

“पुनर्पत्र १९९६”
“RE-AFFIRMED 1996”
IS : 11057 - 1984

Indian Standard
SPECIFICATION FOR
INDUSTRIAL SAFETY NETS

UDC 614.821.4: 677.664



© Copyright 1985

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR INDUSTRIAL SAFETY NETS

Cordage Sectional Committee, TDC 14

<i>Chairman</i>	<i>Representing</i>
SHRI P. K. SUR	The Ganges Rope Company Limited, Howrah
<i>Members</i>	
SHRI P. K. GUPTA (<i>Alternate to</i> Shri P. K. Sur)	
SHRI A. T. BASAK	Directorate General of Supplies & Disposals (Inspection Wing), New Delhi
COL A. K. BHATTACHARYA	Calcutta Port Trust, Calcutta
SHRI S. K. MUKHERJEE (<i>Alternate</i>)	
SHRI A. BISWAS	Rail India Technical and Economic Services Ltd, New Delhi
LT-COL ASHOK COOMAR	Ministry of Defence (DGI)
SHRI S. P. CHAKRABORTY (<i>Alternate</i>)	
DEPUTY CHIEF MECHANICAL ENGINEER (MARINE), NORTH EASTERN RAILWAY, PATNA	Railway Board, Ministry of Railways
SHRI T. N. GHABRU	Ministry of Defence (DPIN)
STOJISO (CHEMICAL) OF CINS (B) (<i>Alternate</i>)	
SHRI A. GHOSH	National Test House, Calcutta
SHRI SEKHAR GUHA	Eskaps (India) Private Limited, Calcutta
SHRI N. B. SENGUPTA (<i>Alternate</i>)	
SHRI TAHER S. M. KHANDAN	M. M. Tayebally, Calicut
SHRI SHABIR S. M. KHANDAN (<i>Alternate</i>)	
SHRI A. C. MATHUR	Ministry of Defence (R & D)
SHRI S. C. GUPTA (<i>Alternate</i>)	
SHRI K. N. MISRA	Gujarat Filaments Pvt Ltd, Vadodara
SHRI G. N. PRABHU	Coir Board, Ernakulam
SHRI V. ABDUL MAJEED (<i>Alternate</i>)	
CAPT B. R. RAO	The Scindia Steam Navigation Co Ltd, Bombay
REPRESENTATIVE	Neomar Limited, Vadodara
REPRESENTATIVE	Office of the Jute Commissioner, Calcutta
SHRI NIRMAL K. SOMANI	Indian Rope Manufacturers' Association, Calcutta
SHRI T. BHATTACHARYA (<i>Alternate</i>)	

(*Continued on page 2*)

© Copyright 1985

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(Continued from page 1)

Members

CAPT V. SUBRAMANIAN	Shipping Corporation of India Ltd, Bombay
CAPT S. B. KUNDERGI (<i>Alternate</i>)	
SHRI H. C. TANEJA	Naval Headquarters, Ministry of Defence
SHRI R. VISHVANATH (<i>Alternate</i>)	
SHRI R. M. TELANG	Garware-Wall Ropes Ltd, Bombay
SHRI A. K. KAPUR (<i>Alternate</i>)	
SHRI KANTILAL G. THANAWALA	M. Best Cotton Rope Manufacturing Co, Bombay
SHRI MADHUKANT G. THANAWALA	
(<i>Alternate</i>)	
SHRI R. I. MIDHA,	Director General, ISI (<i>Ex-officio Member</i>)
Director (Tex)	

Representing

Secretary

SHRI A. R. BANERJEE

Senior Deputy Director (Tex), ISI

Indian Standard

SPECIFICATION FOR INDUSTRIAL SAFETY NETS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 15 September 1984, after the draft finalized by the Cordage Sectional Committee had been approved by the Textile Division Council.

0.2 The objective of this standard is to make available an authoritative specification that will enable users to purchase safety nets with the assurance that they will obtain material of adequate quality and performance and to assist manufacturers by obviating variations in requirements with a view to increasing productivity and providing better service for users.

0.3 This standard is setting only two levels of maximum duty height for safety nets, simplifies the requirements for safety nets and brings the maximum duty height to a level that is considered to be safer and more practical one that reduces the danger of bounce after impact.

