

Code of practice for

The use of safety nets, containment nets and sheets on constructional works

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Technical Sector Board for Building and Civil Engineering (B/-) to Technical Committee B/514, upon which the following bodies were represented:

- Association of Consulting Engineers
- Association of Consulting Scientists
- British Constructional Steelwork Association Ltd.
- British Steel Industry
- Building Employers Confederation
- Concrete Society
- Construction Health and Safety Group
- Construction Industry Training Board
- Department of the Environment (Property Services Agency)
- Electricity Industry in United Kingdom
- Engineering Equipment and Materials Users' Association
- Federation of Civil Engineering Contractors
- Health and Safety Executive
- Institute of Building Control
- Institution of Civil Engineers
- Institution of Structural Engineers
- National Association of Scaffolding Contractors
- National Federation of Master Steeplejacks and Lightning Conductor Engineers
- Prefabricated Aluminium Scaffolding Manufacturers Association
- Suspended Access Equipment Manufacturers Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Cordage Manufacturers' Institute
- English Net Manufacturers' Association

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Foreword

This British Standard code of practice has been prepared under the direction of the Technical Sector Board for Building and Civil Engineering and is a revision and extension of CP 93:1972 which is withdrawn. It deals with safety nets, containment nets and sheets for use on constructional works and has been prepared following requests from the industry and the Health and Safety Executive. It is intended for use by architects, engineers, quantity surveyors, manufacturers, suppliers and installers of site equipment.

It is hoped that this document will encourage the construction industry to adopt uniform levels of application and use of all types of nets and sheets. In this way higher levels of personnel safety will be achieved through improved forms of edge protection, together with improvements to the site environment and therefore contractors will be provided with the apparatus to improve their productivity. Appendix F gives an example of how the use of protective nets and sheets around a high working platform can improve output.

The recommendations for safety nets, containment nets and sheets are performance related to allow the full use and development of various types of equipment.

Research on this subject is currently in hand, and the results of this will be incorporated into this code at a later date.

The publication of this code is intended to encourage the feedback of information on relevant data from users.

This document will be submitted to CEN as the basis for a European Standard covering recommendations for the use of safety nets, containment nets and sheets on constructional works.

This code of practice represents a standard of good practice and takes the form of recommendations.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

0 Introduction

This code deals with the erection and use of safety nets, containment nets and sheets on construction sites. Such equipment is relatively lightweight and manufactured from man-made fibres and sheets.

Containment nets and sheets are usually used to clad scaffolds or buildings and are intended to:

- a) prevent injury to people or damage to property by restricting the fall of objects and/or persons;
- b) to assist in the containment of debris within construction, refurbishment or maintenance sites;
- c) provide weather protection to those in the contained area.

It is usual for nets and sheets to be supplied in bulk and adapted to the site conditions. They therefore have a regular pattern of securing positions. Safety nets, however, can be made to fit a specific location and have fixings positioned to suit that location.

In general all the above equipment will be fitted by scaffolders, sometimes as a means of protecting themselves, but mostly for use by other construction workers or for the protection of the general public.

The advantage of using this equipment is that when used correctly it can provide a high level of protection inexpensively and quickly. A similar level of protection could not usually be provided by other materials except at high expense and by adding a considerable load to the supporting structure.

The disadvantages are that nets and sheets tend to suffer more from damage or misuse, being particularly vulnerable to cutting and chafing. This means that if the best advantages are to be gained from the equipment then more regular inspection and maintenance is required than would be the case if heavier steel and timber materials were used.

However, if care is taken in the design, erection and use of this type of equipment, these disadvantages can be largely overcome and they will offer major benefits to the contractor as regards safety, site morale and control of the work environment.

1 Scope

This British Standard gives recommendations for the use of safety nets, containment nets and containment sheets. It does not cover temporary roofs.

NOTE 1 Advice on temporary roofs is contained in BS 5973.

This British Standard describes the advantages that can be gained in using nets and sheets and gives typical examples of how they should be fitted.

NOTE 2 The user is reminded that the effectiveness of nets and sheets is very dependent on the number and the quality of the fixings and this can be rapidly undermined if such fixings are not installed and maintained to the highest standards.

The user should also be aware that adoption of these materials outside the limits given in this code could produce a false sense of security. In such circumstances the manufacturer or an engineer with suitable experience should be contacted.

