International Standard 4878

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Flat woven webbing slings made of man-made fibre

Élingues plates en sangles tissées en textiles chimiques

First edition — 1981-07-01

UDC 677.755/.756 : 677.4 **Ref. No. ISO 4878-1981 (E)**

Descriptors : webbing, hoisting slings, manmade fibres, equipment specifications, capacity of load, tension tests, designation, marking.

Price based on 13 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4878 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in September 1979.

It has been approved by the member bodies of the following countries:

Australia	Israel	South Africa, Rep. of
Belgium	Italy	Spain
Bulgaria	Japan	Sweden
Canada	Korea, Rep. of	Switzerland
Cyprus	Netherlands	Turkey
Czechoslovakia	New Zealand	United Kingdom
Egypt, Arab Rep. of	Norway	USA
Finland	Poland	USSR
Ghana	Portugal	Yugoslavia
Indonesia	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds:

France
Germany, F.R.

Printed in Switzerland

Flat woven webbing slings made of man-made fibre

1 Scope and field of application

1.1 This International Standard specifies the basic characteristics of flat woven webbing slings made of certain man-made fibres (polyamide, polyester and polypropylene) used for lifting purposes or handling loads, and defines the tests and procedures needed to verify them.

In addition it stipulates the method of manufacture, identification and marking of these slings as well as the means of recording their characteristics.

This International Standard also gives important practical advice on the use, maintenance and inspection of slings (see annexes B and C).

1.2 This International Standard does not apply to special slings or to the types of applications indicated below :

— webbings used for the securing or lashing of cargoes to each other on pallets and platforms or in vehicles;

— slings consisting of webbing with a nominal width below 25 mm[1] or above 320 mm, as well as special slings : bag slings, nets (consisting of several crossed webbings stitched together) "adjustable" slings (containing, for example, intermediate buckles stitched along the webbing), etc.;

— flat slings made from non-woven webbing, such as extruded profile webbing (with or without inclusion of continuous thread cores), monofilament webbing, webbing plaited from cable or rope[2];

— slings used for pre-slinging and not re-used;

— slings of tubular webbing without filling;

— slings formed from strips of cut fabric.

2 References

ISO 3, *Preferred numbers — Series of preferred numbers.*

ISO 17, *Guide to the use of preferred numbers and series of preferred numbers.*

ISO 139, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 1833, *Textiles — Binary fibre mixtures — Quantitative chemical analysis.*

ISO 1968, *Ropes and cordage — Vocabulary.*

ISO 2076, *Man-made fibres — Generic names.*

ISO 2307, *Ropes — Determination of certain physical and mechanical properties.*

3 Definitions

3.1 sling : A flexible component for connecting the lifting appliance and the load during handling and lifting.

NOTE — A distinction is made between :

sling in basic configuration, i.e. a single or endless sling as used for determination of working load limit (see figure 9), and

finished sling or sling assembly, i.e. a sling in the form in which it is actually used (in some cases this will be the same as the sling in basic configuration, in others it will be a form thereof, as in choke hitch, or a derivation or multiple thereof).

3.2 flat woven webbing sling : A sling consisting of webbing with woven edges, sometimes terminating in end fittings to allow fastening.

3.3 woven webbing : A part of the sling comprising a woven area containing one or several woven warps intended to withstand the force exerted by the load.

1) The greatest care should be taken when using narrow or thin slings, because of their greater vulnerability to abrasion, cutting or twisting during use.

2) "**rope** : A textile product not less than 4 mm diameter, generally consisting of three or four strands cabled or plaited together, with or without a core." (Definition from ISO 1968.)

3.4 seams : A method of securing the webbing to itself, or of securing several webbings to each other, by means of a number of stitches produced by thread traversing the layers.

Distinctions are made between two types of seam :

3.4.1 non-load-bearing seam : A seam which joins several webbings in layers without affecting the breaking force of the sling.

