भारतीय मानक

Indian Standard

IS 11927 : 2023

वस्त्रादि — सतह परिवहन में भार संयम प्रणाली के लिए रेशों से बने जाल और रस्सी — विशिष्टि

(पहला पुनरीक्षण)

Textiles — Netting and Fibre Rope for Load Restraint Systems in Surface Transport — Specification

(First Revision)

ICS 59.080.50

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December 2023 **Price Group 6**

Cordage Sectional Committee, TXD 09

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cordage Sectional Committee had been approved by the Textiles Division Council.

This standard was first published in 1987. This revision has been made in the light of experience gained since its publication and to incorporate the following major changes:

a) Requirement for identification of material has been incorporated;

b) Marking clause has been modified; and

c) References to Indian standards have been updated.

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

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 or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*).’ The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — NETTING AND FIBRE ROPE FOR LOAD RESTRAINT SYSTEMS IN SURFACE TRANSPORT — SPECIFICATION

(First Revision)

1 SCOPE

This standard prescribes the requirements for nettings made of fibre ropes or cords or of woven webbings, and for fibre rope lashings used in load restraint systems for road, rail and water transport.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions in addition to those given in IS 3871 shall apply.

3.2 Barrier Netting — A netting manufactured for the purpose of dividing the load space of a vehicle or container into separate compartments.

3.3 Border Cord — A cord or rope surrounding the net on all sides and determining the overall dimensions of the net, into which a mesh cord may be worked.

3.4 Harness — A small net or netting used as load restraint system for unit loads which form part of a larger load.

3.5 Lashing — A load restraint system comprising a length of fibre rope and if necessary one or more suitable tensioning devices or buckles.

3.6 Net and Netting — A load restraint system in net form with or without attachment or tensioning devices. The mesh material may be flat woven webbing or fibre cord, twine or rope.

3.7 Restraint Netting — A netting manufactured for the purpose of securing a load to a vehicle or container and which will provide adequate restraint against any movement which might reasonably be expected to occur during braking, cornering, etc.

3.8 Retention Netting — A netting manufactured for the purpose of containing loose bulk loads on unenclosed vehicle bodies, for example, tipping lorries, and in skip containers.

3.9 Safety Factor — The ratio of strength to the working load limit.

3.10 Shoulder Cord — A cord or rope extending fully around the netting parallel to the border cord, used for the attachment of ties to the anchorage points.

3.11 Tie Cord — A cord or rope used to attach a net to transport vehicle.

4 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTS

The tests shall normally be carried out under prevailing atmospheric conditions. In all cases of dispute, however, the tests shall be carried out on samples that have been conditioned for 24 h in a standard atmosphere at (65 ± 2) percent relative humidity and 27 °C ± 2 °C temperature as prescribed in IS 6359. Where practicable the tests shall be carried out in the standard conditioning atmosphere, otherwise they shall be carried out as quickly as possible but not exceeding 15 min after removal of the test pieces from the conditioning atmosphere.

5 LOAD RESTRAINT SYSTEM

5.1 A load restraint system shall comprise:

a) A lashing and/or netting;

b) Any fittings to secure the rope or netting to the transport vehicle excluding anchorage points permanently fixed to the vehicle; and

c) Any tensioning devices.

5.2 The design and construction of the system shall be such that, when correctly applied, it will restrain a load when used in conjunction with other equipment such as headboards, baulking arrangements and suitable anchorage points on the transport vehicle.

6 REQUIREMENTS FOR ROPE LASHING SYSTEMS

6.1 Material

Rope for lashings manufactured from polypropylene, mixed polyolefins, polyester or polyamide (nylon) shall be in accordance with IS 5175, IS 14929, IS 11066 and IS 4572 respectively. Similarly, sisal and manila shall be in accordance with IS 1321 (Part 1) and IS 1084 respectively. Preferably, 3-strand hawser laid rope is used for lashings.