0.4 This standard is concerned particularly with the performance and testing of safety nets.

0.5 In the preparation of this standard considerable assistance has been derived from BS 3913 : 1982 Specification for industrial safety nets, issued by the British Standards Institution.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements of industrial safety nets made from man-made fibres and designed to catch personnel and/or debris

*Rules for rounding off numerical values (*revised*).

falling whilst work on high buildings, and structural work of shipbuilding is being carried out:

- a) Requirements are specified for two types of safety nets; one suitable for use at maximum duty height up to 6 m and the other for a maximum duty height of 1 m.
- b) Recommendations on the care of nets are given in Appendix C.

2. DEFINITIONS

2.0 For the purpose of this standard the following definitions shall apply.

2.1 Mesh Cord — The cord from which the mesh of the net is constructed.

2.2 Border Cord — The cord surrounding the net and determining the overall dimensions of the net.

2.3 Tie Cord — The cord used for securing the border cord to a suitable support.

2.4 Length of Mesh Side — The distance between two sequential knots or joints, measured from centre to centre when the yarn between those points is fully extended.

2.5 Nominal Size — The overall dimensions of a net when laid evenly on a flat surface in a relaxed condition and without any tension on the border cords.

2.6 Initial Sag — The amount of sag in the centre of the net when placed in the working position.

2.7 Duty Height — The maximum vertical distance between the working level and the level at which the safety net is to be placed in use.

3. CONSTRUCTION

3.1 Materials — Nets shall be made from man-made fibre ropes and plaited cords, with the exception of polyethylene ropes and cords.

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

NOTE — Strong sunlight can cause weakening of the fibres, but it is unlikely to penetrate beneath the surface. An ultra-violet stabilizer should be incorporated in the fibres and unnecessary exposure should be avoided.

3.2 Design — The net shall be designed in such a way that, when tested as described in Appendix A, for a duty height of 6 m or 1 m as appropriate, it complies with requirements given in **6**.

3.3 Cords — The mesh cord, border cord and tie cord shall be flexible, uniform and as free as practicable from defects in the preparation of yarns, strands and in finishing.

3.4 Tie Cords — Tie cords shall be fixed to the net in each corner, and along each side of the net, equally spaced at not more than 75 cm interval.

3.5 Test Cords — Each net shall be provided with at least eight test lengths of mesh cord for periodic testing (*see* Appendix B). Each test length shall be loosely threaded through the meshes of the net and each end shall be firmly attached to the net at not less than 0.5 m from the border cord. The length of each test cord shall be suitable for the method of test adopted (*see* Appendix A) and shall in any event be not less than 2 m. The test cords shall be identified by use of an indelible contrasting colour applied over a length of approximately 50 cm from one end.

3.6 Multi-Layer Nets — If the safety net is in the form of a multi-layer net the layers shall be firmly joined together and fitted to a common border cord or cords.

3.7 Overlay Nets — A safety net may be supplied with an overlay net for use with the safety net to catch objects such as tools and debris but such overlay nets shall not be included when the safety net is subjected to the tests described in Appendix A.

