International Standard 8792

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Wire rope slings — Safety criteria and inspection procedures for use

Élingues de câbles — Critères de sécurité et procédure de contrôle d'utilisation

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Foreword

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International Standard ISO 8792 was prepared by Technical Committee ISO/TC 105, *Steel wire ropes.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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INTERNATIONAL STANDARD ISO 8792-1986 (E)

Wire rope slings — Safety criteria and inspection procedures for use

1 Scope and field of application

This International Standard lays down safety criteria and inspection procedures for the regular use of wire sling ropes.

NOTES

1 The specifications and testing of slings are specified in ISO 7531.

2 The use of wire rope slings is frequently covered by national regulations; these would take precedence over this International Standard.

2 Reference

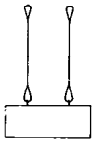
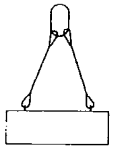
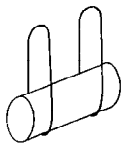
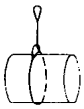
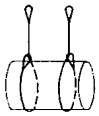
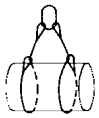
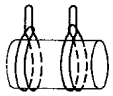
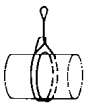
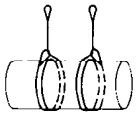
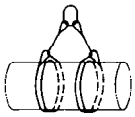
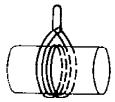
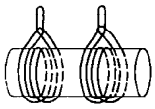
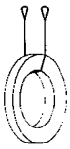
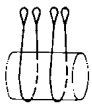
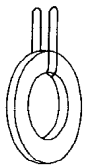
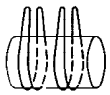
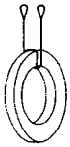
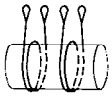
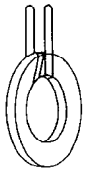
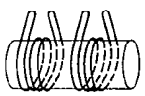
ISO 7531, *Wire rope slings for general purposes — Characteristics and specifications.* [1)]

3 Slinging methods

Table 1 gives a summary of commonly used and approved slinging methods for single-leg slings and two-legged slings.

1) At present at the stage of draft.

Table 1 — Slinging methods

Slinging method	Type of sling				
	Single-leg sling		Two-legged sling[1]	Endless sling	
	single	double		single	double
Direct attachment					
Choke hitch					
Double-wrap choke hitch					
Basket hitch					
Double-wrap basket hitch					

1) The illustrations and designations of the two-legged sling are also valid for three- and four-legged slings.

4 Use of wire rope slings

4.1 Before lifting a load

4.1.1 It is necessary to ensure that the load is suitable for lifting with a wire rope sling. The sling shall not be allowed to damage the load nor shall the sling itself be damaged. If the sling is to be attached to the load, the points used for attachment, e.g. lugs and eyebolts, should be suitable and adequate for the purpose of lifting the load.

4.1.2 The mass of the load to be lifted shall be assessed (see annex B). If the gross mass is not marked, the information may be obtained from the consignment notes, manuals, plans, etc. If there is no information, the mass should be assessed by the person responsible for the lifting.

4.1.3 Once the slinging method has been decided on, a suitable sling shall be chosen and the working load limit (WLL) shall be adequate for the load to be lifted.

As far as is reasonably practicable, the effective diameters of pins, hooks or other components over which soft eyes are used shall not be less than twice the rope diameter.

4.1.4 It is necessary to ensure that the sling is in good condition. Slings found to be damaged or to have deteriorated to such an extent that they are considered not safe for use shall be withdrawn from service immediately (see clause 5).

4.1.5 It is necessary to ensure that the load will be balanced when lifted. The slings shall be attached to designed lifting points, where provided. If lifting points are not marked on the load, the position of the centre of gravity shall be assessed. The type of sling and the slinging methods used shall ensure that the load will not topple or slip. The supporting hook shall be positioned directly above the centre of gravity. Where this is not practicable, particular care shall be taken when lifting the load (see 4.3).

4.1.6 It is necessary to ensure that the load contains no loose accessories. If the load comprises a number of pieces, for instance a bundle of pipes, a slinging method shall be chosen which will secure all the pieces.

The sling shall not be attached to banding or strapping unless they are designed for lifting purposes.