6.2 Strength

The rope to be used as a lashing shall be not less than 18 kN.

6.3 End Treatment

The ends of the rope shall be treated to prevent unlaying. In the case of synthetic fibre ropes heat sealing of the ends is necessary and in the case of natural fibre rope, parceling/whipping of the ends should be done.

6.4 Splicing

If an eye is required in the rope, a splice shall be made so that the splices do not slip under 0.85 times the breaking load of the rope.

6.5 Safety Factor

The safety factor of ropes used for lashings should be a minimum of 5 (*see* Note).

NOTE — The recommendations for the use as given in Annex D (in particular **D-3**) should be followed in choosing an appropriate lashing system.

7 REQUIREMENTS FOR NETTING RESTRAINT SYSTEM

7.1 Mesh Material

7.1.1 *Webbing Nettings*

Webbing nettings shall be made from webbing woven from continuous filament, high tenacity polyester, polyamide (nylon), polypropylene yarns, and mixed polyolefins. The webbings shall be uniformly woven and free from any significant defect. The edges shall have non-fray characteristics. The width of the webbing shall be compatible with the other components used in the assembly. Preferably, sewing threads shall be of the same fibre type as the webbing. Sewing shall be done with lock stitch. The stitches shall not cause damage to the yarn in the webbing. The stitches shall be at least 2.5 mm from the edge of the webbing. The stitches shall be flat and shall penetrate the surface of the webbing in such a way that no part of the yarn (with the exception of the end stitches) stands out of the surface. The locking of the stitches shall not be visible on either side of the webbing. The stitches shall be locked or back stitched so that they do not unravel in use. There shall be not more than one fault (for example, a missed stitch, broken threads, etc) in a seam length of 100 mm. Each fault shall be compensated for by back or over stitching for a distance of at least 25 mm. The ends of cut webbing shall be finished to avoid unravelling in use.

7.1.2 *Cord or Twine Nettings*

Cord or twine nettings shall be made from polyamide (nylon), polyester, polypropylene continuous filaments or from polypropylene fibrillated film. When used as retention nettings the distance between opposite sides of the mesh shall not exceed 50 mm.

7.1.3 *Rope Nettings*

Rope nettings shall be in accordance with the relevant Indian Standard specification indicated in **6.1**.

7.2 Border Cord Material

Cord or rope nets shall be provided with a border cord having minimum 18 kN. The material of the net and the border cord shall be the same. Attachment of the border cord of a net to anchorage points on the vehicle shall be by means of end fittings attached to the border cord, by the tie cords or by direct attachment to the anchorage points. If end fittings are to be used these shall be considered as part of the whole restraint system and shall be included in any strength tests. The maximum distance between successive attachment points shall be 1.5 m.

NOTES

1 Border cords should be thicker than the net material. Tentative values are given in Table 1 for guidance only.

2 Shoulder cord should be included in the construction of at least the larger nets. The shoulder cord should be fitted parallel to the border cord 1.0 m to 1.4 m from it and should be used alternately with the border cord for the attachment of ties to the anchorage points. The recommended values of strength for shoulder cord sizes are the same as for border cords.

3 Lashings may be fitted to a net during manufacture as a supplementary means of restraint.

7.3 Strength of Barrier and Restraint Netting Systems

7.3.1 There shall be no damage or failure of a restraint system when, complete with all ancillary

hooks, tensioning devices, tie cords, etc it is tested in accordance with Annex B and the system shall restrain the test load.

7.3.2 A netting of the same type, construction and material as the netting subjected to test in accordance with Annex B shall be deemed to comply with this standard if the requirements of **7.3.1** are satisfied by the netting tested.

7.4 Rated Assembly Strength

The rated assembly strength of a netting shall be specified by the manufacturer for each netting and, in a test carried out in accordance with Annex B, a mass four times the rated assembly strength shall be retained within the netting.

