code of signals

20 Before any blasting takes place, both audible and visual signalling systems, giving warning of blasting operations, should be established. These must be explained and publicised through the site Induction Training, Site Rules and clearly visible Signs affixed at the entrances to the site. Audible warnings should consist of a series of readily recognisable signals, which have a distinctive sound. Visual signs should take the form of clearly painted notices posted on all access roads and sited outside the danger area. Sentries should be posted with clear instructions as to when they can stop access to the site and when they can allow access.

1.5.9.4 Shotfiring

Competence of shotfirers

1 BS 5607:1998 sets out the training requirements for Shot Firers, these must be adhered to if safety is to be achieved.

General precautions

2 Before explosives are used on any particular site, a written system of work, applicable specifically to that site, should be prepared. The responsibilities of persons with specific duties, such as the Supervisor, Shot firer and Sentries should be detailed in writing. When the system of work is being prepared, consideration should be given to the following matters:

(a) The development of the Blasting Specification.

(b) The preparation of written Explosives Rules that, that can be easily understood by the workforce.

(c) The need to post sentries and visual warning signs around the areas likely to be affected by the blast.

(d) The need to ensure that the danger area is clear of all personnel immediately before firing occurs.

(e) The need to have an audible means of giving warning that a shot is about to be fired and to sound the all clear.

(f) The need to notify the police, the general public, or occupiers of adjacent properties of shot firing times.

(g) The system of work should always emphasise the following general precautions: -

(h) The importance of the shot firer satisfying himself that the danger zone is clear before firing a round and that, after firing, a complete check is made to ensure that no misfires or other hazards exist.

(i) The banning of cigarettes, matches and naked lights within a radius of 10m from explosives and detonators. This is a legal requirement in quarries.

(j) The prohibition of drilling into old sockets, as these may contain explosives or detonators, which may be detonated by a drill.

(k) The use of only wooden rods for charging and stemming shot holes.

(l) Shot holes should be minimum of 3mm larger than the cartridge diameter for normal holes and 13mm for deep holes. Before charging, shot holes should be proved clear by inserting a stemming rod to the bottom.

(m) Cartridges should be inserted into the holes one at a time, and stemming should be completed only with suitable material, e.g. sand, clay, gypsum, etc.

(n) As high explosives are initiated by the application of a powerful local ised shock, exposure to any deliberate, accidental or random compressive action must be prevented.

Electrical shotfiring

3 Electrical detonation allows shot firing from a remote location and also controls the precise instant of firing, thus increasing the safety factor. In addition, the use of timing delay detonators in the firing circuit significantly reduces the levels of vibration. The method is generally used as a number of shot holes can be connected together and fired as a group.

4 The making up of primed charges should normally be undertaken by the shot firer immediately prior to charging. A non-ferrous pricker must be used for piercing the explosive, making it ready to receive the detonator. On no account must any other form of pricker be used. Detonators must be firmly secured to the primer cartridge in such a manner as to prevent the detonator or wire becoming detached or damaged. The ends of the detonator leads must remain twisted together until all holes have been charged.

5 Where it is not possible to achieve safe conditions at the charging place (e.g. in very wet conditions), it will be necessary for priming explosives to be transported to the charging place. Such procedures will require additional careful planning.

6 All rock surfaces, rails, metal objects, cables etc. must be considered as potential sources of stray current and great care must be taken to prevent detonator lead wires coming into contact with them.

7 Good connection of the detonator leads, connecting wire and shot firing cables is essential. Before attempting to fire a shot electrically, the shot firer must test the continuity of the circuit with a suitable instrument before he connects the firing cable to the exploder. This testing procedure must be carried out only after all persons have left the shot firing area and the shot firer himself is in the firing position. The removable handle of the exploder must be kept in the shot firer's possession at all times. The handle may be inserted into the exploder immediately prior to firing only and it must be withdrawn immediately after firing.

8 After the shot has been fired, the appointed shot firer must inspect the area of the blast for misfires, or any other sort of danger, before allowing people to return to the area.

9 When detonating near overhead electrical cables, consultation should take place with the electricity supplier, who may be able to make the cables dead for a limited period. Advice should be sought on the minimum distance permissible between an explosive charge and an overhead electric cable. The following distances may be used for guidance:

(a) 11-70kV 20m

(b) 132-400kV 61m

10 Premature ignition of electric detonators by electromagnetic energy from radar, radio and television transmitters is a possibility which should always be considered and this is why CB radios and mobile telephones should be excluded from the shot-firing area.

11 Beamed transmitters, such as navigational aids and military installations often operate at a high power and, if the station is in direct line of sight of blasting operations, adequate investigations should be made and suitable precautions taken. Commercial radio transmitters may be potentially dangerous as the wavelengths used are often similar to the overall length of the proposed blasting circuit.

12 Television transmitters are not generally a hazard as they transmit horizontal beams from a high mast, but portable walkie-talkie equipment and unmodified car transmitters up to 5W in output should not be taken within 10m of any blasting operation. Modified car transmitters and CB radio transmitters, which may have been illegally modified to increase their power, are potentially dangerous at much larger distances. Users of electric detonators are recommended to discuss this matter with the manufacturer or supplier of their detonators. In any event, the use of CB radios on sites should be banned by notices placed at all entry points.

13 Electrical means of detonations must not be used during storm conditions when there is thunder

and lightning in the vicinity. The possibility of uncontrolled detonation should not necessarily prevent the use of this type of firing method. However, the manufacture/supplier must be consulted to ensure that the firing initiation system is appropriate for the circumstances.

Detonating cord

14 Detonating cord is a very reliable initiator and its use for firing large groups of charges is free from some of the drawbacks of electrical shot firing such as current leakage problems. However, detonating cord must be protected from rain and ground water as moisture penetration can cause transmission failures. Covering the ends of the cord with waterproof tape may prove effective, but if conditions are very wet, the use of sealing compounds may be necessary. When laying out detonating cord, it is essential to ensure that branch lines do not cross over the main line, as on detonation a branch line may be severed, resulting in a misfire in the shot hole which it is serving. Detonating cord must not be kinked or knotted, otherwise transmission failure may occur. In use, detonating cord passes down the outside of explosive cartridges to the bottom of the shot hole, so care should be exercised when using a stemming rod otherwise the cord may be broken or damaged. Breakage of cord can also result from excessive tensioning, repeated stretching or the imposition of a sustained load. The power core of detonating fuse is liable to detonate, with the risk of serious injury if subjected to impact or shock. Detonating cord should always be protected from friction and heat.

