



BS 5502 : Section 1.5 : 1978

[Services]

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British Standard Code of practice for

Design of buildings and structures for agriculture

Part 1. General considerations

Section 1.5. Services

Code de bonne pratique pour le dessin des bâtiments et structures agricoles

Partie 1. Considérations générales

Section 1.5. Services

Richtlinie für den Entwurf von Gebäuden der Landwirtschaft

Teil 1. Allgemeine Erwägungen

Abschnitt 1.5. Dienste

IMPORTANT NOTE. It is essential that this Section be read in conjunction with the information in the 'Introduction' to BS 5502 : Part 1, which is published separately.

Contents	Page	
0. Definitions	1	The roof and floor should be of concrete at least 125 mm thick. Any doorways in the walls should conform to the Rules of the Fire Offices' Committee for the construction and fixing of fireproof doors, at a sill level above the chamber floor to ensure an oiltight catchpit having a capacity at least 10 % greater than the total oil content of the tank(s).
1. Drainage	1	
2. Electrical services	3	
3. Gas (including LPG) and compressed air services	8	
4. Chimneys, flues and heating appliances	8	
5. Water services	9	
6. Storage of liquid fuel	11	0.5 oil catch-pit. (a) A sump or well below ground level immediately beneath a tank or tanks, oiltight and having a capacity at least 10 % greater than that of the tank(s); (b) a space enclosed by walls and/or floor of incombustible material, substantial, oiltight, and having a capacity at least 10 % greater than that of the tank(s).
Tables		
1. Maximum spans and minimum heights of overhead cables	6	
2. Requirements for service pipework	10	

0. Definitions

For the purposes of this Section of this British Standard the following definitions apply.

0.1 transportable motor. A motor which is not permanently wired to a circuit and is of such size and weight that it can easily be moved.

0.2 oil storage tank. A tank for the bulk storage of oil for an oil burning installation.

0.3 oil service tank. An auxiliary oil storage tank of not more than 3000 litres.

0.4 oil tank chamber. A chamber constructed from fire resistant materials, e.g. 225 mm thick walls, brickwork, masonry or concrete or 125 mm thick reinforced concrete.

1. Drainage

This clause is applicable to all drainage systems and installations. Part 2 of this standard gives recommended data and practices for specialized buildings and processes. BS 5502 : Section 3.1 gives information on the principal requirements of the relevant legislation with regard to their effect on farmstead drainage. Reference should also be made to CP 308 'Drainage of roofs and paved areas'.

1.1 Definition of farm and horticultural wastes. For the purpose of distinguishing trade wastes from agricultural and horticultural operations the following types of effluent are included:

- (a) livestock faeces and urine diluted or in raw state, soiled litter and washing-down water from cleansing operations in and around buildings;

This code of practice represents a standard of good practice. Compliance with it does not confer immunity from relevant legal requirements including regulations and byelaws.

BS 5502 : Section 1.5 : 1978

[Services]

- (b) liquors resulting from conservation, fermentation and degeneration of crops, e.g. grass, green maize and pea haulm;
- (c) disinfection and cleansing agents and chemicals, e.g. as used in cleansing of milking plants, crop sprays, oil, sheep dipping procedures, or dressing or denaturing of grain;
- (d) waste from food and vegetable processing;
- (e) infected organic matter;
- (f) surface water contaminated with any of the above or other agricultural sprays, petrol or other fuels.

For information on the precise chemical character, biochemical oxygen demand (BOD) assessment, toxicity and handling of such wastes on the farm, see BS 5502 : Part 2.

1.2 General

1.2.1 All wastes on farms should be disposed of in a safe manner. Farm waste should not be transported through domestic premises, or where food for human consumption is stored or prepared.

Untreated liquid wastes should be disposed of or treated in such a manner that no unacceptable pollution can occur. Local health or the appropriate authority should be consulted before manure storage or disposal facilities are established.

1.2.2 Any system for the collection, storage and disposal of farm waste should be capable of dealing with the maximum load expected from the particular husbandry system allowing for any constraints imposed by climate, soil or vegetation.

1.2.3 Dungsteeds and middens should be designed to withstand safely all loads imposed by the material, vehicles or machines operating in the vicinity. They should be provided with tails and open channels to ensure that any liquid is borne quickly into the nearest gully or liquid manure drainage system.