NOTES

1 The term 'safe working load' is equivalent to rated assembly strength but is not preferred here.

2 The ratio of mesh cord to border cord diameters of braided cords is given in Table 1 for guidance only.

Table 1 Tentative Diameters of Netting Mesh and Border Cords

(*Clause* 7.4, *Note* 2)

Sl No.	Mesh Cord mm	Border Cord mm
(1)	(2)	(3)
i)	6	12
ii)	8	12
iii)	10	16
iv)	12	16
v)	14	20
vi)	16	24

7.5 Strength of Retention Netting Materials

The material used for any one side of the mesh, whether of single or multi-strand construction, shall have a minimum tensile strength of 22 daN. A border cord, having a minimum tensile strength of 200 daN shall be fitted. The tensile strength shall be tested as per the method prescribed in IS 7071.

NOTES

1 Retention nettings are not subject to the requirements of **7.2**, **7.3** and **7.4**.

2 1 daN = 1.02 kgf approximately.

8 REQUIREMENTS FOR HARDWARE

8.1 All hardware shall be free from burrs and sharp edges. All metal parts shall be free from ferrous corrosion.

8.2 The buckle or tensioning device shall have positive release action and shall show no damage that will alter the operation of the mechanism when tested in accordance with Annex C.

NOTE — Normally no hardware, except that permanently fixed to the vehicle, is required for rope lashings.

9 SAMPLING

Where materials forming a part of the load restraint system are produced in accordance with a specific standard, the sampling as prescribed in that standard shall apply. Sampling is not applicable for hardware.

10 PACKING

Unless otherwise specified, nettings shall be packed as per the procedure laid down in IS 3256.

11 MARKING

11.1 Webbing Restraint Nettings

Each complete system and each part of the system, if it is intended that the parts be separable, shall be durably and clearly marked with the following information, either directly or on a durable attached label or sleeve situated as near as possible to a securing device and not more than 1 m from it:

a) Name of the product;

b) Manufacturer's name, initials or trade-mark;

c) Rated assembly strength;

d) Material from which the webbing is manufactured;

e) Batch/lot number;

f) Date of manufacture; and

g) Any other information as required by the law in force.

NOTE — The following abbreviations may be used, provided the recommendations for care and use contain an interpretation of any abbreviation used.

Polyamide	PAM
Polyester	PES
Polypropylene	PPR

11.2 Ropes and Rope Restraint Nettings

Because of limited space for marking, the ropes shall be durably and clearly marked with the following information on a permanently attached label or sleeve:

a) Name of the product;

b) Manufacturer's name or trade-mark;

c) Rated assembly strength;

d) Material used in the manufacture of rope/rope nettings;

e) Batch/lot number;

f) Date of manufacture; and

g) Any other information as required by the law in force.

11.3 BIS Certification Marking

The product (s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

12 INSTRUCTIONS FOR CARE AND USE

The manufacturer shall make available instructions concerning care and use. Any repairs that may become necessary during the life of the system shall be carried out only by a competent person, that is, a person having such practical and theoretical knowledge of nettings as will enable him to detect defects or weaknesses, to assess their importance in relation to the use of the nettings and to effect the necessary repairs

NOTE — It is recommended that the information given in Annex D be used as a basis for the instructions.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 1084 : 2005	Textiles — Manila ropes — Specification (*fifth revision*)
IS 1321 (Part 1) : 2003	Sisal ropes — Specification: Part 1 Untarred varieties (*fourth revision*)
IS 3256 : 1980	Code for inland packaging of ropes and cordages (*first revision*)
IS 3871 : 2013/ ISO 1968 : 2004	Fibre ropes and cordage — Vocabulary (*third revision*)
IS 4572 : 2022/ ISO 1140 : 2021	Fibre ropes — Polyamide — 3-, 4-, 8- and 12- strand ropes (*fifth revision*)
IS 5175 : 2022/ ISO 1346 : 2021	Fibre ropes — Polypropylene split film, monofilament and multifilament (PP2) and polypropylene high tenacity multifilament (PP3) – 3-, 4-, 8- and 12-strand ropes (*fourth revision*)
IS 6359 : 2023	Method for conditioning of textiles (*first revision*)
IS 7071 : 2021/ ISO 2307 : 2019	Fibre ropes — Determination of certain physical and mechanical properties (*second revision*)
IS 11066 : 2022/ ISO 1141 : 2021	Fibre ropes — Polyester — 3-, 4-, 8- and 12- strand ropes (*third revision*)
IS 14929 : 2022/ ISO 10572 : 2009	Mixed polyolefin fibre ropes (*first revision*)