Shotfiring using safety fuse

15 In surface blasting applications, the use of safety fuse is virtually restricted to single shot-firing operations such as the "popping" of large boulders. This is because accurate timing cannot be achieved and, if used in a group, an erratic timing sequence would result. However, safety fuse may be used where it is considered dangerous to use electrical detonation due to the presence of nearby electrical hazards.

16 Safety fuse is used in conjunction with a plain detonator. The fuse is inserted into the open end of the detonator, which is secured by crimping on to the fuse. The correct crimping tool must be used. A primed charge is made up by inserting the detonator into a hole prepared in the primer cartridge.

17 The length of safety fuse must allow the shot firer and assistants ample time to walk to a place of safety after ignition. No single shots should be fired by fuse less than 1m in length, nor any shot in a round be fired by fuse less than 1.25m in length. A shot firer must not attempt to ignite more than six individual shots in a round. Only fuse lighters, specifically designed for the purpose, should be used.

1.5.9.5 Tunnelling and shaft sinking

1 The following additional precautions are relevant to tunnelling and shaft sinking:

Storage

2 Where it is necessary to store explosives in the tunnel between blasting operations, proper reserve stations should be excavated and fitted with steel doors. Reserve stations should not be nearer than 300m to the tunnel face. Reserve stations are not authorised storage places. Any explosives remaining in them at the end of a shift should be returned to the licensed explosives store or magazine.

Transport

3 Explosives should be transported to the tunnel face in a clearly marked special mine car, lined with timber and having top or side lids fitted with padlocks. Explosives must not be carried on the driving locomotive itself.

Drilling and charging

4 Drilling patterns should adhere to the agreed profile. All shot holes should terminate at the same vertical plane, except those drilled for cut shots and easers. If the presence of gas is suspected, tests should be made at the mouth of each shot hole, and within 9m of the face prior to charging. Plastic water stemming, water stemming under pressure, or water gel capsules reduce dust and toxic fumes. If possible, explosives with non-toxic characteristics should be used in tunnelling operations.

5 No explosives or blasting accessories should be conveyed to the face until all drilling operations for the round to be charged have been completed.

Sockets left after blasting

6 The most common cause of severe accidents with explosives in tunnelling results from drilling into sockets containing explosives which were not fired in the previous round. It is essential that drilling into such sockets be avoided.

Electrical faults and hazards

7 Short-circuiting or current leakage from the circuit to earth is more likely to occur when conditions are wet. Ground water from rock fissures often contains mineral salts, which greatly increase its electrical conductivity. Bare wire connections should not be allowed to dangle in water, nor be allowed to hang against a wet rock face.

8 The risk of premature explosion during electric storms is particularly high in tunnelling work. Dangerous static charges can also build up in compressed air equipment, and it is essential that such equipment should be positively earthed. Another hazard is from portable electric lighting cables; such lights should be removed to at least 9m from the face when preparing or charging blasts. Power to drilling and other equipment should also be switched off or completely isolated, when explosives and detonators are in the vicinity.

Shotfiring

9 Serious shock and flash wave effects can be experienced in tunnel blasting work. In straight tunnel work, the minimum distance from the face to the firing point should be at least 300m. A shorter distance may be acceptable where a cross- tunnel or special refuge provides protection but, in such cases, the dangers from ricochets and fumes must be assessed. Before the all clear is given, the shot firer must ensure that all fume has been adequately diluted or has dispersed. This may initially require gas testing with a stain tube detector or some other suitable testing device to establish the timescale at which fume dilution is such that it is safe for the workforce to return to the face. This testing must be repeating as the work progresses and written records kept to ensure that the re-entry timescales are appropriate. Miners are likely to be working on a bonus system and therefore re-entry may require a strong level of control!

Scaling Down Faces

10 All shot-firing operations are likely to leave fragments of loose material on the face. These can fall and have been known to cause injury and in some cases, where inclined, sloping rock beds in tunnelling are concerned, death. These must therefore be removed or stablised before any work involving an approach to the face, where there is a risk from falling material, can begin. A cherry picker will provide a useful platform for scaling down and the Shot firer should not allow anyone to approach a face until he is satisfied that the face has been inspected and loose material cleared.

1.5.9.6 Misfires

Electrical shotfiring misfires

1 If an electrically initiated charge fails to fire, the shot firer must follow the following procedure:

(a) Remove the handle from the shot firing apparatus.

(b) Disconnect the cable from the shot firing apparatus.

(c) After waiting 5 minutes, examine the shot firing cable and connections for any defect. If one is found, it must be remedied.

(d) Return to the firing point and make a further attempt to fire the shot.

(e) If this second attempt to fire is unsuccessful, the circuit should be split in half and each half should be tested in turn to locate the fault.

(f) The faulty half should then be split in two and again each half should be tested separately by continuing this process, the fault can be located. All such tests must be affected from the firing shelter.

(g) Once the faulty detonator has been located, the remainder of the circuit should be connected in series, omitting the faulty detonator. The leading wires of the faulty detonator should be connected by string to a suitable marker to facilitate recovery of the primer cartridge after firing.

(h) After re-testing, the modified circuit should be fired. Dislodged material should then be searched for any undetonated cartridges.

(i) If material in the vicinity of the misfired hole is not dislodged by the blast, recovery of the misfired charge may be attempted by firing shot relieving holes at a distance of at least 300mm from the misfired charge. A similar procedure should be adopted if a misfire is found after a blast has been fired.

(j) Where misfires are encountered after firing a round, the face or structure is likely to be fractured and weakened. Any dangerous conditions must be rectified before the shot firer deals with the misfire.

Safety fuse misfires

2 In the event of a misfire, the shotfirer must adopt the following procedure:-

(a) Ensure that no one approaches the shot firing area until at least 30 minutes have elapsed.

(b) At the expiration of the 30-minute period, inspect the safety detonation fuse and, if the cause of the misfire is clearly evident, rectify the fault and make a second attempt to fire the round.

(c) If this second attempt to fire is unsuccessful, the shot firer may adopt one of the following procedures: -

(i) Remove the stemming by compressed air, or water, using a non-ferrous or rubber blowpipe. Insert a primer cartridge into the hole, re-stem and fire, or

(ii) Drill a relieving hole at least 300mm away from the misfired charge, taking care to ensure that this hole is drilled parallel to the misfired hole. Load and fire the relieving hole in the normal way.