3.4.2 load-bearing seam : A seam by means of which one end of the webbing is joined either to the body of the webbing, to form a soft eye or to carry a metal attachment, or to itself to form an endless sling. The load-bearing seam withstands a considerable part of the force imposed upon the sling.

3.5 Types of slings

NOTE — The drawings are given as examples only.

The following are defined :

3.5.1 single sling with soft eyes (see figure 1) : A sling consisting of webbing of which each end is sewn to form an eye (see 3.9).

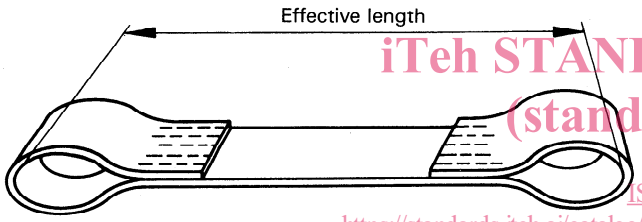


Figure 1 — Single sling with soft flat eyes

3.5.2 single sling with metal end fittings [see figure 2 a) and 2 b)] : A sling consisting of webbing each end of which is terminated with a metal fitting attached by sewing.

The two end fittings may be identical or different; if the sling is to be used in choked lift, one fitting should be able to pass through the other fitting.

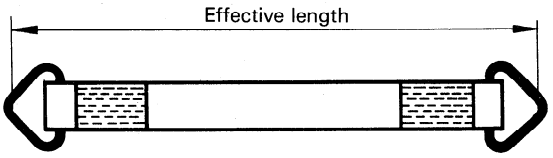


Figure 2 a) — Single sling with metallic end fittings

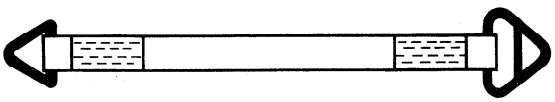


Figure 2 b) — Single sling with metallic end fitting to allow for choked lift

3.5.3 multiple sling (see figure 3) : A sling formed by two or more identical widths of webbing placed side by side widthwise and terminated at each end by a fitting common to all the widths : the different widths can be joined to each other in various places by flexible stitching, for example.

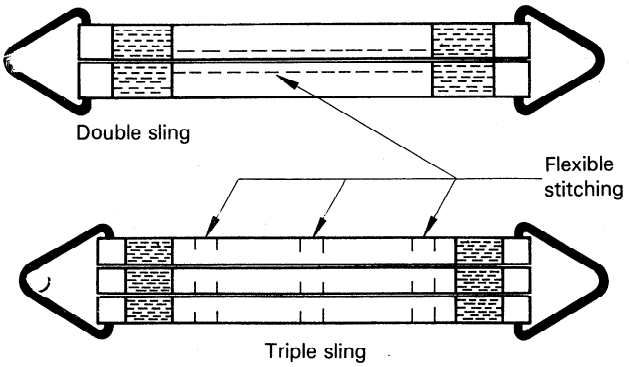


Figure 3 — Multiple slings

3.5.4 multi-layer sling (see figure 4) : A sling consisting of two or more layers of identical webbings superimposed in the lengthwise direction. When such slings comprise several widths of webbing, they are known simultaneously as multiple and multi-layer slings.

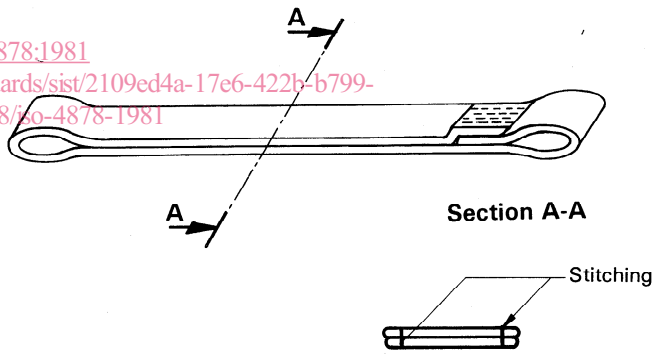


Figure 4 — Multi-layer sling

3.5.5 endless sling (see figure 5) : A sling consisting of a webbing with its ends sewn to each other. (Such a sling can also be woven endless without a seam.)