1.2.4 All tanks intended for the holding or storage of agricultural waste and by-products should be designed to withstand all static and dynamic loads they may be subjected to. Any slatted or gridded cover to which human, animal or machine may have access should withstand safely all applied loading without causing injury.

1.2.5 Where a worker occupies a building for 4 h or more a day, lavatory accommodation is required (see clause 4 of BS 5502 : Section 3.5 : 1978).

Disposal of human waste should be separate from all other waste, and installations should follow the recommendations of CP 301 and CP 304.

1.2.6 Installations for plumbing and drainage of wastes from workshops or areas used for the collection, handling, processing and storage of food products should follow the recommendations of CP 301 and CP 304.

1.3 Movement of effluent for subsequent treatment.

All farm and horticultural waste as defined in 1.1 and normally transported by water-borne methods should, where necessary, be diluted to achieve an adequate flow rate in pipe or ductwork.

1.4 Partial treatment of effluent. In designing systems for the treatment of effluent, account should be taken of the scale of the enterprise and the need to avoid permanent damage to agricultural land, air pollution or unacceptable pollution of any watercourse or underground waters or water used for drinking or cleansing.

1.5 Combining and separation of drainage systems.

Sewage from the homestead and effluent resulting from farm and horticultural operations should not be combined in the same drainage system (see also BS 5502 : Section 3.1).

1.6 Storage of effluent on the farm

1.6.1 Where trade wastes are stored below or partly below ground, the construction and waterproofing of the container should be such that, as far as practicable, the contents do not percolate into the surrounding subsoil. In high water table areas storage should be constructed above the water table or designed and constructed to resist flotation and external hydrostatic pressures. Any storage container should be so sited that domestic accommodation is not subjected to nuisance.

1.6.2 Where manure is stored in solid form

(a) the storage capacity should be based on the type and number of animals and the frequency of manure removal (see Part 2 of this standard); and

(b) the storage structure should be accessible to solid manure handling equipment and to plant for mixing the contents, if necessary.

1.6.3 Where manure is stored in liquid form

(a) the storage capacity should be based on the type and number of animals, the frequency of manure removal and the volume of any required dilution water (see Part 2 of this standard); and

(b) the storage structure should be

- (1) designed to allow complete removal of the liquid manure and cleansing;
- (2) provided with adequate ventilation for safety during filling and emptying;
- (3) accessible to liquid manure handling equipment; and
- (4) provided with safety ladders, if above ground level.

1.6.4 Where appropriate, liquid manure stores should be enclosed by a fence to restrain children or livestock and/or be suitably covered (see 14.6 of Section 1.6 and Part 2 of this standard).

NOTE. Water authorities issue sets of guide lines on slurry storage and disposal in their area, and they should be consulted for methods of disposal not covered by statutory regulations.

1.7 Drainage of isolation facilities for livestock. Where special facilities are provided for diseased animals the effluent from such accommodation should remain separate from other farm effluent and be disposed of independently and in such a manner that it cannot convey infection to other stock.



1.8 Dairy wastes

1.8.1 Where liquid manure storage is available the following procedures should be followed.

All washings and manure from milking parlour floors and other floors and all wash waters from milk rooms, milkhouses and milking parlours should be diverted to the liquid manure store.

1.8.2 Where liquid manure storage is not available the following procedures should be followed.

- (a) All solid manure should be removed and placed in the manure storage.
- (b) Floor wash water containing milk wastes should be piped to a settlement tank.
- (c) Overflow from the settlement tank should be connected to a disposal system which has the approval of the Local Authority.
- (d) Provision should be made for periodic emptying and cleansing of all settlement tanks.

1.9 Silage effluent. Effluent from ensiled crops should be drained to a suitably sized storage chamber. Silage effluent is normally disposed of by diluting with water and spraying onto the land. Because of its very high BOD value, it is unsuitable for processing in waste treatment plants relying on oxygenation. In its undiluted state it is strongly acid, and can cause damage to concrete surfaces which are at all porous.

NOTE. For further guidance on the disposal of silage effluent see the publications produced by the Agricultural Development and Advisory Service of MAFF, the Scottish Agricultural Colleges and the Department of Agriculture Northern Ireland.

1.10 Manure lagoons. 'Manure lagoon' means a structure specifically designed to treat livestock wastes by biological and/or chemical and/or physical processes.