3 After either of these procedures has been followed, a most careful search must be made of the debris for detonators and unexploded explosives.

Records of misfires

4 Records should be kept of any misfires.

1.5.9.7 Disposal of Explosives

1 Extreme care must be taken in the disposal of unwanted, or apparently deteriorated explosives. In general, explosives should be returned to manufacturers or suppliers although substances such as gelignite can be burned Manufacturers guidance is essential in this respect and the persons involved should avoid the fumes as they produce severe headaches. Guidance is also contained in booklet HS (G) 36 Disposal of explosives waste and the decontamination of explosives plant.

2 All empty explosive boxes must be thoroughly examined by the shot firer, taken to a safe place, at least 50m from the store or magazine, and burned.

Construction Site Safety

1.5.10 Office Safety Regulations

1.5.10.1 Introduction

Facilities Management is the co-ordination of many specialist disciplines to create the optimum working environment for staff. Core disciplines include the reactive and preventative maintenance of site offices including any hard services (e.g. building fabric – air conditioning, electrical, heating and ventilation, etc.). Coordination of any soft services (e.g. human activities – catering, cleaning, grounds maintenance, security, etc.)

1.5.10.2 Definitions or Interpretation

1 In these Regulations, unless the context otherwise requires: -

(a) "**Office**" means any establishment or premises where the administration, management and control is undertaken for a working organisation registered under Qatari Law.
(b) "**Offices**" in any establishment shall adopt these Regulations as a minimum unless there is more specific Regulation under the main purpose of the organisation
(c) "**Work**" is any activity undertaken for financial or other gain.
(d) "**Organisation**" can also mean a singular individual or one who is self-employed.
(e) "**Employer**" is one who engages in activities classed as work and who employs others under his charge to perform these activities, or is self-employed as mentioned in "c" above.
(f) "**Display Screen Equipment**" is any computer, laptop or similar which is used for the display or information for the user.
(g) "**User**" is a person who uses Display Screen Equipment or works at an office workstation.
(h) "**Workstation**" is the immediate area where the user undertakes their particular activities, e.g. desk

1.5.10.3 Legal Duties

1.5.10.3.1 Duties of Employers

1 Each Employer shall –

(a) So far as is reasonably practicable, mitigate all hazards and risks to his employees, visitors, members of the public, and others with a regard to preventing their exposure to harm, injury, or worse whilst at work in an office environment.
(b) Where it is not reasonably practicable to prevent exposure to these hazards and risk
  i. Make a suitable and sufficient assessment of risk
  ii. Take appropriate steps to ensure mitigation measures are in place to eliminate, minimise or reduce the potential for harm, injury or worse.
  iii. Communicate the appropriate steps required to all staff, visitors and third parties who may be affected by these risks.
  iv. Ensure all staff are trained in the above with regards to the working environment and all activities undertaken.

2 Any assessment referred to in paragraph 1 (b) (i) shall: –

(a) be recorded and reviewed by the employer
  i. At regular intervals not exceeding one year since its date of inception, or
  ii. When significant change has occurred which may affect the potential or severity of the risk arising.

iii. Extra measures shall be considered for employees who are considered more at risk
- Pregnant and expectant mothers
- Young persons
- New and inexperienced workers
- Workers with inherent medical conditions or disability

3 Provide any equipment identified during risk assessment and ensure such equipment is compatible with the working environment, workstation, individual or end user: –
(a) Examples of such equipment are:
i. Display screen equipment
ii. Evacuation chair

1.5.10.3.2 Duties of Employees

1 Each Employee while at work shall: -
(a) Co-operate with the Employer in pursuance of compliance with these Regulations.
(b) Make full and proper use of any system or work, procedure or equipment provided by his employer in compliance with these Regulations.
(c) Take reasonable care for their own health, safety and welfare and that of others who may be affected by their activities.
(d) Inform the employer or any circumstance which could affect the outcome of any control measures in place to mitigate risk or affect the severity of any perceived effects.

1.5.10.4 Office Safety Risk Assessment

1 The owner/occupier shall carry out a suitable and sufficient assessment of all risks presented to employees and visitors whilst in the office environment

2 The risk assessment shall be approved by the Senior person in the organisation who is situated in the office establishment

3 The risk assessment and subsequent office safety plan shall be performed by a competent person with sufficient knowledge of office and building safety

4 This risk assessment shall be communicated in part or whole as relevant during introduction to the office environment

5 Risk assessment should be carried out to control any hazards that cleaning operatives and office building users may encounter from the carrying out cleaning operations on site.

6 The main hazards encountered by an office cleaner are: -

(a) Manual Handling

(b) Chemicals

(c) Slips, Trips and Falls

(d) Clinical Waste

(e) Infection Control

(f) Electrical

1.5.10.4.1 Manual Handling

1 Cleaning operatives should be made aware of the risk from manual handling tasks including instruction in how to lift correctly.

(a) Assess the load and plan the route prior to the lift.

(b) Remove any obstructions or hazards from your route.

(c) Use mechanical aids where possible.

(d) Wear suitable footwear ideally with steel toe caps.

(e) Beware of sharp objects.

(f) Lift load with heaviest side to the body.

(g) Keep the feet apart, bend knees, keep a straight back.

(h) Keep the load close to the body, take a firm grip and lift maintaining a straight back at all times.

(i) Lift smoothly to knee and then to waist level, moving forward without twisting.

(j) Reverse procedure to put the load down.

1.5.10.4.2 Chemicals

1 Cleaning operative should be made aware of the risks involved in the use of cleaning chemicals.

(a) Select a suitable product for the task to be undertaken.

(b) Must read safety data sheet prior to use.

(c) Ensure any personal protective equipment (PPE) is worn.

(d) Dilute chemicals as directed by the label.

(e) Correctly label all spray bottles and do not use unlabelled containers.

(f) Never mix chemicals as this may produce a toxic gas.

(g) Ventilate areas and place warning signs when using chemicals.

(h) Clean up any spillages immediately.

(i) Dispose of any unused or soiled solution as directed by the safety data sheet.

(j) Rinse and neutralise cleaning equipment after use.

(k) When not in use ensure chemicals are stored safely and securely.

(l) Keep chemicals out of the reach of children at all times.