4. DIMENSIONS

4.1 The minimum nominal size of the net shall be 4 m \times 3 m in length and width respectively.

4.2 Nets shall be made with a square or diamond mesh and the length of the mesh side shall be not greater than 10 cm.

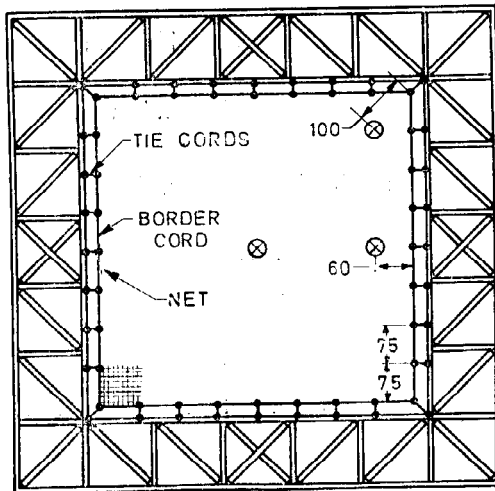
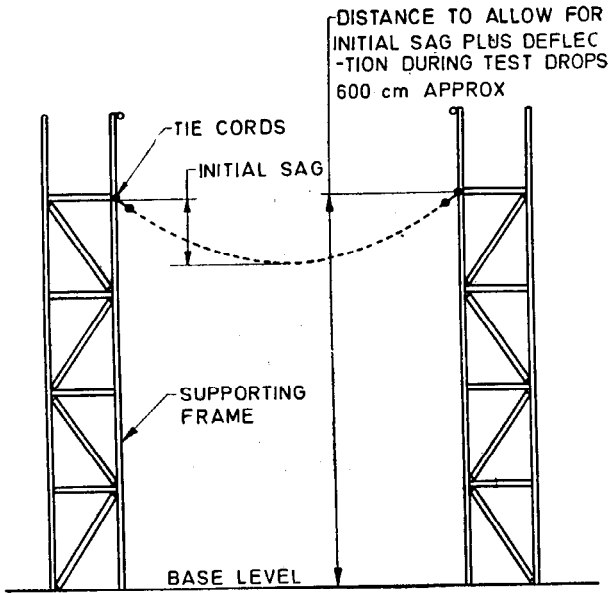
4.3 A continuous length of net, having no joins, shall be used to cover the span between supports.

4.4 When in use, the net shall have a sag at the centre of not less than one-fifth and preferably not more than one-fourth of the length of the shorter side (*see* Fig. 1).

NOTE — Purchasers should distinguish between the area to be covered (the coverage) and the size of the net required when allowance is made for the recommended sag, for example, a 6 m net with a sag ratio of 1 : 5 will only cover approximately 5 m \times 5 m.

5. FINISH

5.1 The ends of all cords used in the nets shall be secured to prevent unravelling.



All dimensions are in centimetres.

NOTE — Dropping points for test loads are shown at ⊗ (see appendix A).

FIG. 1 TEST RIG FOR INDUSTRIAL SAFETY NETS

6. PERFORMANCE

6.1 The performance of safety nets shall be tested as described in Appendix A, using a representative net.

6.2 A net of the same type, construction and material when subjected to the test described in Appendix A shall be deemed to behave in the same way as the tested net and to comply with this standard if the tested net complies with **6.4**.

6.3 Safety nets shall be capable of retaining, without failure of any of the cords in the net, as a sequence of drops of a test load as described in Appendix A.

6.4 The deflection at the center of the net, when subjected to impact as described in Appendix A, shall not be greater than 2 m or one-half of the length of the shortest side, whichever is more.

6.5 The breaking strength of the mesh cord, when tested as described in Appendix A, shall be recorded as a basis for comparison with subsequent measurements of test cords as described in Appendix B.

NOTE — The user of a safety net should carefully retain the manufacturer's certificate (*see 7.3*) for the purpose of this comparison.

7. MARKING AND MANUFACTURER'S CERTIFICATION

7.1 Each net shall be provided with soft, flexible, permanent labels of textile or plastics material, at two different positions, and also marked with indelible ink in letters of 3 cm in height with the following wording:

“MAXIMUM DISTANCE BELOW WORKING LEVEL ‘X’
METRES”

where ‘X’ is the duty height at which the net complies with requirements given in 6.

7.2 The label shall also be marked with the following:

- a) Manufacturer's name or trade-mark,
- b) The nominal size of safety net,
- c) The date of manufacture, and
- d) The deflection at the centre of the net (*see 6.4*).

7.2.1 The safety net may also be marked with ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7.3 The manufacturer shall supply a certificate with each net or batch of nets of the same type and construction that specifies:

- a) Type of net, the method of construction and the materials used;
- b) Breaking strengths of the mesh and border cords in the net supplied;
- c) Breaking strengths of the mesh and border cords in the net that has been tested as described in Appendix A; and
- d) Drop height and the deflection at the centre of a net with the same construction, when tested as described in Appendix A.

APPENDIX A

(Clauses 3.7 and 6.3)

TESTS FOR SAFETY NET

A-1. METHOD OF TEST

A-1.1 General — If an overlay net is provided for use with the safety net, testing shall be carried out on the safety net without the overlay net.