The code also gives advice on the properties of the materials used and on suitable performance specifications.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1 safety net

a net, made from man-made fibres, which complies with BS 3913 and which is used for catching personnel or light debris falling from buildings or structures during construction work

2.2 containment nets

a series of nets designed to control and prevent the fall of small objects or tools, to restrict dust and/or to provide protection for persons from falling objects

NOTE These nets should comply with the specification for containment nets which will be published in due course.

2.3 containment sheets

a system of sheeting designed to protect a structure from inclement weather, to contain dust and pollution and to control the fall of debris

2.4 overlay net

a net made from man-made fibres which is used in conjunction with a safety net and has a mesh size finer than that of a safety net, not exceeding 25 mm in any circumstances

2.5 coupling ties or joining materials

materials used to join separate sheets or nets into larger configurations and to secure them into position, all in a manner which will not impair their purpose and therefore, where necessary, allow the uniform transfer of loads from one item to the next, and from the complete assembly to their fixings, without reducing the load carrying capacity of the items. In the case of safety nets such ties, materials or equipment should not be capable of injuring anyone falling into the net

2.6**eyelets**

attachment eyes principally within containment nets through which coupling ties or securing ties can be threaded

2.7**bursting strength**

the maximum fluid pressure [expressed in kilonewtons per square metre (kN/m^2)] applied to a circular specimen in distending it to rupture

2.8**net assembly**

the net (or nets) together with the supporting framework, including wires and anchorages

2.9**mesh size**

the distance between the centres of the mesh cords

2.10**mesh cord**

the cord from which the mesh of the net is constructed

2.11**border cord**

the cord surrounding the mesh and determining the overall dimensions of the net

2.12**tie cord**

the cord used for securing the border cord to a suitable support

2.13**securing tie**

individual fixing for containment nets or sheets

2.14**initial sag**

the amount of sag when the net is first supported

2.15**outriggers**

supporting framework extending from the structure to which the net is fixed

2.16**anchor points**

attachment points principally within sheets through which coupling ties or securing ties can be threaded

2.17**karabiner**

a type of safety link formed as a complete loop with a spring loaded entry gate safeguarded in the closed position

2.18**screw gate karabiner**

a karabiner with the entry gate safeguarded in the closed position by a screwed collar

3 Regulations and British Standards

The following sets of regulations and standards publications are drawn to the attention of persons in charge of the sites:

The Health and Safety at Work etc. Act 1974

S.I. 1961 No. 1580 The Construction (General Provisions) Regulations, 1961

S.I. 1961 No. 1581 The Construction (Lifting Operations) Regulations, 1961

S.I. 1966 No. 94 The Construction (Working Places) Regulations, 1966

S.I. 1984 No. 1593 The Construction (Metrication) Regulations, 1984

SR & O (Northern Ireland) 87 of 1963 Construction (General Provisions) Regulations

SR & O (Northern Ireland) 86 of 1963 Construction (Lifting Operations) Regulations

SR & O (Northern Ireland) 175 of 1967 The Construction (Working Places) Regulations

Control of Substances Hazardous to Health Regulations (COSHH), 1988

Offshore Installations (Operational Safety, Health and Welfare Regulations, 1976)

BS 302, *Stranded steel wire ropes*.

BS 1139, *Metal scaffolding*.

BS 1397, *Specification for industrial safety belts, harnesses and safety lanyards*.

BS 1610, *Materials testing machines and force verification equipment*.

BS 2087, *Preservative treatments for textiles*.

BS 3913, *Specification for industrial safety nets*.

BS 4928, *Specification for man-made fibre ropes*.

BS 5973, *Code of practice for access and working scaffolds and special scaffold structures in steel*.

BS 6399, *Loading for buildings — Part 1 Code of practice for dead and imposed loads*.

CP 3, *Code of basic data for the design of buildings — Chapter V-2 Wind loads*.

It is envisaged that British Standards covering specifications for containment nets and sheets will be published in due course.

4 Safety considerations

4.1 Falling objects

The Construction (Working Places) Regulations require that persons should be protected from falling objects. Although the regulations do not specifically refer to netting or sheets it is considered that the correct use of this equipment offers the contractor the opportunity to enhance the safety standards on construction sites. This will result in greater efficiency of production, and in improved quality of the product.

NOTE It is a legal requirement under the Construction (Working Places) Regulations for employers to ensure that the use of any temporary equipment (such as nets) does not cause instability to those buildings or scaffolds to which it is attached.