1.5.10.4.3 Slips, Trips and Falls

1 Cleaning operatives should be made aware of the risk from trailing cables associated with the use of vacuum cleaners and other cleaning equipment. Also the risk to office users with regards slipping on wet floors immediately after cleaning. Warning signs must be used when carrying out floor cleaning operations.

2 Slips, trips and falls are the most common cause of major injuries in the workplace. The majority of slip injuries can be contributed to wet or contaminated floors and trips to poor housekeeping. Slips, Trips and Falls

(a) Clean up spills or contamination from floors immediately.

(b) While the floor is wet cordon off the area.

(c) Use of safety signage until completely dry.

(d) Clean slippery floors with the appropriate cleaning chemical.

(e) Maintain a high level of housekeeping.

(f) Keep walkways clear and unobstructed.

(g) No trailing cables inside site offices.

(h) Prevent trips by maintenance of damaged and unsuitable floor surfaces.

(i) Staircases and walkways should be fully illuminated.

(j) Provide a visual warning for changes in level.

(k) Provide handrails where there are changes in level.

1.5.10.4.4 Clinical Waste

1 Clinical waste is mainly produced by hospitals or health centers but on rare occasions office cleaners will come into contact clinical waste so should be properly trained in order to keep any such risks to a minimum.

2 Examples of clinical waste in offices: -

(a) Vomit

(b) Blood

(c) Excretions

(d) Syringes

1.5.10.4.5 Control Measures – Infection Control

1 Risk assessment should be carried out for site offices to ensure that control measures are on place to reduce the risks levels. Please refer to section 11-2.4.01 - Risk Assessment Guides and Method Statement (SAMAS).

2 For The Control of Substances Hazardous to Health (COSHH), Please refer to section 11-2.3.02 - Control of Substances Hazardous to Health COSHH (SAMAS).

3 Hierarchy of Control

(a) Elimination by Design

(b) Substitution with Less Hazardous Substance

(c) Automation of Process

(d) Reducing Exposure by Process Change

(e) Engineering Controls

(f) Minimising Exposure

(g) Personal Protective Equipment

(h) Monitoring / Health Surveillance

4 The list below details a number of control measure that can be introduced to control risk to any hazards that may be present in site office environment. This is not an exhaustive list but only a starting point to help risk assessors for the purpose of risk assessment.

A

- Access control
- Administrative control
- Adjustable equipment
- Alarms
- Anti-slip
- Authorised persons

B

- Back-up procedures
- Barrier systems
- Battery powered tools
- Bund

C

- Cable management
- Caution sign
- CCTV
- Cleaning
- Communications

- Contact (emergency services)

D

- Data protection
- Document holder.
- Document shredder machine.
- Drinking water

E

- Emergency lighting
- Emergency plan
- Ergonomics

F

- Fire action notice
- Fire detection
- Fire extinguishers
- Fire marshals
- First aid

H

- Handrails where changes in level
- Hazard signs
- Housekeeping

I

- Incident procedure
- Induction training
- Insurance (employee liability)
- Insurance (public liability)

L

- Lighting
- Light meter

- Location
- Lockable cupboard
- Lock out/ tag out procedure
- Luminous signs

M

- Maintenance procedure
- Material safety data sheets (MSDS)

R

- Rest facilities

S

- Safety checklist
- Security
- Spill kits

T

- Toilet facilities
- Traffic management
- Training

V

- Ventilation
- Visitor book

W

- Washing facilities
- Waste collection
- Warning sign
- Welfare facilities

1.5.10.5 Display Screen Equipment (DSE)

1.5.10.5.1 What is DSE?

1 DSE are devices or equipment that have an alphanumeric or graphic display screen and includes display screens, laptops, touch screens and other similar devices.

1.5.10.5.2 What are the health risks with DSE?

1 Some workers may experience fatigue, eye strain, upper limb problems and backache from overuse or improper use of DSE. These problems can also be experienced from poorly designed workstations or work environments. The causes may not always be obvious and can be due to a combination of factors.

2 This section does not apply to workers who use DSE infrequently or for short periods of time. However, the controls described in 'How to control the risk' may still be useful for these workers.

1.5.10.5.3 If the Company has DSE users, the Company must:

(a) analyze workstations to assess and reduce risks;

(b) make sure controls are in place;

(c) provide information and training;

(d) provide eye and eyesight tests on request, and special spectacles if needed;

(e) review the assessment when the user or DSE changes.

1.5.10.5.4 How to control the risk?

1 An employer needs to assess the risks associated with using DSE equipment and any special needs of individual staff. The risks from DSE can be controlled using the following control measures: -

(a) Workstations Design

I. Keyboards and keying in (typing)

- A space in front of the keyboard can help you rest your hands and wrists when not keying.
- Try to keep wrists straight when keying.
- Good keyboard technique is important – you can do this by keeping a soft touch on the keys and not overstretching the fingers.

II. Using a mouse

- Position the mouse within easy reach, so it can be used with a straight wrist.
- Sit upright and close to the desk to reduce working with the mouse arm stretched.
- Move the keyboard out of the way if it is not being used.
- Support the forearm on the desk, and don't grip the mouse too tightly.
- Rest fingers lightly on the buttons and do not press them hard.

III. Reading the screen

- Make sure individual characters on the screen are sharp, in focus and don't flicker or move. If they do, the DSE may need servicing or adjustment.
- Adjust the brightness and contrast controls on the screen to suit lighting conditions in the room.
- Make sure the screen surface is clean.
- When setting up software, choose text that is large enough to read easily on screen when sitting in a normal comfortable working position.
- Select colours that are easy on the eye (avoid red text on a blue background, or vice versa.

IV. Changing the work position. The following may help DSE users:

- Stretch and change position.
- Look into the distance from time to time, and blink often.
- Change activity before users get tired, rather than to recover.
- Short, frequent breaks are better than longer, infrequent ones.

(b) Portable computers

I. These same controls will also reduce the DSE risks associated with portable computers. However, the following may also help reduce manual handling, fatigue and postural problems:

- Consider potential risks from manual handling if users have to carry heavy equipment and papers.
- Whenever possible, users should be encouraged to use a docking station or firm surface and a full-sized keyboard and mouse.
- The height and position of the portable's screen should be angled so that the user is sitting comfortably and reflection is minimised (raiser blocks are commonly used to help with screen height).
- More changes in positions may be needed if the user cannot minimise the risks of prolonged use and awkward postures to suitable levels.