A-2. SELECTION OF SAMPLE FOR TEST

A-2.1 At least one sample of each type or construction of net shall be subjected to this loading test.

A-3. APPARATUS

A-3.1 Supporting framework, rigid and strong enough to resist shock load imposed during the test without serious distortion or deflection. A suitably supporting framework is illustrated diagrammatically in Fig. 1.

A-3.2 Test mass, consisting of a bag of sand of mass 140 kg. The bottom shall be hemispherical with a radius of 20 cm (1260 cm² cross-section).

A-4. PROCEDURE FOR THE DROP TEST

A-4.1 Suspend the net on a rigid framework as shown in Fig. 1 and conduct the test by dropping the test mass successively three times on to the centre of the net, then once on to a point on a diagonal 100 cm from one corner of the net and once half-way along any side 60 cm from the border cord of the net (*see* Fig. 1).

The test drop height for nets of each type shall be:

- a) for nets of maximum duty height of 6 m : a 12 m test drop height; and
- b) for nets of maximum duty height of 1 m : a 3 m test drop height.

The deflection of the net for each of the three drops at the centre shall be measured and the mean deflection, in metres, calculated.

A-5. PROCEDURE FOR THE CORD STRENGTH TEST

A-5.1 Determine the breaking strength of each type of cord by following any one of the methods as given in Appendix A of IS : 4572 (Part 1) - 1982*.

APPENDIX B

(*Clauses 3.5 and 6.5*)

PERIODIC TESTING AND INSPECTION OF INDUSTRIAL SAFETY NETS

B-1. PERIODIC TEST AND INSPECTION

B-1.1 It is recommended that nets in use should be inspected weekly by a competent person. Immediately after any incident that may have affected the strength of the net (*see* Appendix C), the net should be carefully examined.

B-1.2 Deterioration of nets during use is difficult to assess. It is recommended that the users should seek the advice of the net manufacturers on this point and also when to carry out tests on the test lengths (*see* 3.5). The number of test lengths for each net is based on one test every 3

*Specification for polyamide multifilament ropes: Part 1 (hawser-laid and plaited) General (*second revision*).

months and a net life of 2 years. The test length should not be used for any other purpose and should remain fixed to the net until required for test. At present it is not possible to make recommendations as to when a net should be taken out of service if the tensile strength of the cords has fallen below that shown in the net manufacturer's certificate (*see 7.3*), the advice of the net manufacturer should be sought on this matter.

A P P E N D I X C

(*Clause 6.5*)

THE CARE OF INDUSTRIAL SAFETY NETS

C-1. GENERAL

C-1.1 Safety nets made from any material are liable to wear and mechanical damage, and may be weakened to some extent by various agencies such as chemicals, heat and light. Regular inspection by a competent person is necessary to ensure that the nets are still serviceable.

C-1.2 It should also be emphasized that no matter what agency has weakened the net, the effect will be more serious on smaller cordage than on the larger sizes of cordage. Consideration should, therefore, be given to the relationship of the surface area of the cordage and cross section.

C-1.3 Inspection should be done by examination of the net in small sections, the cordage being turned to reveal all sides before continuing. At the same time the cordage should where practicable, be opened up to allow for internal examination.

C-1.4 To define a standard of acceptance or rejection is much more difficult than to describe the method of inspection. There can be no well-defined boundary between nets, that are safe and those that are not, because this depends on the stresses placed on the net in an emergency. The decision whether to continue to use a net or to take it out of service should be based on an assessment of the general condition of the net. This is necessary because many of the conditions that will guide the competent person cannot be exactly described but only stated in general terms. If, after examination, there should be any doubt about its safety, it should be withdrawn from service. It should again be emphasized that the effects of wear and mechanical damage are relatively great on thinner cordage, which therefore require more stringent standard of acceptance.

C-2. CAUSES OF DAMAGE

C-2.1 External wear due to dragging over rough surfaces causes filamentation. This is the most readily noticeable cause of weakness particularly if a new net is available for comparison. In the extreme use, the strands become so worn that their outer faces are flattened and the outer yarns severed. In ordinary use, some disarrangement or breakage of the fibres on the outside of the net is unavoidable but is harmless if not too extensive.

