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Code of Practice for
**The use of
safety nets on
constructional works**

Gr 7

British Standards Institution



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The following BSI references relate to the work on this standard:

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Code Drafting Committee BLCP/70, Use of Safety Nets

Mr. S.G. Ward *Chairman*

Mr. B.L. Clark
Mr. J. Taylor
Mr. R. Alexander
H.M. Chief Inspector of Factories
Mr. E.K. Clarke
Mr. A.F.W. Budden
Mr. S.T. Tarling
Mr. J.M. Totterdell
Mr. J.G. Hopton
Mr. A. Wikeley
Mr. I.M. Laurie
Mr. D.P. Winter
Mr. J.W. Bielous
Mr. M. Beaumont
Mr. R.H.W. Lindsay
Mr. M. Beaumont
Mr. S.G. Ward
Mr. J. May, M.B.E.
Mr. G.L. Caldwell, M.B.E.
Mr. M.B. Christie
Mr. B.J. Dunn
Mr. R. Harrison

Association of Consulting Engineers
British Broadcasting Corporation
British Constructional Steelwork Association Ltd.
Department of Employment
Electricity Supply Industry for England and Wales
English Net Manufacturers Association
Federation of Civil Engineering Contractors
Institution of Civil Engineers
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British Standards Institution · 2 Park Street · London W1A 2BS

Telephone 01-629 9000

Telex 266933



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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.

Foreword



This Code deals with safety nets 'complying with BS 3913 used on constructional work'. It has been prepared under the authority of the Code of Practice Committee for Building following a request from H.M. Factory Inspectorate. Regulations require in certain circumstances the use of safety nets where it is not practicable to provide standard working platforms or gangways suitably protected with guard rails and toeboards.

Safety nets are particularly suited for use during the construction of certain types of high altitude projects, for example, bridge building, chimneys and towers, multi-storey buildings, over railway lines and highways, silos and tanks. They can also be used to advantage on maintenance works. More extensive use of safety nets as a means of preventing injuries in constructional works is to be expected in the future. It is recommended that provision for their use should be included in contract documents when appropriate so that all contractors can provide for safety nets on an equal basis. Whilst the safety net is an essential safety requirement, in addition to having several important advantages over alternatives, its use may achieve financial savings on a project provided it is properly planned at the initiation of the project. Although the capital cost is fairly high, the overall costs including rigging the nets in position can be relatively low and the savings on otherwise essential temporary works worthwhile.

'The committee responsible for this document are aware that a variety of nets are used in different ways for safety purposes which are outside the scope of the present document. It is their intention to prepare a revised document with a broader scope.

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



British Standard Code of Practice for

The use of safety nets

on constructional works

1. General

1.1 Scope



This Code of Practice gives guidance for the use of safety nets complying with BS 3913 which are intended to prevent personnel from sustaining injury in the event of their falling while engaged on construction, demolition and maintenance work or to protect persons from objects falling from a height.

1.2 Definitions

For the purposes of this Code the following definitions apply:



(1) *Safety net*. A net, made from man-made fibres, which complies with the requirements of BS 3913 and is used for catching personnel or debris falling from buildings or structures during construction work.



(2) *Overlay net*. A net made from man-made fibres, which is not a safety net but may be used in conjunction with it. The mesh size is finer than a safety net, normally not exceeding 25 mm.



(3) *Mesh size*. The distance between the centres of the mesh cords.

(4) *Mesh cord*. The cord from which the mesh of the net is constructed.

(5) *Border cord*. The cord surrounding the mesh and determining the overall dimensions of the net.

(6) *Tie cord*. The cord used for securing the border cord to a suitable support.

(7) *Initial sag*. The amount of sag when the net is first supported.

(8) *Net assembly*. The net (or nets) together with the supporting framework, including wires and anchorages.

1.3 Regulations and British Standards

Reference should also be made to the following Regulations and publications:



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

BS 302 Wire ropes for cranes, excavators and general engineering purposes

BS 1051 Terms relating to the conditioning of textiles and method for the determination of correct invoice weight

BS 1139 Metal scaffolding

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BS 1397 Industrial safety belts and harnesses

BS 1610 Methods for the load verification of testing machines



BS 2087 Preservative textile treatments



BS 3913 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 : Part 2. Wind loads

1.4 Supervision



The design of the net its layout and its supporting framework should be carried out under the direction of a suitably qualified engineer. The erection, moving and dismantling of the net should be closely supervised by an experienced person, employing only competent operatives.