4.1.7 If a sling leg is likely to rotate during lifting of the load, handsplices shall not be used.

4.2 Fitting the sling

When fitting the sling, it is necessary to ensure that

a) sling legs are free of any tendency to kink;

b) the terminations are properly seated without overcrowding;

c) the relevant leg angle does not exceed that for which the sling is rated and marked;

d) the sling is not bent around any sharp corners that might damage the sling or reduce its effective strength — where necessary, suitable packing pieces should be used;

NOTES

1 A sharp corner is considered to have a radius of curvature of less than the rope diameter.

2 When a rope is bent over its own diameter, it can lose 50 % of its original strength.

e) and, when using a choke hitch, to ensure that

1) the angle of choke is allowed to form itself naturally and is not forced,

2) a thimble or stirrup is used, where practicable, at the eye to reduce damage to the rope and thereby prolong the life of both the eye and the main part of the rope;

f) a sling in choke hitch is not used to turn, rotate or drag a load unless special precautions are taken to ensure that neither the sling nor the load is damaged — such special precautions may entail a reduction of the safe working load;

g) a tag line(s) or control rope(s) is available to assist in the control of the swing or rotation of the load.

4.3 Raising or lowering the load

When raising or lowering the load, it is necessary to ensure that

a) a recognized code of signals is used which is fully understood by all concerned;

b) there is nothing to prevent the free movement of the load, e.g. bolts holding down the load or jointing;

c) there are no obstacles, such as cables or pipes, which can be fouled, and there is sufficient height for the lift;

d) every person concerned with the operation can see and/or communicate with all other persons concerned;

e) all personnel are clear of the load;

NOTE — If a person has to be near the load, special care during starting the hoisting and control of the movements of the load should be taken.

f) the load is balanced (see annex A);

g) the load is raised or lowered steadily avoiding snatch loading;

h) the sling is not trapped under the load — if necessary, place suitable battens, etc. in positions so that the load can be put down without damage to itself and without trapping the sling;

i) there are no free swinging legs; even when hooked back these might constitute a danger and should be subject to careful control.

4.4 Precautions

The following precautions shall be taken:

a) no one shall be allowed to ride on the load;

b) the load shall not be allowed to be carried over anyone without due care being exercised;

c) a suspended load shall not be left unattended;

d) slings shall not be dragged along the floor;

e) the slings shall not be unnecessarily exposed to corrosive liquids, solids or vapours;

f) if the sling is to be used in an environment where the temperature exceeds 100 °C, advice of the sling manufacturer shall be sought.

5 Inspection, thorough examination and discard criteria

5.1 General

During service, slings are subjected to conditions which affect their safe working characteristics. It is necessary therefore to ensure, as far as is reasonably practicable, that the sling is safe for continued use.

The sling shall be inspected for damage or deterioration before each period of use and thereafter shall be checked for obvious defects at suitable intervals during service.

In addition, thorough routine examinations shall be carried out by a competent person.

If at any time there is reason to doubt the safe condition of the sling, it shall be withdrawn from service and subjected to a thorough examination (see 5.3).

5.2 Inspection (for details, see 5.4)

An inspection is a visual check on the condition of the sling to identify damage or deterioration which might affect its fitness for use, such as:

a) broken wires;

b) distortion of the rope (crushing, kinking, etc.);

c) distortion of ferrules, splicing or fittings;

d) excessive wear;

e) heat damage;

f) corrosion.

5.3 Thorough examination

A thorough examination is a visual examination carried out by a competent person and, where necessary, supplemented by other means, such as non-destructive testing, in order to detect damage or deterioration which might affect the fitness for use of the sling.

A thorough routine examination shall be carried out at intervals not exceeding six months and this interval shall be less where deemed necessary in the light of service conditions or where required by statutory requirements.

Records of such tests shall be kept in accordance with national standards and regulations.

5.4 Assessment of the condition of the sling and discard criteria

5.4.1 Broken wires

5.4.1.1 General

Broken wires are detrimental because of

a) the possibility of injury to user's hands;

b) the loss of strength in the rope.

Broken wires are usually caused by mechanical damage, although corrosion may be a significant factor.

The appearance of well distributed broken wires may have no marked effect on the strength of the sling, but it might be indicative of mechanical or corrosive damage. In general, the loss of strength caused by the mechanical or corrosive action on the rope as a whole is more critical than the loss in strength resulting from the actual wire breaks.

To prevent injury to the user's hands, protruding wires shall be broken off in the gusset by reverse bending until fracture occurs.

5.4.1.2 Randomly distributed breaks

If the total number of visible broken wires in any length of six rope diameters exceeds 5 % of the number of wires in the rope, the sling shall be withdrawn from service and referred to a competent person for thorough examination.

5.4.1.3 Localized breaks

If there are three or more broken wires closely grouped, the sling shall be discarded.

5.4.2 Excessive wear

If surface wear reduces the measured diameter of the rope at any point to less than 90 % of the nominal diameter, the sling shall be discarded.