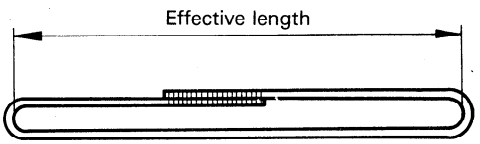


Figure 5 — Endless sling (single layer)

3.6 end fittings : Fittings attached to the end of the sling by stitching of the webbing (see 4.4).

3.7 eye reinforcement : A piece of reinforcing material put between the webbing and its end fitting. The reinforcement may be sewn to the webbing by a seam.

3.8 protective sleeve : A component of leather, woven fabric or other material, to provide extra protection to the webbing, but having no effect on the breaking force of the sling.

3.9 soft eye : An end of the sling webbing in the form of an eye, sewn so as to allow attachment or reeving. The inside of this eye can be reinforced in the same way as in 3.7.

Distinctions are made between three types of eye :

3.9.1 flat eye : An eye produced by sewing the webbing back on to itself without twisting (see figure 6).

3.9.2 reversed eye : An eye produced by sewing the webbing to itself after turning it through 180° so that the top of the webbing is placed on the back of the same webbing (see figure 7).[1)]

3.9.3 folded eye : An eye produced by folding the parts of the webbing which form the eye (reversed eye) on to each other, the two edges being sewn either together or to the webbing itself (see figure 8). The folded eye can be provided with a "sleeve" (of leather or fabric, for example) for further protection.

3.10 effective length : The distance between the bearing points of the sling stretched out by hand (without noticeable tension) on a flat surface.

This length is measured either between the inner sides of the eyes formed by the webbing (single sling with soft eyes) (see figure 1) or between the inner sides of the bearing points of the end fittings (single slings with end fittings) [see figure 2 a)]. Endless slings are measured between the inner side of the ends of the laid-out fully extended sling (see figure 5).

3.11 breaking force of the webbing component : The maximum force, in decanewtons[2)] which the sewn webbing component can withstand when tested to break in the form of a representive sling, i.e. complete with end fittings (if any), as described in 5.1.

Figure 6 — Flat eye

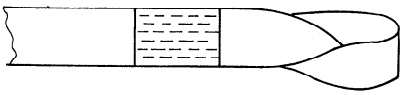


Figure 7 — Reversed eye

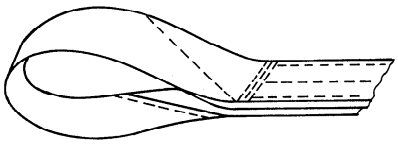
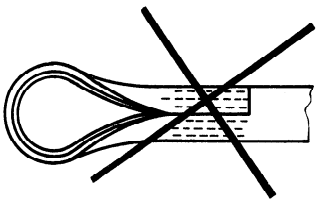


Figure 8 — Folded eye

1) The term "reversed eye" can also be used when the ends of the webbing are divided into two equal parts in a longitudinal sense, as shown in the figure below. This type of eye is strongly deprecated.



2) 1 daN is equivalent to 1,02 kgf.

3.12 safety factor : The ratio of the breaking force to the maximum force of utilization. This International Standard gives only a minimum safety factor of 6 for the sewn webbing component of flat woven slings. Due to their more durable nature, metal end fittings may carry a different safety factor (see 4.4).

3.13 maximum force of utilization (MFU) : The maximum static force, F, in decanewtons, which the sling in basic configuration is permitted to sustain.

$$\text{MFU} = \frac{\text{breaking force of the webbing component}}{\text{safety factor for the webbing component}}$$

3.14 working load limit (WLL) : The maximum mass, in kilograms or tonnes, which the sling in basic configuration is permitted to sustain vertically, (see figure 9). This, in kilograms, corresponds to the MFU, in decanewtons, × 1,02.