(c) DSE user training

I. The Company must provide information, instruction and health and safety training to users to help them identify risks and safe work practices. When training users, consider explaining:

- the risks from DSE work and the controls put in place;
- how to adjust furniture;
- how to organise the workplace to avoid awkward or frequently repeated stretching movements;
- how to clean the screen and mouse;
- who to contact for help and to report problems or symptoms;
- how to use the Display screen equipment (DSE) workstation checklist? (See Appendix 1).

1.5.10.6 Electrical Equipment:

1 Electrical systems shall be installed by a competent and approved installer/contractor and tested and commissioned prior to use.

2 An electrical plan shall detail the permanent and temporary installations, including IT hub rooms, desk set up and kitchens etc.

3 The electrical plan shall be monitored continually and audited periodically by a competent service provider.

4 The electrical plan shall include part of the office risk assessment which is reviewed on an annual basis.

(a) Only approved electrical supply provided by the building and regularly maintained is allowed to be used

(b) Electrical supplies and equipment must not exceed the standard voltage rating for the building

(c) Equipment using electricity must be approved by the electrical engineer for the building

(d) All fixed and portable electrical equipment must be tested, logged and tagged

(e) Temporary electrical systems must be maintained periodically and recorded

(f) Only competent and approved persons may work on electrical systems

(g) An adequate number of sockets should be provided and the running cables and/or wires across floors must be avoided, physical protection means shall be provided for all temporary or extension cables.

(h) If it is necessary to run a cable or electrical cord across the floor a cable cover should be used to protect the wiring and to prevent tripping. Always contact authorized personnel to carry out such tasks

(i) Worn Electrical cords, loose or broken electrical wires, broken outlet covers and receptacles and damaged electrical plugs are dangerous and should be repaired or misplaced before being used again.

(j) Moisture and electricity does not mix. Placing liquids on or around electrical equipment (such as computers, radios, copiers, printers and microwaves) increases the risk of electrocution if the liquid spills and gets into the electrical equipment.

(k) Do not block the electrical panel doors. If any electrical malfunction should occur, the panel door and anything else in front of the door will become very hot.

(l) Electrical panel doors should always be kept closed to prevent “electrical flashover” in the event of electrical malfunction.

(m) Faulty Equipment should be repaired only by authorized personnel

(n) Do not clean electrical equipment prior to switching them off.

(o) Major electrical installations and equipment must be provided with a suitable fire extinguisher in addition to those identified and located as part of the fire plan.

5 All staff and visitors shall be trained in the above and records kept.

6 Relevant notices shall be used at all times warning of added risks or giving information

7 A permit to work shall be used for all work on electrical systems, including a lock out/tag out control measure

8 Only a qualified electrician may work on electrical systems

9 Any defects will be reported to the relevant electrical engineer

1.5.10.7 Ergonomics

1.5.10.7.1 What is Ergonomics?

1 The term "ergonomics" refers to the relationship between individuals and their work environment. The problems addressed by ergonomics include improper "fit" of the workplace, poorly designed or improper workstations, and poor body mechanics when performing repetitive tasks (including computer keyboard use).

1.5.10.7.2 Responsibility

1 Contractor shall encourage workers for prompt and accurate reporting of signs and symptoms of Cumulative Trauma Disorders (CTDs) by employees so that they can be evaluated and treated.

1.5.10.7.3 Employee's Responsibilities

2 IF employee believes that… He/she has developed a work-related CTD, Any work conditions, including but not limited to the following, could produce CTDs:

(a) work method

(b) pace

(c) workstation,

3 THEN employee must… immediately report this information to the supervisor.

4 There is a way to change work methods that provide. Suggestions to the supervisor will reduce the potential for CTDs, submitting CTD-related information to supervisor would have a bad outcome

(a) report the information directly to the QHSSE Department OR

(b) make a report to contractor management

1.5.10.7.4 Supervisor's Responsibilities

5 The supervisor must:

(a) promptly transmit employee reports to the appropriate management and

(b) Inform the reporting employee of management response to the report.

6 Supervisors and HSE managers must not discriminate against or otherwise punish any employee for making a report OR supplying information relating to:

(a) ergonomics,

(b) CTDs and

(c) This safety program in general.

1.5.10.7.5 Reducing and Eliminating Ergonomic Problems Deciding on control methods

1 **IF** ergonomic hazards can be prevented by effective design of the workstation, **THEN** use the following to correct or control them:

(a) engineering controls,

(b) administrative or work practice controls and

(c) personal protective equipment

Note: Engineering controls are preferred over other methods.

2 Designing work stations

Work stations must be designed to:

(a) accommodate the person(s) who works on a job, **not** the "average" worker;

(b) be easily adjustable for specific tasks;

(c) be comfortable for the workers who use them and

(d) be large enough to allow for the full range of required movements.

3 Designing work methods

Work method design addresses the tasks performed by the workers. It requires analysis of work processes in order to design or modify tasks to eliminate stressors.

Work methods must be designed to reduce:

(a) postures that are static, extreme or awkward,

(b) repetitive motion

4 Work method monitoring

Regular monitoring must be conducted at all levels to ensure that employees continue to use proper work methods.

Monitoring must include a periodic review of:

(a) techniques in use,

(b) effectiveness of techniques,

(c) procedures in use compared to the procedures specified,

(d) changes that may have occurred and

(e) whether additional action is necessary.

1.5.10.7.6 Training

1 **Training for employees** potentially exposed to ergonomic hazards is a critical component of the ergonomics program.

Training allows managers, supervisors and employees to understand:

(a) ergonomic hazards associated with their jobs and processes and

(b) hazard prevention, control and medical consequences.

2 **General employee training**

Employees who may be exposed to ergonomic hazards must train on:

(a) CTD (Cumulative Trauma Disorders) types,

(b) risk factors,

(c) recognition and reporting of symptoms and

(d) Prevention.

The instruction must be repeated for an affected employee as necessary

3 **Supervisor training**

Supervisors must go through the same training as their employees. In addition, supervisors must be trained to:

(a) recognize the symptoms of CTDs (Cumulative Trauma Disorders);

(b) recognize and correct hazardous work practices;

(c) reinforce the ergonomic program and

(d) train employees about ergonomics.

4 **Manager training**

Managers must be:

(a) aware of their safety and health responsibilities and

(b) trained in ergonomic issues:

(c) at each work station and

(d) in the ergonomic process as a whole.