2. Application and use

2.1 General

During building operations and works of engineering construction, safety nets should be suspended at or below areas or places from which men may fall a distance of more than 2.0 m and other precautions are impracticable or where nets are considered to be an essential addition thereto.



2.1.1 Consideration should also be given to the use of safety nets where conditions are such that the safety of persons and the protection of property below cannot be adequately ensured without their use.

2.1.2 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. Particular attention is drawn to the need to take additional and/or alternative precautions where there is a danger to persons below from objects falling through or piercing the net. For guidance on protection fans, reference should be made to



3. Planning and design

3.1 Siting



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 figures 2a and 2b)'.



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 should be hung with a minimum clearance equal to two thirds the length of the shortest side to prevent contact with surfaces or structures below (see Fig. 2).



Care should be taken to ensure that the free space below the net is not infringed, thus obstructing the passage of vehicles or vessels and regard should be given to the proximity of high voltage cables, moving gantries and other dynamic structures. Special consideration may be required when nets are used over tidal waters.

3.2 Access



In order to facilitate the rescue of persons the net should be so sited that access to it is readily available. For clearance of debris a means of removal should be used which avoids the need to walk in the net. Access should be achieved by erecting the net adjacent to a working platform, floor or other access point.

3.3 Design

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 catchment area.

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

Consideration should be given to the possibility of nets billowing in the wind and any consequential effects.

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

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.



3.3.1 Nets. Nets, border cords and tie cords should be of a minimum strength and quality at least equal to that required to comply with the requirements of BS 3913. It is important to realize that BS 3913 applies to nets of 4 m x 3 m or larger. When such a net is used in conjunction with supports which restrict the effective area to less than 12 square metres then its energy absorption potential will be reduced and the design of the net should be given special consideration.



When erected, outriggered nets should project horizontally a minimum of $(2 + \frac{2}{5}H)$ m beyond the outermost working point above the net, where H = the vertical distance in metres between the net and the outermost working point above.



3.3.2 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, Part 2.

The supporting framework should be designed to withstand at any point, the direct impact of 140 kg falling from 1 m above the working level



The supporting framework should be so arranged as to reduce to a minimum the risk of a person falling directly onto any part of it.

The net assembly 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 recommendation on the construction and use of supporting scaffolds, see BS 5973. Some examples of using nets on typical structures are shown in Figs. 3 to 6.



3.3.3 Attachment of the net to the supporting framework. The net should be securely attached to the supporting framework using tie cords, hooks, or rings. The tie cords, hooks, or rings should be

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equally spaced at not more than 750 mm intervals 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.

The strength of tie cords, hooks, or rings should be, at least, twice that of the net mesh cord. Adjacent nets should be joined using only tie cords, hooks, or rings as described in this clause. Connections between adjacent nets should be capable of developing a strength at least equal to that of the net.

Where cords are wrapped round sections with sharp edges e.g. rolled steel sections, suitable packing should be provided to prevent damage. Where it is necessary to attach the edge of the net to a steel wire, the method of attachment must be such as would prevent chafing or damage to the border cords or mesh cords. Hooks, or rings are suitable for this purpose.

3.3.3.1 Tie cords. Tie cords should be looped round the border cord and adjacent mesh cord of the net as shown in Fig. 1. The two free ends of the tie cord should be passed through or around anchorage points and securely knotted in such a way as to prevent chafing.

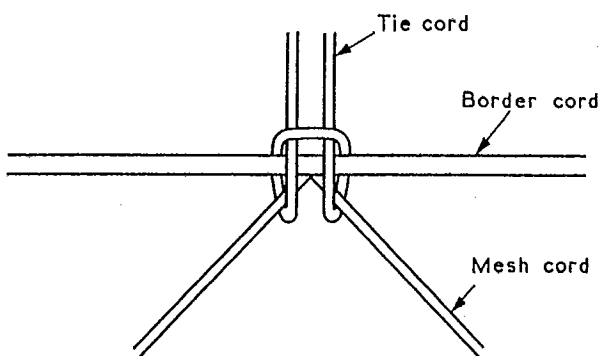


Fig. 1. Attachment of tie cord to safety net

3.3.3.2 Hooks. Only hooks with effective locking devices incorporated should be used.

3.4 Choice of net

Nets are normally made from polyamide (nylon) or polyester (terylene).