C-3. SPECIFIC CAUSES OF DAMAGE

C-3.1 Abrasion — Man-made fibre nets have very good abrasion resistance.

C-3.2 Overloading — The resistance of man-made fibre cordage to damage due to repeated overloading is excellent but a permanent elongation may occur and then the extension available in any emergency is reduced.

C-3.3 Chemical Attack — The chemical resistance of man-made fibres is in general very good and a very brief description of the resistance to chemical attack of the different man-made fibres is given below.

C-3.3.1 The resistance of polyester fibres to acids is good, with the exception of sulphuric acid with a concentration of above about 80 percent (v/v), but the resistance to alkalis is only moderate. On the other hand, the resistance of polyamides to alkalis is good but the resistance to acids is poor. The resistance of polyolefins (for example, polypropylene) to both acids and alkalis is good.

C-3.3.2 Resistance of man-made fibres to hydrocarbon oils and common organic solvent is good, although certain man-made fibres may swell in some chlorinated solvents. Attack by concentrated phenols on polyamide and polyester fibres is severe and contact should be avoided.

C-3.3.3 As a general rule, if acids or alkalis of any concentration are brought into contact with a man-made fibre net, they should not be allowed to dry off and thus concentrate the chemical, but the net should be washed out well and taken out of service. Advice should be taken on the most suitable material if a net is to be used in an environment where chemical contamination is likely.

C-3.3.4 Net should not be subjected to excessive heat, fibre or steam and they should not be used where they could be damaged by falling sparks or molten metal from welding equipment.

INDIAN STANDARDS

ON

CORDAGE

IS:

- 1084-1983 Manila ropes (*third revision*)
- 1321-1982 Sisal ropes:
 - (Part 1)-1982 Untarred varieties (*second revision*)
 - (Part 2)-1982 Tarred varieties (*second revision*)
- 1410-1983 Coir ropes (*second revision*)
- 1804-1982 Fibre core for steel wire ropes (*second revision*)
- 1857-1972 Tarred hemp marline, two-ply (*first revision*)
- 1887-1978 Spun jute yarn (*first revision*)
- 1912-1984 Country jute twine (*second revision*)
- 1920-1973 Hemp lines (*first revision*)
- 2452-1973 Hawser-laid cotton ropes (*first revision*)
- 2453-1978 Cable-laid cotton ropes (*first revision*)
- 2807-1981 Whipcords (*first revision*)
- 2819-1983 Braided cotton cord (*second revision*)
- 3252-1975 Shroud-laid cotton line (*first revision*)
- 3253-1965 Hawser-laid nylon rope for mountaineering purposes
- 3256-1980 Code for inland packaging of ropes and cordages (*first revision*)
- 3262-1965 Pilot lead line
- 3871-1984 Glossary of terms relating to fibre ropes and cordage (*first revision*)
- 4145-1967 Code of practice for storage of ropes
- 4572 Polyamide multifilament ropes
 - (Part 1)-1982 General requirements for hawser-laid and plaited ropes (*second revision*)
 - (Part 2)-1983 Hawser-laid ropes for specific applications (*second revision*)
 - (Part 3)-1983 Hawser-laid ropes for general purposes (*second revision*)
 - (Part 4)-1982 8-Strand plaited
- 4575-1983 Code for handling of fibre ropes (*second revision*)
- 5175-1982 Polypropylene ropes (3-strand hawser-laid and 8-strand-plaited) (*first revision*)
- 5176-1969 Hawser-laid hemp line and ropes
- 5177-1969 Jute lines and ropes
- 6587-1972 Spun hemp yarn
- 6590-1972 Braided nylon ropes for mountaineering purposes
- 7082-1973 Sisal lines
- 8674-1980 Polyethylene ropes (*first revision*)
- 9536-1980 Nylon cord
- 9560-1980 Colour code for identification of ropes and cordages
- 9936-1981 Guide on equivalence between manila ropes and nylon, polyester and polypropylene ropes for marine purposes
- 9944-1981 Recommendations on safe working loads for natural and man-made fibre ropes slings
- 11058-1984 Sisal agricultural twines
- 11066-1984 Polyester multifilament ropes (hawser-laid)