5 Evaluating the effectiveness of the training program

To determine if those who received training understand the material and the work practices to be followed, conduct periodic:

(a) employee interviews,

(b) testing and

(c) work practice observation

1.5.10.7.7 Evaluating the Ergonomics Program

1 The QHSE Department will conduct surveys of the worksite to evaluate success in meeting the Company's goals and objectives:

(a) periodically **OR**

(b) whenever there are significant changes

2 Conducting a periodic survey

When evaluating the effectiveness of the program, the QHSE Department will:

(a) conduct employee surveys,

(b) before and after surveys and evaluations of workstation changes;

(c) review survey results, up-to-date records and logs of job improvements implemented;

(d) analyze trends in injury/illness rates;

(e) identify new and previously undetected risk factors;

(f) identify needed changes in work practices and engineering controls and assess the effects of previous changes in the work process.

1.5.10.8 Office Safety Plan

1 An office safety plan shall be produced which incorporates
(a) Office risk assessment
(b) Welfare facilities and environmental controls
(c) Access and egress
(d) Security
(e) First aid
(f) Fire and emergency procedures
(g) Ergonomics

2 The office safety plan shall be specific and reviewed and updated at least annually or when a major change occurs.

1.5.10.9 Office Facilities

1 Office risk assessment – refer to 1.5.10.4.

2 Welfare facilities shall meet the requirements of Qatar Labour Law No. 19, essentially with regards to:

(a) Temperature – the workplace temperature shall be controlled so as to ensure
   i. 'thermal comfort', taking into consideration the immediate environment, the tasks undertaken and the individual
   ii. Not be less than 16°C in a normal office environment and not less than 13°C if physical effort is involved (unless other legislation requires lower temperatures)

(b) Ventilation – workplaces shall be adequately ventilated
   i. Fresh clean air should be drawn from an outside source and circulated through the office
   ii. Ventilation should remove and dilute warm, humid air and provide air movement which gives a sense of freshness without causing a draught which could cause an individual to experience discomfort
   iii. Windows or other openings may provide sufficient ventilation but, where necessary, mechanical ventilation systems should be provided and regularly maintained

(c) Lighting – should be;
   i. Suitable and sufficient and enable persons to work and move around safely
   ii. provided locally if necessary and where ambient lighting does not provide enough illumination to perform the tasks required
   iii. lighting and light fittings shall not present a hazard or risk to the workers

(d) Cleanliness shall be;
   I. It's the duty of employers to ensure the workplace including any furniture, furnishings and fittings are kept sufficiently clean. The following to be implemented:
      - Providing suitable receptacles to collect general office waste and arrangements to ensure they are emptied on a regular basis to stop the build-up of rubbish in the office.
      - Providing sufficient sanitary closets for both male and female employees.
      - Providing running hot and cold water, toilet paper, hand soap and a means of drying hands.
      - Arrangements for cleaning of spillages and dealing with defective sanitary equipment should also be in place.
   II. By the introduction of an office-cleaning schedule this will reduce risk from micro-organisms which will help prevent the spread of disease. Draw up a cleaning schedule and assess the frequency would help to ensure all areas are cleaned and sanitsed on a regular basis.
   III. Cleaning operatives should be trained. If outsourcing office cleaning to a specialist contractor, companies should ensure this is specified during the tender process as this may cause future problems with poor safety awareness and result in poor cleaning standards.
   IV. maintained throughout the entire office environment
   V. waste materials shall be disposed of by an effective method which does not present added risks to individuals
   VI. travel routes, corridors, lifts and emergency exits shall be kept free of waste and other materials
   VII. furniture, fixtures and fittings shall be kept clean and surfaces and floors regularly cleaned as part of an office maintenance programme

VIII. where chemicals and substances are required to clean any of the above then adequate mitigation measures shall be introduced to eliminate or minimise the exposure of workers

(e) room dimensions and space shall be;
   i. suitable and sufficient for the individual and the tasks performed
   ii. not less than 11 cubic metres per person

(f) workstations and seating shall be;
   i. suitable and sufficient for the individual and the tasks performed
   ii. ergonomically designed so as to prevent or minimise the effects on the individual caused by their everyday activities

(g) suitable and sufficient sanitary conveniences and washing facilities shall be
   i. provided at readily accessible places within the office environment
   ii. cleaned and maintained regularly
   iii. equipped with hot and cold running water, soap and drying facilities
   iv. toilets shall be separate for men and women with lockable individual closets and of an amount which shall satisfy the number of persons
   v. dependent upon the tasks undertaken and in line with risk assessment, there shall be provided showers and changing facilities
   vi. accommodation for changing clothes shall be provided where required in v. above, and this accommodation shall be separate to eating and drinking facilities

(h) drinking water shall be provided which is
   i. clean and from the direct mains or where this is not possible
   ii. from a supplier who is registered and approved

(i) eating, drinking and rest rooms shall be provided which;
   i. are separate to the normal working environment
   ii. cleaned and maintained regularly

(j) where food preparation areas or food and drinks are prepared and served then these places shall conform to food hygiene standards as described in Qatar Labour Law No. 19

(k) all work areas shall be designated “no smoking” and where necessary specific smoking areas shall be provided which are separate to rest rooms, food and drink preparation and serving areas, and any other part of the working environment

3 Access and egress shall be provided which is;

(a) Clearly indicated by signage and other suitable means

(b) Well-lit and clear of obstacles

(c) Suitable and sufficient for the demographics of any workers or intended visitors, including the elderly, lesser abled and infirmed

(d) Supportive of any emergency procedures, e.g. door openings, window openings, safety glass etc.

(e) Conducive to the free flow of pedestrians and does not present a conflict zone with traffic and vehicles, plant and equipment

(f) Inclusive of floors which do not present slips and trips hazards

(g) Provided with suitable drainage points where water is likely to accumulate

4 Office Energy Policy

Here are some simple measure that can be carried out to help reduce the environment impact of offices: -

(a) Air Conditioning

I. Do not overcool the office

II. Regular technical check should be done ensuring the sufficiency.

(b) Office Equipment

I. Turn office equipment off when not in use.

II. Enable computer power saving features.

III. Ensure energy efficiency is a factor when purchasing new office equipment.

(c) Lighting

I. Ensure unnecessary lighting is turned off.

II. Turn the lights off at the end of the day.

III. Specify energy efficient bulbs.

IV. Install motion sensors to turn lighting on and off in areas such as toilets and photocopier rooms.

5 Pest Control

(a) Procedures to reduce the risk of insect or rodent infestation should be implemented as site office provide pests with suitable temperature, food and shelter. Catering and eating areas are particular areas at risk and by ignoring simple pest control measures this may aid pest infestation and help spread disease and cause distress amongst staff.