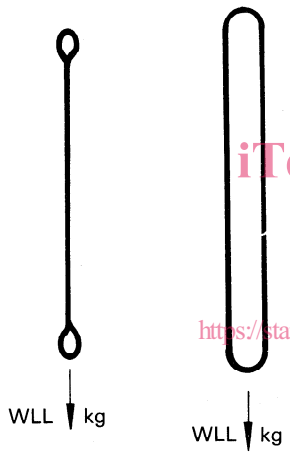


Figure 9 — Working load limit

3.15 mode factor, M : The factor which takes into account the geometry of the assembly, the multiplicity of parts, and empirically determined constant considerations. Each mode of slinging is defined by a diagram (see annex A) and is used to calculate either the maximum safe working load or the carrying force.

3.16 maximum safe working load (maximum SWL) (under normal conditions of use, i.e. not taking into consideration extreme conditions resulting, for example, from the action of extreme heat, abrasion, chemical reagents, etc) : The mass, in kilograms or tonnes, which the finished sling or sling assembly, as shown in annex A, is permitted to support after applying the mode factor to the WLL.

Maximum safe working load = WLL × mode factor M

3.17 carrying force of slinging : The force, in decanewtons, resulting from the vertical application of the mass corresponding to the maximum safe working load as defined in 3.16. (The proportional relationship between the carrying force of slinging and the MFU is the same as that between the maximum SWL and the WLL.)

3.18 proof force : The force, in decanewtons, to which the finished sling or sling assembly may be submitted in order to check its qualities prior to use.

The proof force is equal to the product of the carrying force of slinging and a test factor of 2.

3.19 proof load : The load, in kilograms or tonnes, which is suspended from the end of a sling held vertically by its other end and submits the sling to a force equivalent to the test force defined in 3.18. (Note that the force of 1 daN corresponds to a load of 1,02 kg.)

4 Specifications

4.1 Webbing

The webbing shall be woven from continuous filament yarn.

4.1.1 Materials[1)]

The webbing may be composed of :

— polyamide[2)] high tenacity continuous multifilament;

— polyester[2)] high tenacity continuous multifilament;

— polypropylene[2)] high tenacity continuous multifilament.

NOTE — Care should be taken to ensure that polypropylene is adequately stabilized against solar degradation. This might be a significant factor in use.

1) The content of the constituent materials can be determined by using ISO 1833.

2) The terms are defined in ISO 2076.

4.1.2 Weaving

The webbing shall be uniformly woven, free from any significant defect, with widths as defined in 4.1.3.

All yarns which have an effect on the strength of the webbing shall be of the same material.

The edges shall not be such that they can be "unpicked" when one of the yarns breaks.

The method of weaving shall be such that the width of the finished webbing decreases by no more than 10 % when submitted to a force equal to the maximum force of utilization.

4.1.3 Width

The nominal width shall be chosen with preference for the following dimensions (measured without tension) :

25 — 35 — 50 — 75 — 100 — 150 — 200 — 300 mm

Other widths within these limits can be chosen by agreement between the interested parties. Such slings shall, however, still satisfy the other parts of the specification in this International Standard.

Unless otherwise specified, tolerances for the chosen nominal widths shall be as follows :

— ± 10 % for widths less than or equal to 100 mm;

— ± 8 % for widths greater than 100 mm.

4.1.4 Thickness

The webbing is characterized by its thickness. When the sling consists of several assembled webbings, these shall all be identical.

The surfaces of the webbing can be covered with suitable protection.

4.1.5 Dyeing

The webbing can be supplied dyed or undyed. The dyestuff or the dyed product shall not prove toxic to human organisms (see note to 4.1.6).

4.1.6 Other treatments, after treatments or coverings

Webbing can be submitted to surface treatments and impregnation or be completely covered with a flexible coating to improve its resistance to abrasion. The treatments and products used shall not prove toxic to human organisms.