5.4.3 Corrosion

Corrosion may occur where slings have been improperly stored or have been used in particularly corrosive conditions, such as in moving loads in and out of acid/alkali baths. The effect is readily identified through the loss of flexibility and roughness to the touch. While slight surface rusting is unlikely to affect the rope strength, it may be indicative of internal corrosion, the effect of which is not predictable.

Where internal corrosion or corrosion beneath the serving of a hand splice is suspected, the sling shall be withdrawn from service and referred to a competent person for thorough examination.

5.4.4 Significant distortion of the rope

The sling shall be discarded when distortion due to kinking, crushing, core collapse, or knotting is identified. However, in certain circumstances, permanent deformation may occur without necessarily affecting the strength of the sling, e.g. flattening when the rope is bent around a small diameter under heavy loading.

In cases where it is difficult to distinguish between detrimental distortion and acceptable deformation, the sling shall be withdrawn from service and referred to a competent person for examination.

5.4.5 Heat damage

Discolouration of the wires and other evidence of overheating, such as loss of lubrication or pitting of the wires caused by electrical arcing, etc., may be detrimental.

A sling which has been exposed to excessive temperatures for an excessive length of time may have a significantly reduced strength.

Where such conditions are identified, the sling shall be withdrawn from service and referred to a competent person for examination.

5.4.6 Damaged or defective fittings, ferrules or splices

Particular attention shall be paid to signs of

a) opening up, distortion or cracking of the hook;

b) distortion and wear of links or closing of the thimble;

c) cracks in the ferrule;

d) severe crushing or abrasion of the ferrule or hand splice;

e) pulling out of splice or ferrule;

f) concentrations of broken wires near to the ferrule or splice, or in the splice;

g) the effect of bursting stress at the throat of the eye due to the use of a pin of excessive diameter or certain types of thimble;

h) fractured wires on the outside surface of the eye, e.g. where a soft eye has been used with an excessively small pin;

i) effect of friction on bearing surface of a soft eye.

The conditions described under items a) and b) may be an indication of overloading and will usually be justification for withdrawing the sling from service.

Annex A

Load stability

(This annex forms an integral part of the standard.)

A.1 General

Before lifting with slings, it is important to ensure that the load will be stable when it is raised clear of the ground. It is dangerous if a load can tilt or swing in an uncontrolled manner, or if it can topple over.

A load will not tilt, if, before lifting, the sling(s) is (are) arranged so that the load is suspended with its centre of gravity aligned directly below the main point of attachment of the hook (see figure 1). (The centre of gravity is the point about which the parts of a body, when left free, exactly balance each other.)

A.2 Effect of "out of balance"

If a load is out of balance when lifted, it will tilt and swing towards the position of balance, until the centre of gravity settles directly below the main point of attachment.

This movement can give rise to hazardous situations, such as:

a) the swinging load might strike persons or obstacles;

b) the individual sling legs might become overloaded;

c) the load might move within the sling;

d) in severe cases, the load may topple or be displaced from the sling with consequent damage.

If there is uncertainty about the balance of a load, it may be necessary to have a series of trial lifts before the position of balance can be determined. The load shall be lifted only sufficiently for the degree and direction of any tilt and swing to be determined. The tendency to tilt and swing shall be corrected by moving the slinging points and the supporting hook a little at a time, each time making a trial lift until the position of balance is obtained (see figure 2).

A.3 Effect of a high centre of gravity

To minimize the risk of toppling, the points of attachment of the sling legs shall, where practicable, be above the centre of gravity of the load (see figure 3).

Where the centre of gravity of the load is above the point of sling attachment a greater stability will result where the angle α between the horizontal and the sling leg is substantially greater than the angle β formed between the horizontal and a line between the centre of gravity and the attachment point (see figure 4).