(b) The Contractor should provide a regular pest control through a specialist pest control contractor.

(c) Control measures should include; -

I. Discouraging the eating of meals at workstations and providing designated areas such as rest areas and restaurant facilities for this purpose.

II. Introducing a strict cleaning regime with the emptying of office bins on a daily basis to an external refuse area.

III. The integrity of the office building should be maintained with any holes and gaps in walls plugged and filled.

IV. The sighting of the external refuse area should be away from the office building.

V. Waste skips and bins within the external refuse area should be emptied regularly to ensure they are not being overfilled.

VI. Waste skips and bins containing food waste should include lids or covers

VII. General good hygiene practices in all areas including bathrooms and pantry areas.

6 Preventative Maintenance

(a) Planned preventative maintenance should be carried out at regular intervals on any plant and equipment where there is a direct or indirect risk to health and safety or business continuity from a complete or partial failure.

(b) In site office preventative maintenance is the action of carrying out inspections and servicing of any hard services normally the fixed plant and equipment associated with the office fabric. The aim is to prolong the life of plant and equipment and prevent failures of component which may lead to breakdowns and result in associated safety risks and

business continuity issues. Preventative maintenance should only be carried out by a competent person.

(c) It is a mandatory requirement that certain plant and equipment is routinely inspected and tested to a specified standard. This will include; -

I. Electrical installations (fixed)

II. Portable appliances

III. Heating systems

IV. Emergency Lighting

V. Fire alarms

VI. Fire extinguishers

(d) Some of the routine checks can be carried out by competent employees who have received adequate instruction and training. Checks should be signed and dated.

(e) Records of all maintenance including any checks by employees must be kept.

7 Waste Minimisation Tips

Follow our simple tips to help reduce office paper waste to landfill.

(a) Prevention

I. Select appropriate software use in order to send internal and external correspondence electronically.

II. Store files electronically on your computer, shared server, disk or device.

III. When editing documents on your computer make use of print preview, use small font and set narrow margins.

(b) Reduce

I. When printing use both sides of the paper, photocopiers can be set to print on both sides by default.

II. Ensure printer and copiers by default return to single copy printing after use.

III. Keep mailing lists up to date to avoid duplication and unwanted correspondence.

(c) Re-use

I. Reuse scrap paper as notepaper.

II. Envelopes can be reused for internal post.

(d) Recycle

I. Join an office paper recycling scheme.

II. Provide office paper receptacles around the office and encourage staff to segregate their paper waste.

III. Only purchase recycled paper products to help support the market for paper recycled goods.

8 Security
(a) Security awareness should be part of the contractor's culture. It's recommended to consider the security on site as a separate department.
(b) Arrangements should be put in place to ensure non- employees are not at risk whilst on the premises and adequate security measures should be taken. A simple system should be introduced.

1.5.10.10 General Office Safety

1 Windows and doors shall be constructed of a material which does not present added hazards
(a) Safety glass as described in British Standards shall be installed wherever possible
(b) Provision shall be made wherever possible to ensure the cleaning of windows does not present falls from height hazards
(c) In new build offices the windows shall be designed so they can be cleaned from inside or by use of a permanent and proprietary system from the outside

2 Floors will be non-slip whenever possible. Ramps shall be provided for the use of wheelchairs, where persons are unable to use steps, and for the movement of materials on mechanical handling devices (trolleys etc.).

3 Traffic routes shall be designed so as to control the speed of traffic to a reasonable speed and to give clear delineation between traffic and pedestrians.

4 Traffic routes shall take into consideration the need for reversing and strive to eliminate this potential at all times.

5 Proper and appropriate signage shall be installed at all areas identified in the office risk assessment.

6 Office traffic and pedestrian routes (including emergency evacuation.

7 Pedestrian routes shall come into conflict with traffic routes where possible, emergency evacuation routes and assembly points will be planned away from traffic
(a) Where this is not possible then mitigation measures to control traffic and pedestrians shall be introduced

8 Where escalators and moving walkways are provided they shall be:
(a) equipped with necessary safety devices
(b) fitted with one or more emergency stop controls which are easily identifiable and readily accessible

9 Provision shall be made for the safe storage of hazardous and flammable materials
(a) Premises shall be suitable and designed to prevent exposure to office workers
(b) Suitable and sufficient firefighting and clean up equipment and systems shall be provided as identified by the office risk assessment
(c) Material Safety Data sheets shall be provided for all chemicals and substances stored

1.5.10.11 First Aid, Fire and Emergency Procedures

1 All offices shall conform to the local building regulations with regards to:
(a) The prevention of fire

(b) The protection of individuals in the event of fire, including;
(c) Fire and smoke detections systems which are maintained and tested on a regular basis
(d) Alarm systems which are audible and understood
(e) Emergency lighting which shall be provided in the event of a failure of primary lighting systems
(f) Evacuation routes which are:
  i. kept free from obstacles and waste
  ii. identified by the approved internationally recognised signage, and
  iii. well-lit

2 First aid facilities shall be provided which are commensurate to the hazard and risks identified and the potential injuries to persons from their everyday undertakings

3 Location of first aid facilities shall be clearly sign posted

4 Records of all first aid treatments, fire and evacuation drills shall be kept by the owner/occupier

5 Appointed persons shall be trained on specific duties with regards to first aid, fire and emergency evacuation.

6 Fire Safety
(a) The main reference here is “Civil Defence Department, Ministry of Interior, Qatar, - Fire Safety Standards- Minimum Requirements - Portable Cabin”
(b) All emergency lighting units now display a picture of a running man with a directional arrow to direct building users to the nearest fire exit. The running man is to indicate the urgency required and is not an invitation to sprint out of the building. You should, of course, leave by the quickest possible means but also maintain the safety of yourself and others.
(c) The emergency lighting system should be regularly inspected and serviced.
(d) No smoking is allowed any time inside the site offices. Designated smoking areas should be used for that purpose.