The choice of material will be determined by the circumstances in which the net is to be used, the performance required of the net and the prevailing conditions.

Appendices B and C give guidance on the properties of the various materials available. Special care should be taken to identify any special hazards likely to be present or to arise during the construction work. Nets should not be used in conditions that will result in excessive deterioration of the net. In such conditions safety precautions other than nets should be used.

4. Erection and dismantling

4.1 General

The erection and dismantling of safety nets is a potentially hazardous operation requiring careful planning to avoid the exposure of the personnel who do this work to unnecessary dangers. Close supervision should be maintained during erection to ensure that all design requirements have been incorporated correctly.

Care should be taken to ensure that nets are installed so as to facilitate the removal of test cords for testing.



Where erection or dismantling cannot be carried out from a suitable working platform or scaffold, safety harness may be required. Where possible, fabrication of the net assembly should be carried out at ground level or on an adjacent floor (see 3.3).

4.2 Typical arrangements of safety nets

A variety of hanging and support procedures have been utilized satisfactorily in practice and some typical examples are outlined in 4.2.1, 4.2.2, 4.2.3. As variations will probably be found necessary, it is essential that each contract on which nets are to be used should be given individual consideration to identify any special characteristics and problems.

Nets may be outriggered either by spreader beams or cantilevered framework from any scaffold or platform where the protection of persons, either working above or below, is required. These nets may be used in conjunction with sheets to form fans for catching debris. Where nets are cantilevered from scaffolds, (see Fig. 3a), the scaffold should be designed to take the additional loads imposed on it (see 3.3.2) and additional ties to the structure provided as necessary.

4.2.1 Arrangement of nets attached to the periphery of structures. This arrangement which is usually referred to as outriggered or perimeter nets may be used to protect edges which are either external or internal to the structure.

Structures on which this arrangement has been used successfully include bridge piers, framed buildings, towers, masts, chimneys, silos and large tanks. Great emphasis is placed on taking care of as much detail as possible on the ground or adjacent floor before hoisting the nets into a hanging position.

In this method the outer and inner edges of the net are normally attached to wire ropes or tubes. The exterior rope or tube is fixed between suitable outriggers and ropes should incorporate some means to allow adjustment to be made. The interior cable or tube may be attached to the outriggers or the structure or both as appropriate. The inner ends of the outriggers and supporting members are secured to the structure as necessary, preferably by fittings which allow them to pivot (see Fig. 3b). This permits the net assembly to be erected or hoisted up into the vertical position while working from the structure. The net assembly is then allowed to pivot from the upright to the final hanging position, the supporting members being so arranged to hold the outriggers securely in position. Alternatively, the outrigger may be fed out horizontally from the structure.

If the nets and framework are assembled at ground level, the completed assembly should be hoisted into position by attaching it to a light spreader beam fitted with a lifting bridle. The spreader beam and net assembly should then be lifted to the required height by a crane or winch and the outrigger and supporting members secured to the structure, preferably by a pivot type fitting.

Where only a small area of net protection is required and the net supporting framework is to be frequently moved, wheels may be fitted to facilitate quick and easy movement (see Fig. 3c). This method is generally only suitable when the net assembly can be positioned immediately below the working level, for example, when moving tableforms or when cladding units are to be received at an open edge.

Nets may also be used to form a vertical barrier across wall openings and at floor edges. On structures such as reinforced concrete chimneys which utilize climbing shutter construction the safety net may be attached to the scaffold platform, see Fig. 4.

4.2.2 Arrangement of nets over enclosed areas. Because of the difficulties of joining several nets in situ, nets for this purpose should usually be supplied in one piece. This method is appropriate for use when areas are to be protected such as the interior of silos and tanks. For very large areas the methods outlined in 4.2.1 may be more practical.

4.2.2.1 Methods of erection for silos and tanks. The methods outlined in 4.2.2.2 and 4.2.2.3 have been found to be satisfactory in practice.

4.2.2.2 Manual erection. The net is hauled into position from ground level by men situated at the level to which the net is to be attached and operating from a suitably guarded platform or catwalk. Sufficient suspension ropes should be attached to the perimeter of the net at suitable intervals for this purpose. The suspension ropes should be held in place preferably by giving at least one turn round a structural member, which should not have any sharp edges, to enable control to be maintained during lifting. When the required height is reached, the