ANNEX B

(*Clauses* 7.3 *and* 7.4)

NET STRENGTH TEST

B-1 Principle

A rectangular test load secured by the restraint system under test to a rigid table hinged at one edge is tilted until the table is vertical and the net inspected for damage after lowering the load to the horizontal.

B-2 APPARATUS

A rigid table, hinged at one edge provided with a range of load attachment points and either means for raising the table from the horizontal to the vertical position or an attachment point for external raising means such as the hook of a crane. The apparatus shall include a chain or other suitable means to prevent tilting of the table beyond the vertical.

B-3 Procedure

Secure to the centre of the table a rectangular test load corresponding to four times the rated assembly strength of the net assembly and of matching size using the attachment devices of assembly on all four sides. In the case of rope nets supplied without lashing cords or similar items the border cord may be used directly. Raise the table into the vertical position at the rate of 30°/min to 45°/min. Maintain in the raised position for 5 min and then lower the table to the horizontal.

B-4 TEST REPORT

Observe and report any failure or damage to the test net.

ANNEX C

(*Clause* 8.2)

DROP TEST OF HARDWARE

C-1 Principle

A ratchet tensioner, cam buckle, buckle containing springs or other form of-end fitting is dropped a specified number of times on to a stone or concrete floor from a specified height and the effect on the hardware is examined.

C-2 APPARATUS

Means for raising a hardware item to a height of 2.5 m and releasing it so that it falls on to a stone or concrete floor.

C-3 PROCEDURE

Raise the hardware item to a height of 2.5 m and release it so that it falls on to the concrete or stone floor. Repeat this for six times and examine the specimen tested for any signs of damage that might alter its operation.

C-4 TEST REPORT

Report any visible damage to the specimen.

ANNEX D

(*Clauses* 6.5 *and* 12)

RECOMMENDATIONS FOR USE

D-1 INTRODUCTION

Netting and rope restraint systems can be used in many transport and storage situations. The following recommendations apply, in the main, to their use in road transport and while some of the more general recommendations apply throughout the fields of the use of such products, it is most important to realise that in some applications, different requirements may apply. For instance, it is likely that the requirements of system for a river barges system will be less severe than for road, rail, and sea transport where higher acceleration and deceleration forces are frequently encountered. It is recommended that the information given in **D-2** to **D-5**, suitably amended according to the application should be used as a basis for instructions on use and care of load restraint systems (*see* **11**).

D-2 PROPERTIES OF MATERIALS

D-2.1 Polyester loses little strength when wet, it is resistant to moderate strength acid but it is damaged by alkalis.

D-2.2 Polyamide may lose up to 15 percent in strength when wet, it is highly resistant to alkalis but it is damaged by moderate strength acids.

D-2.3 Polypropylene is particularly useful where chemical resistance is an important requirement in use. Attention is drawn to the fact that some polypropylene products are likely to be susceptible to actinic degradation (loss of strength when exposed to sunlight), and it is essential that an ultraviolet stabilizer be incorporated in the polymer. Organic solvent stabilizer such as white spirit, xylene and meta-cresol may affect polypropylene ropes.

D-2.4 Sisal and manila ropes are susceptible to swelling and to shrinking in length when wet and also to attack by micro-organisms. Ropes may be treated to resist these effects.