4.2 Personal protection from falls

As far as possible all potential hazards should be removed from the work site. Where a hazard cannot be eliminated completely, it is essential that the work person should be protected from its consequences. Where the hazard is the risk of falling, persons should be fenced in to prevent this occurring. If this is not possible the use of a harness or man catching safety nets should be considered. Safety nets have an advantage over many forms of harness and lanyard in that they allow the worker complete freedom of movement.

4.3 Safe use of nets and containment sheets

To try to ensure that nets and containment sheets do not create a hazard to those erecting them or working in association with them or who otherwise may be affected by them, the following points should be considered.

- a) Suppliers of materials should carry out appropriate design, research or testing to ensure that the products will be safe when used as intended. They should inform the user of the correct way of using the material and of any hazards or limitations associated with the product.
- b) Employers should do all they can to ensure the safety of their employees and others who may be affected by the use of the equipment.
- c) Employees should cooperate with their employers in creating and maintaining a safe system of work. While working they should be required to act in a manner that will endanger neither their own safety nor that of others who may be affected by their poor working practices.

The Health and Safety at Work Act 1974, imposes duties on suppliers, manufacturers, employers, occupiers and work people to ensure, so far as is reasonably practicable, that all forms of materials used at work and working methods are safe.

Users of containment nets and sheets should appreciate that these materials can reduce exposure of persons to foul weather when working at heights. Appendix F gives an indication of the potential differences that could be experienced by workers thus protected.

4.4 Fire precautions

The materials used in the manufacture of nets and sheets may give off toxic fumes and smoke if burnt. This may not be a great problem when rigged in the open as any smoke and fumes will quickly disperse. However, it is important that areas below such nets or sheets are kept clear of flammable materials to avoid possible ignition from burning droplets of melted plastics.

Where nets or sheets are used or stored indoors, careful consideration should be given to the difficulties that might be experienced should a fire break out, particularly to ensure that essential escape routes do not become blocked. If necessary suitable vents or alternative escape routes should be provided.

It is essential that where any flammable materials are stored or used on site the site should be equipped with sufficient suitable fire fighting equipment which personnel on site have been trained to operate.

Care should be taken when rigging nets or sheets to avoid obstructing any fire exits, hydrants and inlet/outlet boxes to dry rising mains.

Care should be taken during welding operations and weld grinding that the sparks do not come in contact with the nets, containment sheets or harness lanyards. Nets observed to have been in contact with sparks should be carefully inspected and repaired if necessary.

4.5 Design considerations

The design of safety nets, containment nets and containment sheets and their fixings should take into account all the various types of loadings including the effects of wind, rain or snow as applicable.

Where further information is required, reference should be made to BS 5973, BS 6399 and CP 3:Chapter V-2.

Section 2. Safety nets

5 Application and use

5.1 General

Safety nets may be used to advantage during construction projects and in maintenance works where the workers may be required to work in highly exposed situations.

It is envisaged that in the future there will be more extensive use of safety nets as a means of preventing injuries in constructional works. It is recommended that, where appropriate, provision for their use should be included in contract documents so that all contractors can provide for safety nets on an equal basis. See C.2 for a recommended specification clause for inclusion in the contract document.

The safety net can give essential safety benefits, in a manner that has several important advantages over other alternatives. Therefore its use may achieve financial savings on a project provided it is properly planned at the initiation of the project. Although the purchase cost may be fairly high, the total costs including rigging the nets in position can be relatively low.

5.2 Configuration

Nets are used in two principal configurations, either laid out horizontally to catch persons who have fallen and to prevent falling materials hitting persons at a lower level, or vertically to restrain both persons and material and prevent them falling. (See also section 3.)

5.3 Construction

Safety nets complying with BS 3913 are made of knotted line with 100 mm mesh size. They have a heavier line around the perimeter to which suspension loops may be stitched or tied. Therefore these nets are supported one way or another by the perimeter cord. Where there is a risk of small items falling, the net should be covered by a finer overlay net. While the large mesh safety nets are usually made to order for a particular location such finer mesh nets are not.

5.4 Use

5.4.1 On building operations and works of engineering construction, where it is deemed impractical to provide normal methods to prevent falls, safety nets should be suspended at or below areas or places from which persons may fall a distance of more than 2.0 m. There will also be other situations where normal methods do not provide a total guarantee against falling persons or objects and nets will be an essential addition at these places.