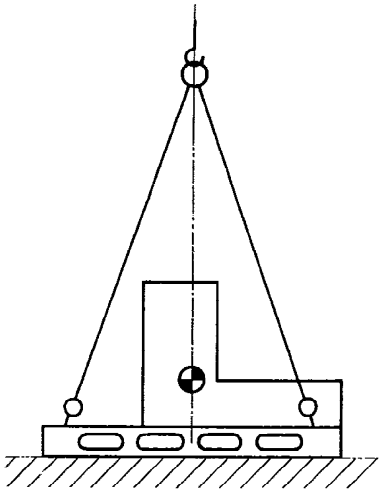


Figure 1 — Alignment of centre of gravity

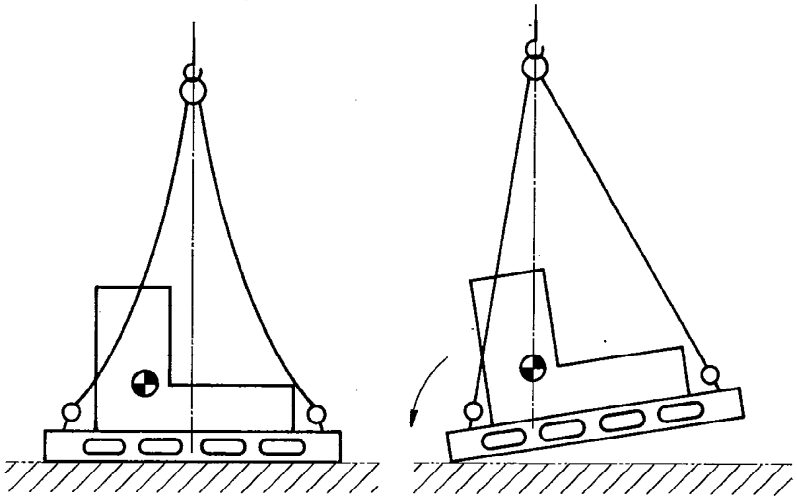


Figure 2 — Example showing effect of centre of gravity misalignment

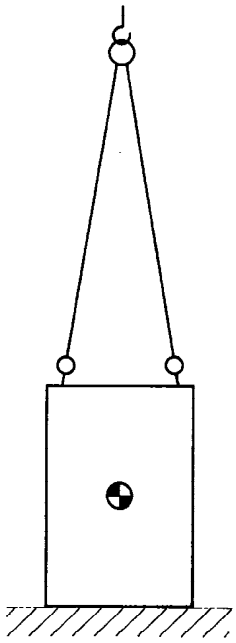


Figure 3 — Example of stable load

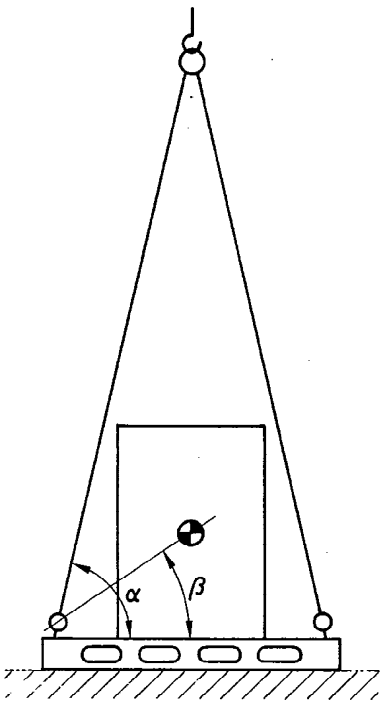


Figure 4 — Example of high centre of gravity relative to attachment points

Annex B

Determination of load mass

(This annex forms an integral part of the standard.)

The mass of a load, m, in kilograms, is determined using the following formula:

$$m = V\varrho$$

where

V is the volume of the load, in cubic decimetres or litres;

ϱ is the density of the material, in kilograms per cubic decimetre or in kilograms per litre.

The volume of a load can be found by dividing it into single elements (fundamental bodies), for which the volumes can be calculated using one of the formulae given in table 2, and by totalling the volumes of the elements.

In the cases of complex volumes or heterogeneous material or in other cases where it is difficult to calculate the load mass, the mass should be determined by a measuring device, such as a dynamometer, which is interposed between the crane hook and the load.

The densities for the most commonly used materials are listed in table 3.

Table 2 — Volumes of fundamental bodies

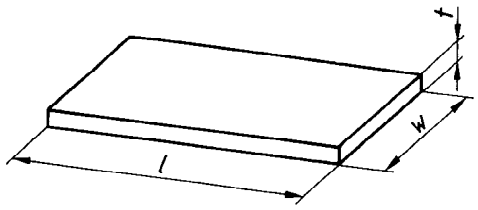
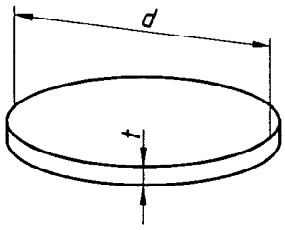
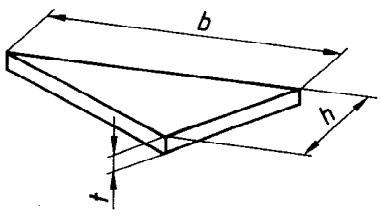
Fundamental bodies	Volume
Sheet (rectangular) 	$V = lwt$
Sheet (circular) 	$V = \left(\frac{d}{2}\right)^2 \pi t$
Sheet (triangular) 	$V = \frac{b}{2} ht$