NOTE — Any effects of dyeing or other treatments on the webbing should be taken into account when assessing the strength of the sling.

4.2 Sewing of slings

Non-load-bearing seams and load-bearing seams shall be made from good quality yarn in the same material as the webbing[1].

4.2.1 The load-bearing seams shall be made in such a way that, when finished, they have a strength as near as possible to that of the webbing.

4.2.2 The seams shall be made on a machine with a lock stitch; the damage caused by the stitches to the yarn in the sling shall be minimal (for example, no overheated needles).

4.2.3 The stitches shall traverse the parts of the webbing to be sewn together; the seams shall be flat and penetrate the surface of the webbing in such a way that no part of the yarn (with the exception of the end stitches) stands proud of the surface; the locking of the stitches shall not be visible on either side of the webbing.

The stitches shall not touch or affect the edge and shall cover at least the full width of the portion lying 2 to 4 mm from each edge for webbing up to 10 mm thick and 4 to 8 mm from each edge for thicker webbing.

4.2.4 The stitches shall begin and end with a row of back stitching of at least 25 mm.

Only one fault (a missed stitch, broken thread, etc.) is allowed in a seam length of 100 mm; each fault shall be compensated for by back stitching as mentioned above.

4.2.5 The ends of cut webbing shall be finished in such a way as to avoid unravelling; the ends can, however, remain untreated when cut if the webbing has previously been thoroughly impregnated to prevent thread slippage, and may be oversewn.

Ends fused by heating shall be of such a type that they do not damage the thread and shall not be oversewn.

1) So as to facilitate inspection of the stitching, yarns of a different colour from that of the rest of the sling can be used.

4.3 Soft eyes

Whatever their type, soft eyes should be made with care so as not to diminish the load-bearing capabilities.

It is recommended that the inside length[1)] of the eyes when measured flat be of the following minimum dimensions[2)] :

- 100 mm for webbing of width 25 or 35 mm;
- three times the width of the webbing for widths from 50 to 150 mm;
- two and a half times the width of the webbing for webbing of width greater than 150 mm.

4.4 End fittings

End fittings are inserted in a small eye formed by a fold of the webbing which is then sewn in the manner specified in 4.2. The inside length of the eye shall be not less than 2,5 times the thickness (or diameter) of the fitting.

4.4.1 Material

End fittings shall be of metal, but never cast or moulded; they should be shock resistant and should have good resistance to ageing, to mechanical stress and to normal temperature ranges (from − 30 to + 80 °C).

They shall have a breaking strength at least equal to four times the carrying force of the associated finished sling or sling assembly (or greater, if required by national standards for end fittings). The maximum carrying force shall be not less than that of the associated finished sling or sling assembly. The sling manufacturer shall ensure before delivery of the statement of conformity referred to in clause 8 that the sling end fittings provided conform with these requirements.

The end fittings shall withstand without permanent deformation a force from the sling at least equal to twice the carrying force of the finished sling or sling assembly. This condition would be regarded as satisfied if no permanent deformation is observed during proof loading as given in 5.2.

NOTE — End fittings made from material or methods other than those prescribed cannot be accepted unless their suitability has been confirmed.

4.4.2 Finish

All surfaces shall be properly finished, with no sharp edges. The part through which the sling passes shall be finished in such a way as to cause no damage to the webbing.

4.4.3 Types

The seating of the end fitting where the webbing rests during lifting shall be well rounded. The junction between the webbing and the seating of the end fitting shall allow a uniform spread of force across the whole width of the webbing. The seating on which the webbing bears shall, for preference, be straight. Bulging or oval rings shall not be used for webbing with an effective width of the eye greater than 75 mm. For webbing with an effective width of the eye less than or equal to 75 mm, rings with a radius of curvature equal to at least 0,75 times the webbing widths are allowed.