5.4.2 Consideration should also be given to the use of safety nets where conditions are such that they may increase the safety of persons and/or protect property at a lower level and where protection cannot be adequately ensured without their use. In these cases an overlay net, or other suitable precautions, may be required to be used in conjunction with a safety net to catch small objects such as tools and small pieces of debris. For guidance on the detailing and construction of protection fans, reference should be made to BS 5973.

5.5 Nets used as protection fans

Nets can be used as a limited form of protection fan, by employing a combination of safety net and overlay net; the size and spacing of the mesh in the overlay net varying with the type of material likely to fall into it. Safety nets should not be used to catch debris weighing more than 40 kg. Following the impact of heavy objects, the net should be taken out of service for checking, testing and repair where necessary (see 8.3). In any case where nets are to be used as protection fans advice should be sought from the safety net manufacturer.

As with all forms of horizontal nets and protective fans, debris should not be allowed to accumulate in or on them. Such accumulation could not only overload the net etc., but could result in subsequent items bouncing out of, or being deflected from the net to the danger of those below. (See also 8.4.)

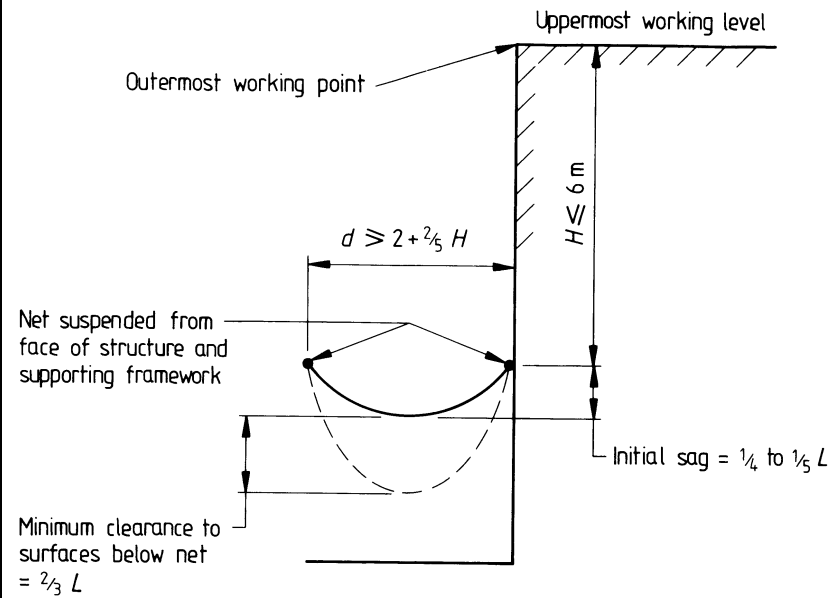
6 Planning and design

6.1 Siting

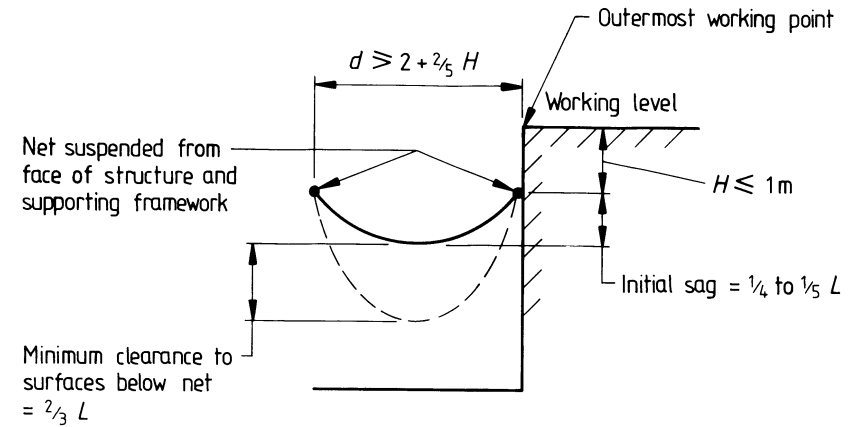
6.1.1 Nets should be installed as close as possible to the working levels and in no case further below than the maximum distance marked on the label attached to the net in accordance with BS 3913, which will be either 1 m or 6 m (see Figure 1). The gap between a net and the building should be as close as practicable but in no case should this be more than 200 mm.