Table 2 — Volumes of fundamental bodies (*continued*)

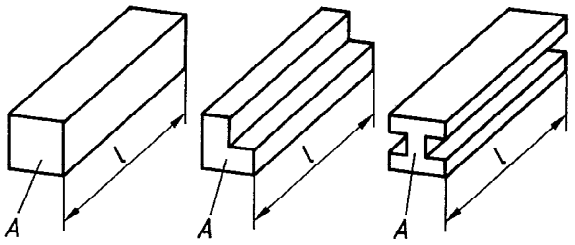
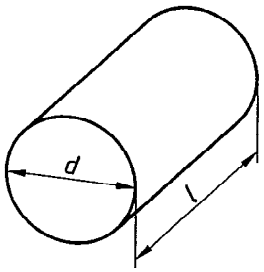
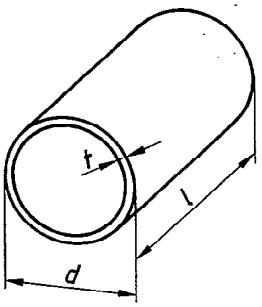
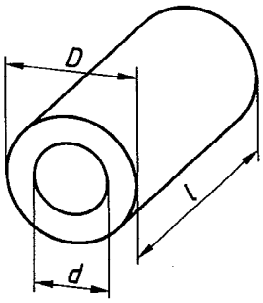
Fundamental bodies	Volume
Prism, bar or profile  A is the surface area of the base	$V = Al$
Cylinder  	$V = \left(\frac{d}{2}\right)^2 \pi l$
Tube Thin-walled  	$V = d\pi lt$
Thick-walled  	$V = \pi l \left[\left(\frac{D}{2}\right)^2 - \left(\frac{d}{2}\right)^2\right]$

Table 2 — Volumes of fundamental bodies (*continued*)

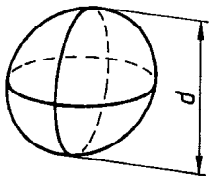
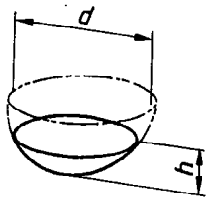
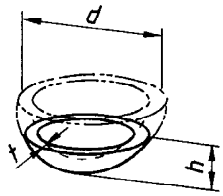
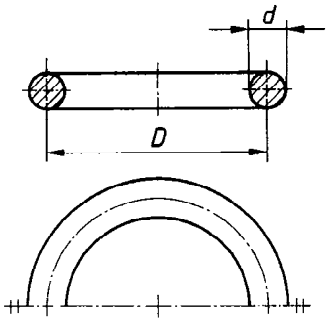
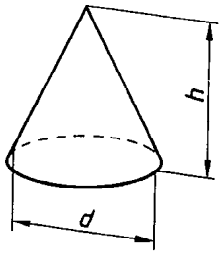
Fundamental bodies	Volume
Sphere 	$V = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3$
Spherical segment 	$V = \frac{1}{6}\pi h\left[3\left(\frac{d}{2}\right)^2 + h^2\right]$
Spherical shell segment 	$V = \frac{\pi}{4}(d^2 + 4h^2)t$
Torus (cylindrical ring) 	$V = \frac{1}{4}\pi^2 Dd^2$
Cone 	$V = \left(\frac{d}{2}\right)^2 \pi \frac{h}{3}$

Table 2 — Volumes of fundamental bodies (*concluded*)

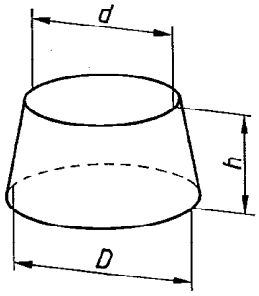
Fundamental bodies	Volume
Frustum of cone 	$V = \frac{\pi h}{12}(D^2 + Dd + d^2)$

Table 3 — Densities of the most commonly used materials

Material	Density kg/dm³
Aluminium	2,7
Brass	8,5
Bronze	8,4 to 9,2
Cast iron	7,4
Copper	8,96
Steel	7,8
Wood	0,4 to 0,8
Glass	2,4 to 2,6
Brick	1,4 to 2,0
Concrete	1,6 to 2,4
Marble	2,8
Stone	2,7
Cement (loose or set)	1,5 to 3,0
Soil, dry	1,3 to 1,9
Soil, wet	2,0
Sand, dry	1,5
Sand, wet	1,65
Coal	1,2 to 1,35