1.10.1 The local and/or water authorities should be consulted before lagoon size and location are determined.

1.10.2 A lagoon should be so located as to avoid nuisance, odour and:

- (a) where the subsoil is pervious or a part is pervious, a lagoon should be provided with an impervious lining;
- (b) should be in an area with adequate room for future extension, and be of sufficient capacity for proper operation;
- (c) should be sited with consideration to the prevailing winds;
- (d) should be an adequate distance from any living area to avoid becoming a nuisance (see 1.6 and CP 302);
- (e) should exclude surface drainage from adjacent areas;
- (f) should be located where it cannot contaminate surface and well water supplies;
- (g) should be in a location exposed to the wind.

1.10.3 A lagoon should be enclosed by a fence to restrain children and livestock (see 14.6 of Section 1.6 of this standard).

Signs should be attached to the fencing to indicate the purposes of the lagoon and give warning of any danger involved.

A lagoon should preferably be surrounded by an embankment to allow expansion of the contents due to rainfall and encrustation.

1.11 Surface water. Uncontaminated surface water may be discharged into soakaways and water courses, etc.

2. Electrical services

2.1 Definitions. For the purposes of this clause the definitions given in BS 4727 and in the Regulations for the Electrical Equipment of Buildings* apply.

2.2 General. This clause deals with the construction and provision of electrical installations. To ensure safety and efficient operation, all material and electric wiring should comply with the requirements of the relevant British Standards and of the current Regulations for the Electrical Equipment of Buildings published by the Institution of Electrical Engineers. CP 3007 gives recommendations for milking installations.

Electrical installations include the following:

- (a) consumers' controls and distribution system;
- (b) lighting of buildings, yards and roadways;
- (c) heating;
- (d) motive power, including ventilation;
- (e) battery-charging;
- (f) electric fences, when within or around buildings;
- (g) standby stationary or mobile generating plant.

2.3 Exchange of information. See clause 7.2 of BS 5502 : Section 3.1 : 1986 for consultations that are required with other statutory undertakings, etc.

2.4 Wiring diagrams. In every farm building or part of a farm building other than one used as a domestic dwelling, there should be on permanent display beside the main supply switch for that building, or part of the building, a schematic diagram, of a suitable size, showing the main distribution circuits and the control switches.

2.5 Design considerations and operating conditions.

Electrical installations on farms and horticultural premises are subjected to widely differing conditions calling for installations which are robust and simple in character. For convenience, these conditions may be broadly classified as follows.

- (a) Barns or general purpose buildings providing storage space for carts, trailers, implements and feeding-stuffs. These buildings also house various food preparation equipment, and sometimes built-in threshing plant constituting a dust hazard. Conditions are generally dry, but precautions against mechanical damage to wiring should be taken where ladders and elevators are stored and materials are stacked high.
- (b) Covered yards, stables, cowsheds, piggeries and buildings or parts of buildings used for housing livestock should be regarded as constituting semi-damp situations, with a recurrent high degree of humidity, caused by hosing floors and washing animals, etc. In addition, ammonia fumes may be present in the air to a substantial degree.
- (c) Dairies, milking sheds, milking parlours and other premises or rooms where milk or milk products are processed. These should be regarded as constituting damp situations, with a high degree of humidity and free steam, containing lactic acid and milk fats.
- (d) The dispersal of farm buildings and the extensive use of mobile machinery involve the use of long, trailing cables, often lying in water or damp situations, sometimes in the presence of corrosive liquids.



(e) In buildings of various forms of light construction, such as wooden poultry houses, the conditions are generally dry and no particularly corrosive circumstances prevail.

(f) Drying sheds and buildings or parts of buildings housing crop-drying plant vary in degree of humidity because of damp or fumes. An open-sided building used for these purposes should be treated as an outdoor installation. In all cases a high degree of atmospheric humidity is likely to occur and may be accompanied by temperatures up to 47 °C. In the case of solid fuel, gas and oil-fired plant, products of combustion may be present in the drying chamber and outlet passages, and with hop-drying plant sulphur dioxide fumes may also be present.

(g) In Dutch barns and similar buildings, where only roof cover is provided, substantially outdoor conditions prevail.

2.6 Incoming electricity supply. Standard a.c. supply systems on farms are as follows:

- (a) single-phase 240 V;
- (b) single-phase 480 V (240-0-240 V);
- (c) three-phase 415/240 V.