4.4.4 Re-use by the manufacturer of end fittings returned by the user

A complete end fitting, transferred from a damaged sling to a new sling, shall be examined by a competent person. The fitting can only be re-used if

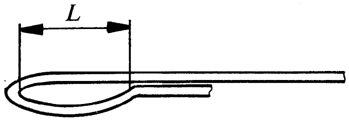
a) it satisfies all the requirements of this International Standard;

b) it is found to be free from damage or fault.

The competent person can, at his discretion, request a new proof test.

An end fitting which has been subjected to a force greater than twice its carrying force shall not be re-used.

1) The inside length of the eye is L as shown in the figure below :



2) When using an end attachment, its diameter bearing on the sling should not be more than one-third of the length of the eye [see B.6 h) in annex B]. In other cases, the part of the fitting to which the webbing is attached shall be essentially straight; attachment direct to a hook is not recommended for webbing of width more than 75 mm. For webbing with width less than or equal to 75 mm, this is permitted, provided that the radius of curvature of the hook is at least equal to 0,75 times the width of the webbing.

4.5 Working load limit (see definition 3.14)

4.5.1 The working load limit (WLL) for each sling in basic configuration should preferably be chosen from the values (in kilograms or tonnes) from the R 10 series of preferred numbers[1] given in table 1.

Table 1 — Working load limits for slings in basic configuration

WLL	
kg	t
160	
200	
250	
315	
400	
500	
630	
800	
1 000	1
1 250	1,25
1 600	1,6
2 000	2
2 500	2,5
3 150	3,15
4 000	4
5 000	5
6 300	6,3
8 000	8
10 000	10

4.5.2 The loads given in table 1 apply to slings in basic configuration, i.e. single-legged slings or endless slings (see figure 9).

The coefficients for increasing or decreasing, called mode factors (see 3.15) are given in annex A. Table 2 in this annex makes it possible to find by direct reading the maximum safe working load of a sling or sling assembly as a function of the working load limit of the sling in basic configuration and the method of slinging.

4.6 Safety factor

The minimum value for safety factor, as defined in 3.12, is given as 6 for the sewn webbing component of slings, and 4 for metal end fittings.

5 Test methods

From each batch of finished slings a defined number of slings shall be sampled for breaking tests in accordance with 5.1, in ambient atmosphere. By agreement between the interested parties, testing can be carried out in the standard atmosphere defined in ISO 139.

The purchaser may request that tests be carried out at double the carrying force in accordance with 5.2.

The tests shall be preceded by visual and dimensional checks.

5.1 Breaking tests

The breaking test is intended to determine the maximum force which the sewn webbing component of the sling can withstand before breaking.

5.1.1 Sampling

A representative sling is defined as one representative of a production run or batch of slings of the same type, i.e. having webbing of the same type of weave, the same width and the same material, the same type of stitching and the same end fittings (if applicable), but not necessarily of the same length.

Unless required otherwise, a representative sling shall be selected from each batch of 250 slings from the production run or batch of the same type to be the specimen for testing.

In cases where slings are produced with metallic end fittings (see 4.4.1) having a breaking force less than the product of the MFU and the appropriate safety factor for the sewn webbing component of the sling (see 4.6), the test specimen shall consist of one sample from 250 of the same type of sling made at the same time as the production lot but without the metallic end fitting.

When the slings comprising the batch are of such a length that they cannot be tested on available equipment, a specimen shall be made identical with the slings but of a length suitable for testing.

5.1.2 Method of test

Place each sling comprising a specimen (as given in 5.1.1) straight and without tension (the force being applied on a single part for a single sling and on two parts for endless slings) on the test machine or in a special mounting and submit it to a force at least equal to the product of the MFU and the safety factor for the sewn webbing component of the sling (which is a minimum of 6). The test machine shall comply with the requirements given in ISO 2307.

1) The R 10 series of preferred numbers, given in ISO 3 and ISO 17, is : 1,00 — 1,25 — 1,60 — 2,00 — 2,50 — 3,15 — 4,00 — 5,00 — 6,30 — 8,00 — 10,00.