6.1.2 Nets should not be stretched taut when erected, but should have an initial sag of between a quarter and a fifth of the length of the shortest side. Because nets deflect when arresting a falling body, they require a minimum clearance below, equal to two-thirds of the length of the shortest side or 2 m, whichever is the greatest to prevent contact with surfaces or structures below (see Figure 1).

6.1.3 Care should be taken to ensure that this free space required below the net does not infringe on the space required for the passage of vehicles or vessels.



(a) Siting of 6 m duty height net (outrigged)



(b) Siting of 1 m duty height net (outrigged)

Key

H is the vertical distance in metres between net and uppermost working level above net

L is the length of shortest side of net in metres

d is the horizontal projection from outermost working point in metres

NOTE 1 Supporting framework not shown.

NOTE 2 The minimum net dimension should be 2 m.

Figure 1 — Siting of net (outrigged)

Regard should be given in siting safety nets to the proximity of high voltage cables, moving gantries and other dynamic structures. Special consideration may be required where nets are used over tidal waters.

6.2 Access

In order to facilitate the rescue of any person who has fallen into them, nets should be sited so that access onto them is readily available. Access might be achieved by erecting the net adjacent to a working platform, floor or other access point.

A means for clearance of debris should be used which avoids the need to walk in the net. If nets are temporarily dismantled to facilitate the clearing of rubbish then personnel should be restricted from entering those areas which were protected by the nets unless they are provided with other suitable means of protection.

6.3 Design

6.3.1 General

6.3.1.1 The shape and dimensions of the net assembly and the design of the supporting framework are determined by the configuration of the structure to which the net is to be attached and the extent of the working areas that are being protected; hence the need for the net to be purpose made for that location.

6.3.1.2 When nets are to be erected over motorways or other routes used by the public services, the loadings, design and erection methods should be agreed with the appropriate authorities.

6.3.1.3 Consideration should be given to the possibility of nets breaking free and billowing in the wind together with any consequential effects.

6.3.1.4 When designing supporting frameworks consideration should be given to a degree of prefabrication in order to reduce the risk associated with the erection of the nets. It is important that handling stresses should be taken into account when designing prefabricated frameworks.

6.3.1.5 The net assembly should be so designed to facilitate its safe dismantling on completion of the works and, where appropriate, the need to move the net as the work progresses.

6.3.2 Nets

Nets, border cords and tie cords should be of a minimum strength and quality at least equal to that required to comply with BS 3913 (see Appendix D). It is important to realize that BS 3913 applies to nets of 4 m × 3 m or larger. When a net is used in conjunction with supports which restrict the effective area to less than 12 m² then its energy absorption potential will be reduced and the design of the net should be given special consideration to ensure that it will comply with BS 3913. It is important that the user should get an assurance about this from the manufacturer.

When erected, outriggered nets should project horizontally a minimum of $(2 + 2/5H)$ m beyond the outermost working position above the net, where H is the vertical distance in metres between the net and the outermost working point above (see Figure 1).

6.3.3 Supporting framework

The supporting framework should be designed to support the dead weights of the net assembly and the total superimposed loads including wind loading determined in accordance with CP 3:Chapter V-2 without the risk of collapsing or overturning.

The framework should be designed to withstand at any point, the direct impact of 140 kg falling from 1 m above the working level, i.e. 7 m for a 6 m duty height net, and be so arranged as to remove the risk of a person falling directly onto any part of it. Where this is not possible, such members should be suitably covered to minimize the degree of injury likely to be suffered should a person strike it.

An equivalent static load to 140 kg falling 1 m may be taken as 200 kg.

The supporting framework should be adequately secured to the structure by suitable anchorages and a check made to ensure that the structure is capable of resisting all the forces arising. Wherever possible, reference should be made to the designer of the structure or to any available design detail.

For recommendations on the construction and use of supporting scaffolds, see BS 5973.

6.3.4 Attachment of the net to the supporting framework

The net should be securely attached to the supporting framework using tie cords, hooks, rings or thimbles. The tie cords, hooks, rings or thimbles should be equally spaced at intervals not greater than 750 mm along each side of the net and at each corner. They should be attached to the net to include the border cord and adjacent mesh cord of the net. Where the net is made with a diamond mesh, the point of attachment should be where the border cord touches the outer mesh cord.