They may be supplied either direct from a distribution network or from a separate transformer.

2.7 Layout of installation. The regulations issued by the Institution of Electrical Engineers, in particular section K, should be observed as far as they apply. The main intake and controls should be as close as practicable to the major electrical appliance. Each building or group of buildings should be treated as a separate installation and isolated from other supplies.

2.8 Heating and lighting. Recommendations for electric heating and lighting in and around particular types of farm building and for farm processes are made in relevant Sections of Part 2 of this standard, together with special heating requirements for horticultural purposes.

2.9 Precautions against special conditions; general considerations

2.9.1 When selecting conductors and similar components, preference should be given to the use of fully insulated equipment where livestock may be present, where dampness, wet conditions, chemical, corrosive or flammable gas atmospheres may exist, or where special types of building are involved (see also 2.5).

2.9.2 All apparatus and conductors exposed to weather, corrosive atmosphere or other adverse conditions should be so constructed or protected as to prevent danger arising from exposure.

2.9.3 Where a conductor or similar component is likely to be exposed to flammable surroundings or is installed in an explosive atmosphere, it should be protected in a flameproof enclosure or be so constructed as to prevent danger by ignition or sparking. (See BS 229, BS 4683 : Part 2, CP 1003 : Part 1.)

2.9.4 A 'flameproof enclosure', in relation to any conductor or similar component, should provide an enclosure or casing which will withstand any explosion by a flammable gas that may occur within it. This is with the proviso that the apparatus is operated within its rating and recognized overload. The enclosure should prevent the transmission of flame such as would ignite any flammable gas that may be present in the surrounding atmosphere (see also 2.10 'Installations in oil tank chambers').

2.9.5 When considering the location of equipment for isolation and control of circuits and apparatus, it is essential that care be exercised to ensure that access to the isolation and control equipment will not at any time be impeded by the presence of livestock.

2.9.6 The control and guarding of electric motors should comply with the requirements of the Agriculture (Stationary Machinery) Regulations 1959 which come under the Health and Safety at Work etc. Act 1974, in addition to the requirements of the IEE Regulations.

2.9.7 In order to comply with the above requirements, all isolation and control equipment having a voltage exceeding 250 V should be marked to indicate the voltage present.

2.9.8 In considering the installation and positioning of electrical equipment, attention should be given to the possible results arising from mechanical damage and fire especially relating to livestock, e.g. nuzzling or chewing of fittings or wires by the stock, broken glass from light fittings falling into livestock feeding areas, or bedding or other combustible material being heaped accidentally close enough to a fitting (such as an infra-red heater) to constitute a fire risk.

2.10 Installations in oil tank chambers. Adequate electric lighting should be provided in the oil tank chamber. The installation should be permanent and preferably in screwed metal conduit or mineral-insulated metal-sheathed cable.

Light switches should be located outside the chamber and light fittings should be of the bulkhead or well-glass type.

Where fuel with a flash point lower than 54.4 °C (closed cup) is stored, any electrical equipment in the tank chamber should be of flameproof or other intrinsically safe design (see BS 4683 : Part 2 and BS 1259).

2.11 Safety controls: electrical and mechanical installations. Fail-safe cutouts, remote controls, isolators, circuit breakers, etc., should be within easy reach, simple and quick to operate and clearly and suitably indicated (see BS 861 : Parts 1 and 2).

2.12 Distribution systems

2.12.1 General. This subclause deals with the design and installation of consumers' distribution systems for low and medium voltages.

The systems considered include overhead lines, underground cables and cables attached to walls and buildings.

Special factors affecting electrical distribution in horticultural establishments are dealt with in the relevant Section of Part 2 of this standard.

2.12.2 The supply to all buildings should be suitably rated using a stepdown transformer located if possible in a central position for distribution and complying with the requirements of the supply authority.

2.12.3 Access should be provided for the maintenance of poles, towers, switch gear and transformers and, where applicable, protective fences (child and stock-proof) should be provided.

