
British Standard

Textile lifting slings

Part 1. Specification for lifting slings for
general service made from certain natural
and man-made fibre ropes

Elingues de levage en textile

Partie 1. Elingues de levage d'usage général en cordages de fibres
naturelles et artificielles

Textile Anschlagseile

Teil 1. Anschlagseile für allgemeine Zwecke aus Natur- und Kunstfasern

Foreword

This Part of BS 6668 has been prepared under the direction of the Textiles and Clothing Standards Committee. It specifies requirements for the material, construction, rating, splicing and marking of fibre rope slings and, in an appendix, gives recommendations for their safe use, inspection, care and storage.

Users of rope slings should study the recommendations given in appendix A and regard them as the minimum to be observed in the usage and care of fibre rope slings. It is the responsibility of the user to ensure that the safe working load is competently assessed, taking into account all the circumstances of use. There are three stages in this assessment:

- (a) calculation of the working load limit of the spliced rope in straight tension;
- (b) applying the appropriate mode factor, which takes into account multiplicity of parts, sling geometry, etc., to obtain the maximum safe working load;
- (c) deciding whether it is necessary to reduce the maximum safe working load on account of any adverse conditions of use, such as a hostile environment, and specifying the safe working load.

These stages are explained in more detail in this Part of BS 6668.

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

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Specification

1 Scope

This Part of BS 6668 specifies requirements for the material, construction, rating, splicing and marking of three-strand hawser laid and eight-strand plaited construction fibre rope lifting slings, and contains, in appendix A, recommendations for the safe use, inspection, care and storage of these slings. It is applicable only to products made from material specified in BS 2052 (excluding hemp and coir) and BS 4928 (excluding polyethylene). Three-strand hawser laid ropes with a nominal diameter of more than 48 mm or less than 12 mm and eight-strand plaited ropes of a size greater than 6 or less than 1½ are excluded from this Part. Information to be provided with an enquiry or order is given in appendix B. Smaller ropes have not been specified since they are unduly susceptible to loss of strength through mechanical damage.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard, the definitions given in BS 3724 apply, together with the following.

2.1 fibre rope sling. An assembly comprising one or more parts of fibre rope, terminating in splices with or without end fittings, or, in the case of an endless sling, joined to itself by splicing.

2.2 single sling (strop). A length of rope formed into a sling by having an eye spliced at each end (see figure 1).

2.3 endless sling. A length of rope formed into a sling by having its ends joined together by a short splice (see figure 2, and also clause 6, especially item (e)).

2.4 two-legged sling. A sling comprising two identical strops, one end of each of which is joined to a common ring or link (see note). In use, the ring or link is placed on the hook or other lifting device, and the two legs, which may incorporate end fittings, are connected to and support the load (see figure 3).

NOTE. The use of thimbles in the joining of the strops to the ring, link or metal end fitting is recommended.

2.5 four-legged sling. A sling comprising four identical strops. One end of each of the four legs is attached by splicing (see note 1), either to one of two intermediate rings or links which themselves are attached to a master ring or link (see figure 4), or directly to a master ring or link (see note 2). The master ring or link is placed on the hook or other lifting device and the four legs, which may incorporate end fittings, are attached to and support the load.

NOTE 1. The use of thimbles in the attachment of the strops to the intermediate or master ring, link or metal end fitting is recommended.

NOTE 2. Direct attachment of the strops to the master ring or link without intermediate rings or links is less satisfactory.