7 Other evacuation scenarios shall be considered in line with the office risk assessment and the office safety plan, including but not limited to (where required);
(a) Bomb threat
(b) Earthquake and or compromise of the building structural integrity
(c) Adverse weather
(d) Armed intrusion and or robbery
(e) Other unplanned events with the potential to cause harm to building occupants

8 Evacuation routes shall be
(a) Clearly identified with illustrations posted at all relevant points
(b) Communicated to all persons entering the building

9 Emergency evacuation drills shall be performed periodically at intervals not exceeding six months

10 Records of training on all of the above shall be kept

11 Details of emergency contacts shall be kept up to date and posted in prominent areas as well as being made available to workers and visitors

12 Assembly points shall be in a place so as not to present further hazards to evacuees or block the passage of the emergency services.

1.5.10.12 Inspections, Monitoring and Reporting

1 General office facilities shall be inspected monthly as a minimum and a report completed which highlights;
   (a) Any defects or non-compliances to these regulations
   (b) Assigned mitigating actions with designated individuals responsible for these actions

2 Other more specialized rooms or areas where hazardous chemical or substances are present, shall be subject to more stringent inspections and more frequently

3 Firefighting systems shall be inspected as per Qatar Building Regulations and a report made available for audit by Civil Defence or other institution

Appendix 1:

Display Screen Equipment Work Station Assessment Checklist

(The following assessment should be carried out jointly between Assessor and Employee).

Department	Work Station Identification	Date of Assessment

1. Employee

Employee Name.	
Is the workstation used habitually as a significant part of normal work?	Yes ☐ No ☐
If YES, what percentage of his/her working time is spent operating the DSE (if intermittent give estimated average)	%

2. Equipment

1. Monitor	Make and Model				Remarks
	Swivel/tilt available?	Yes ☐	No ☐		Remarks
2. Screen	Stable Image?	Yes ☐	No ☐		
	Adjustable brightness?	Yes ☐	No ☐		
	Glare/reflection free?	Yes ☐	No ☐		

3. Keyboard	Make and Model				Remarks
Separate from monitor?	Yes		No		
Tiltable?	Yes		No		
Matt surface?	Yes		No		
Legible keys?	Yes		No		

4. Work Desk/Surface					Remarks
Adequate Strength/stability	Yes		No		
Area adequate size? (inc. space for the processing of any involved paperwork)	Yes		No		
Matt surface?	Yes		No		
Adequate space for worker to gain a comfortable posture during any combined work/paperwork?	Yes		No		
Surface non-reflective?	Yes		No		

5. Work Chair

					Remarks
Is chair adjustable (swivel)?	Yes		No		
Seat height adjustable?	Yes		No		
Back height/tilt adjustable?	Yes		No		

6. Ancillary Equipment (If required!)

					Remarks
Document holder available?	No		Yes		
Footrest available?	No		Yes		
Suitable task light available?	No		Yes		

3. Environment

7. Space Requirements

					Remarks
Adequate for postural changes?	Yes		No		

8. Lighting

					Remarks
Adequate lighting levels?	Yes		No		
Glare/reflections present?	No		Yes		

9. Noise					Remarks
Causing distractions?	No		Yes		
Disturbs speech?	No		Yes		
10. Thermal Comfort					Remarks
Background temp' satisfactory?	Yes		No		
Humidity adequate?	Yes		No		
Ventilation adequate?	Yes		No		

4. User/Computer Interface

11. Software					Remarks
Is software adequate for tasks?	Yes		No		
12. General Safety					Remarks
Electrical hazards?	No		Yes		
Trip hazards	No		Yes		
Is equipment positioned safely?	Yes		No		
Adequate space to allow easy Access/egress?	Yes		No		

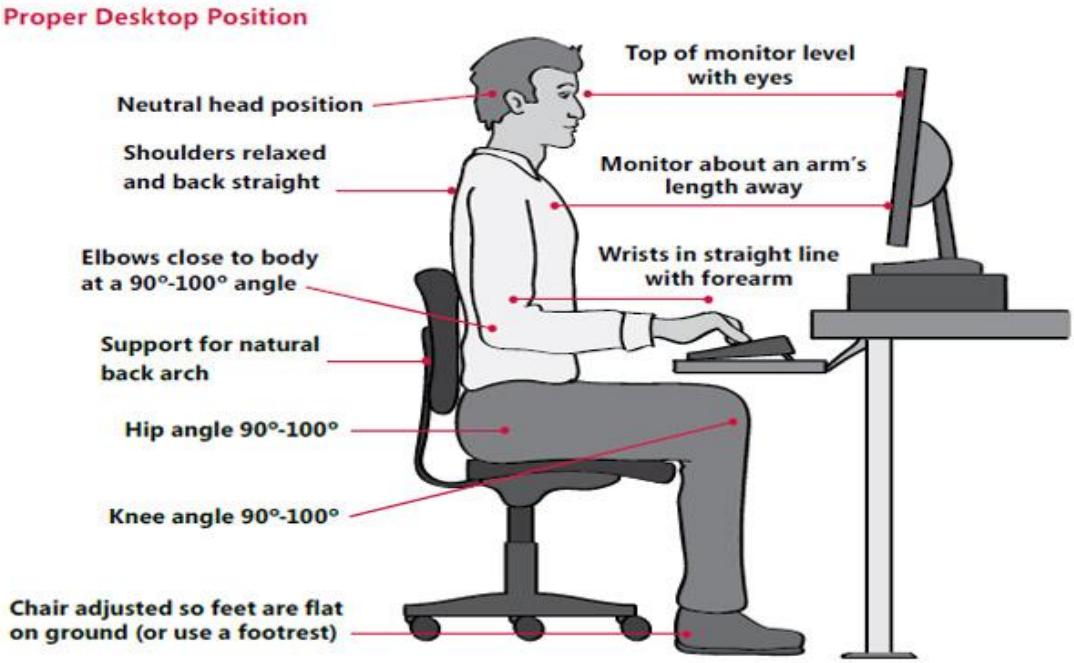
5. Remedial Action Required / Advice Given

6. Confirmation

Signature of Assessor		**Signature of Employee**	
Print Name		**Print Name**	
		Review Date (where applicable)	

Review of this assessment should be done for the following conditions/frequency as follows:

- **Annual, whenever there is no change in the workstation.**
- **When transferred to another workplace.**
- **Whenever health issues arise.**
- **Monthly review of remedial actions required to resolve the issues.**



Incorrect

1. The laptop screen is too close and too low.

Incorrect

2. The viewing distance is too far and the screen is too low.

Incorrect

3. Correct viewing distance, but back and neck strain.

Correct

4. Correct posture and viewing distance because of the K laptop stand.

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