2.12.4 Materials, appliances and components. Materials, appliances and components for distribution overhead, underground and on walls of buildings should be selected according to the recommendations of the following clauses, and should comply with the requirements of relevant British Standards

2.12.5 Intake facilities. Provision should be made for a switchroom, intake room or substation for the distribution



of cables throughout the farmstead. The location of the service intake should fulfil the following conditions. It should

- (a) allow the supply cable to be brought in without undue difficulty;
- (b) be reasonably accessible at all times for reading the meter, replacing fuses and general maintenance;
- (c) be separated from any gas meters by a fire resisting partition;
- (d) not be placed in any areas where heavy condensation is likely;
- (e) provide an easy and accessible route for outgoing cables, suitably sited and protected against rodent damage and direct sunlight;
- (f) be in such a position that the minimum radius of bend for the supply cable is observed;
- (g) ensure that underground cables are laid at sufficient depth to avoid damage from tillage operations (see IEE Regulation K.20); and
- (h) be sufficiently large for any additional equipment, i.e. with provision for at least a 25 % increase in load.

2.12.6 Mains and submains isolation and control

2.12.6.1 The mains switch controlling the whole of the electrical installation should be not more than 1.8 m from the Electricity Board's point of supply.

The mains switchgear should be mounted on a panel securely fixed to a wall or to a framework of angle iron or slotted angle.

The main controlling switch should be positioned immediately beside the meter and should cut off the mains supply to the whole installation in one operation. Additional switches should be provided to isolate all circuits and subcircuits and all apparatus in case of emergency.

2.12.6.2 Where the main service intake serves other buildings, each building should have a control switch to isolate all those parts of the installation that are contained in that building.

Where there is an 'off-peak' supply, a separate control switch is necessary for the 'off-peak' installation.

2.12.6.3 Where isolated apparatus, e.g. a pump, is in use and remote from the main installation, there should be separate means of control adjacent to the apparatus and readily accessible to the person in charge of the apparatus, to enable it to be disconnected and/or isolated from the supply at that point.

2.12.6.4 Where different nominal voltages exist, means of access to all live parts of switchgear and controls should be marked to indicate the voltages present, e.g.:

- (a) a three-phase and neutral four-wire supply (415/240 V);
- (b) a single-phase three-wire supply (480/240 V).

2.12.7 Fuses, switches and circuit-breakers

2.12.7.1 Every electrical circuit and subcircuit should be protected against excess current by fuses, circuit-breakers, or other similar devices which

- (a) will operate automatically when the current exceeds the safe current ratings of the circuit;
- (b) are of adequate breaking capacity, and suitably located;

(c) are constructed to prevent danger from overheating, arcing or the scattering of hot metal when they come into operation, and to enable the fusible metal to be renewed without danger (see BS 88, BS 1361, BS 1362, BS 4265 for suitable fuses and BS 842 and BS 4293 for suitable circuit breakers).

2.12.7.2 Where, because of an earth fault developing such as might result in the current in a circuit being insufficient to operate the fuses, circuit-breakers or other similar devices should also be fitted to prevent persisting earth leakage which is potentially dangerous.

2.12.7.3 No fuse or circuit-breaker other than a linked circuit-breaker should be inserted in a conductor connected to earth. Any linked circuit-breaker inserted in a conductor connected to earth should break every live conductor.

2.12.7.4 Any single-pole switch should be inserted in the live conductor. Any switch inserted in the conductor connected to earth should be a linked switch, arranged to break every live conductor.

2.12.7.5 A switch or switches should be provided immediately adjacent to or combined with every socket outlet on farms and commercial growers' holdings.

When more than one means of stopping a motor is provided, the requirements of IEE Regulation A.64 (i), (ii) and (iii) are applicable.

The exemptions from Regulation A.64 (i) are as follows.

- (a) Motors in chilled water and other cooling equipment.
- (b) Automatic environment and feed-control systems, and automatic feed preparation installations.
- (c) Ventilation/drying installations, where special consideration has been given to the mechanical as well as to the electrical requirements.

NOTE 1. The supply undertaking should be consulted regarding arrangements for starting motors requiring heavy current loads.

NOTE 2. For the purposes of this code an electric motor is a prime mover.

2.12.8 Electrical conductors and apparatus

2.12.8.1 All electrical conductors should be of sufficient size and current rating for the purposes for which they are to be used.

2.12.8.2 All electrical apparatus should be of sufficient power rating for the purposes for which it is to be used.

2.12.8.3 All live conductors, including conductors forming part of the apparatus, should be either

- (a) effectively insulated, and protected; or
- (b) so placed and safeguarded as to prevent danger to humans and livestock as far as is reasonably practicable.