D-3 STRENGTH OF ROPE LASHINGS

D-3.1 A safety factor of 5 should be used and this factor should be associated with the following assumptions:

a) That the rope is in satisfactory condition;

b) That the rope is protected against friction, cutting, or damage at all points where it is in contact with sharp edges;

c) That the surface of the anchorage point is sufficiently broad and smooth, so that no cutting action takes place;

d) That the storage of the rope after it leaves the rope manufacturer is in every way satisfactory;

e) That ropes made from differing materials or of differing sizes of the same material are not used under any circumstances; and

f) That any knots are correctly made and the lashing system so arranged that failure of one length of rope does not lead to failure of the lashings.

D-3.2 The safe working load should be taken as equal to the breaking strength of a single part of rope divided by the safety factor used.

D-4 GENERAL INSTRUCTIONS

D-4.1 Nettings

D-4.1.1 Webbing nettings are used primarily as barriers to divide the load space into separate compartments. The maximum mesh opening is selected according to the intended use but should always be, less than the smallest item the net is expected to restrain.

D-4.1.2 Rope nettings are primarily used to restrain whole loads, in particular loads comprising of a number of separate items, such as boxes, barrels or sacks, or for palletized loads, whereas a cord or twine net may be used for the individual pallet load. The maximum mesh size is related to the size or strength of the mesh material.

D-4.2 Lashings

The following recommendations should be met while using lashing system:

a) The lashing system should be properly tensioned and should be checked during transit;

b) Over tensioning, which may weaken the system, should be avoided;

c) The restraint system should be arranged so that failure or slackening of a single component does not render the system ineffective;

d) Lashings to provide forward or rearward restraint should be as near horizontal as possible and never at an angle to the vehicle bed of more than 60 °C; and

e) Lashings should be protected from contact with sharp edges in the vehicle or load.

D-4.3 Lashing and Nettings

Recommendations common to both these restraint systems are as follows:

a) Ensure that an adequate total system is used and that it is in good condition and strong enough to secure the load;

b) The nettings or lashings be tightened in accordance with the manufacturer's instructions and wedges, scotches, etc be used wherever necessary, to secure the load and prevent movement. The security of the load be checked:

1) Before moving off;
2) After negotiating ramps in private premises and before entering public roads;
3) After having travelled a few miles;
4) On any occasion when unusual road conditions, for example, a ramp or a rapid change of chamber, may have altered the tension of the restraint; and
5) Following removal of any items from, or addition of any items to the load during the journey.

c) The nettings or lashings be protected against abrasion and/or cutting by the use of corner protectors or protective sleeves;

d) Under any circumstances, knots shall not be tied in the webbing;

e) No attempt shall be made to increase the tension on the system by the use of levers, etc, other than those specified and supplied by the manufacturer;

f) Any modifications or repairs to the netting or lashing shall not be carried out except by a competent person;

g) The users be instructed of the restraint system in their use and make expert advice available; and

h) The information on the meaning of any abbreviations used referring to fibre type shall be supplied.

D-5 SPECIFIC INSTRUCTIONS FOR ROAD TRANSPORT

D-5.1 Suitable anchorage points of adequate strength shall be used. These may, for example, include the chassis of the vehicle.

D-5.2 Ensure that the overall restraint achieved by the system is at least equal to the rated assembly strength.

D-5.3 Ensure that the vehicle's load space and the condition of its load platform are suitable and adequate for the type and size of the load.

D-5.4 If possible, always ensure that the front of the load is in contact with the headboard of the vehicle. Where this is not possible a similar form of restraint, such as baulking fitted transversely across the vehicle platform and firmly attached to the chassis frame should be used.

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Cordage Sectional Committee, TXD 09

Organization	*Representative(s)*
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Member Secretary
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SCIENTIST 'B'/ASSISTANT DIRECTOR
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