2.12.8.4 Every electrical joint and connection should be constructed to provide proper conductance, insulation and mechanical strength with safety.

2.12.9 External wiring system (overhead). Where electricity is taken from one building to another, suspended overhead cables are recommended, placed as high up as possible outside the building.

2.12.10 Support. Distribution systems intended for use at low or medium voltage should employ suitable conductors and be adequately supported.

Any metal used as a support or guard should be protected against corrosion.

The length of span and the minimum height above ground should not contravene statutory requirements. The type of cable used and span and mounting heights should be in accordance with the IEE Regulations for the Electrical Equipment of Buildings (see B.127 and B.33 (x)) and table 1 (see 2.12.12). Enamelled or slip conduit installations are unsuitable for farm conditions and should not be used.

2.12.11 Routes, angles, terminals and stays. Poles should be sited and routes should be planned observing the following considerations.

(a) All lines should be as straight as possible, using the minimum number of terminal-poles and angle-poles.

Where changes in direction are unavoidable the deviation should be as small as possible, i.e. less than 15°.

(b) Poles should be conveniently placed for the connection of service-lines to buildings.

(c) Poles and lines should not obstruct the work of the farm, and routes should be so planned as to minimize the risk to personnel and the possibility of damage, e.g. lines should not be installed where there is any likelihood of damage from tractors, elevators and loaded wagons (see 2.12.12).

(d) Poles may be used for mounting lighting brackets for yard and road use.

(e) The number of lines crossing other lines should be reduced to a minimum.

Terminal poles should be of larger diameter than straight-line poles, with adequate concrete foundations to resist overturning from horizontal forces. Siting should

allow for stays to be at an angle of more than 30° to the vertical.

2.12.12 Overhead wiring, spans and clearances.

The maximum span between supports of any overhead supply cable from one building to another building or other point of utilization, and the minimum height of such cable above ground level or paved surface should be as given in table 1.

For situations not covered by table 2 of BS 5502 : Section 3.8 : 1978, heights should be determined by allowing sufficient clearance above buildings, loaded wagons, etc., to ensure that no live conductor is accessible in the ordinary course of farm work. Spans should average 45 m but should in no case exceed 54 m. Sags should not reduce the clearances given in table 1 and pole heights should be designed to allow for the maximum sag at a temperature of 47 °C. Conductors should normally be arranged in vertical formation, spaced approximately 250 mm apart. Where two circuits are to be provided on the same route, the conductors should be installed on opposite sides of the same pole.

2.12.13 Overhead distribution lines. These should also be constructed to comply with the Overhead Line Regulations of the Electricity Supply Acts (see 2.12.12 and clause 7.2 BS 5502 : Section 3.1 : 1986 and Section 3.2).

2.12.14 Wiring on walls. Wiring on walls should comply with the requirements of IEE Regulation B.126 for the various systems of wiring on walls between buildings. Certain cables are not permitted to be used if in contact with liquid creosote (see K.15 of IEE Regulations).



Table 1. Maximum spans and minimum heights of overhead cables

(adapted from Reg. B.127 of the IEE Regulations for the Electrical Equipment of Buildings)

Type of cable	Maximum span between supports	Minimum height of cable		
		Above roads and yards	Elsewhere on the farm	
			Locations accessible to vehicles	Locations not accessible to vehicles
1 Cable sheathed with PVC or having an oil-resisting and flame-retardant or heat-resisting, oil-resisting and flame-retardant (HOFR) sheath, without intermediate support	m 3	m	m	m 3.5
2 Similar cable in heavy-gauge steel conduit	3			3
3 PVC covered overhead line conductors on insulators without intermediate support	30	5.8 for all types	5.2 for all types	3.5
4 Cable sheathed with PVC or having an oil-resisting and flame-retardant or HOFR sheath, supported by a catenary wire	As recommended by manufacturer			3.5
5 Aerial cable incorporating a catenary wire	As recommended by manufacturer			3.5
6 Bare or PVC covered overhead line installed in accordance with the Overhead Line Regulations*				5.2

*The use of bare overhead lines on farms should be avoided whenever possible. If used, all supports for such lines should carry permanent warning notices in conspicuous and readable positions.

NOTE. For height of mobile farm machinery see clause 4 of BS 5502 : Section 3.6 : 1986