Figure 1. Single sling

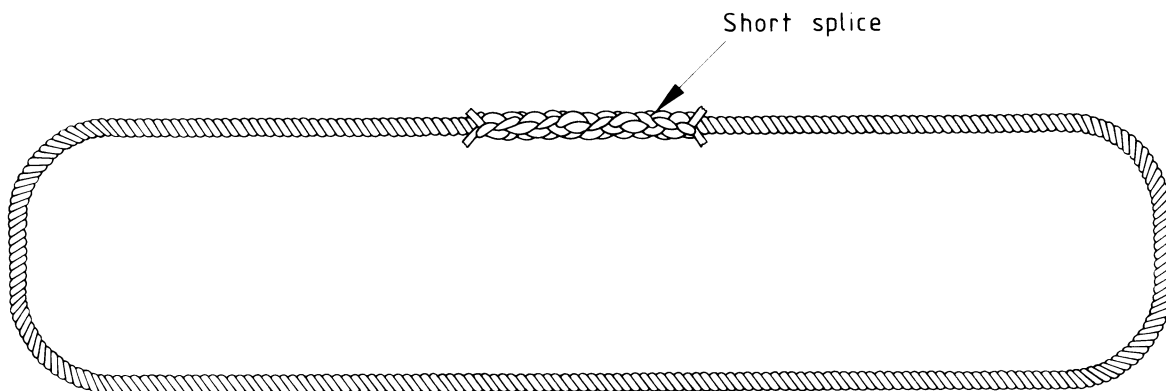


Figure 2. Endless sling

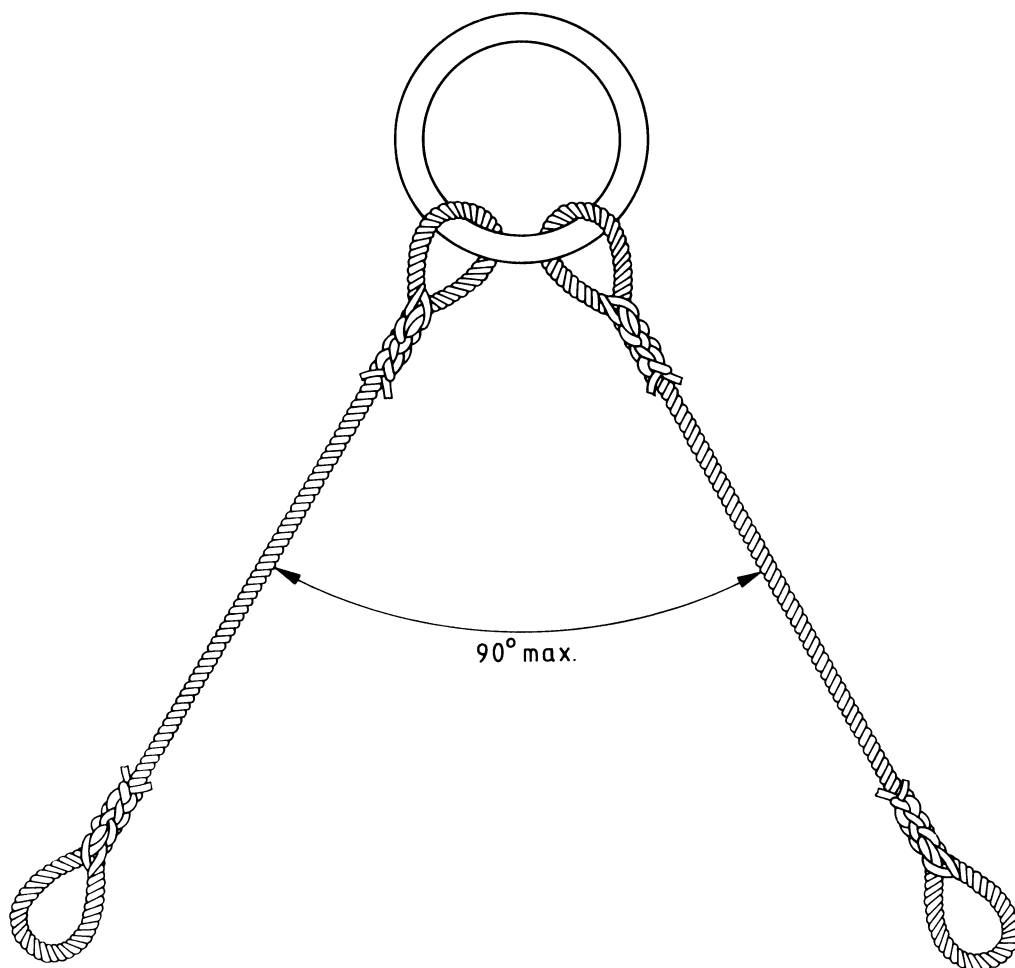
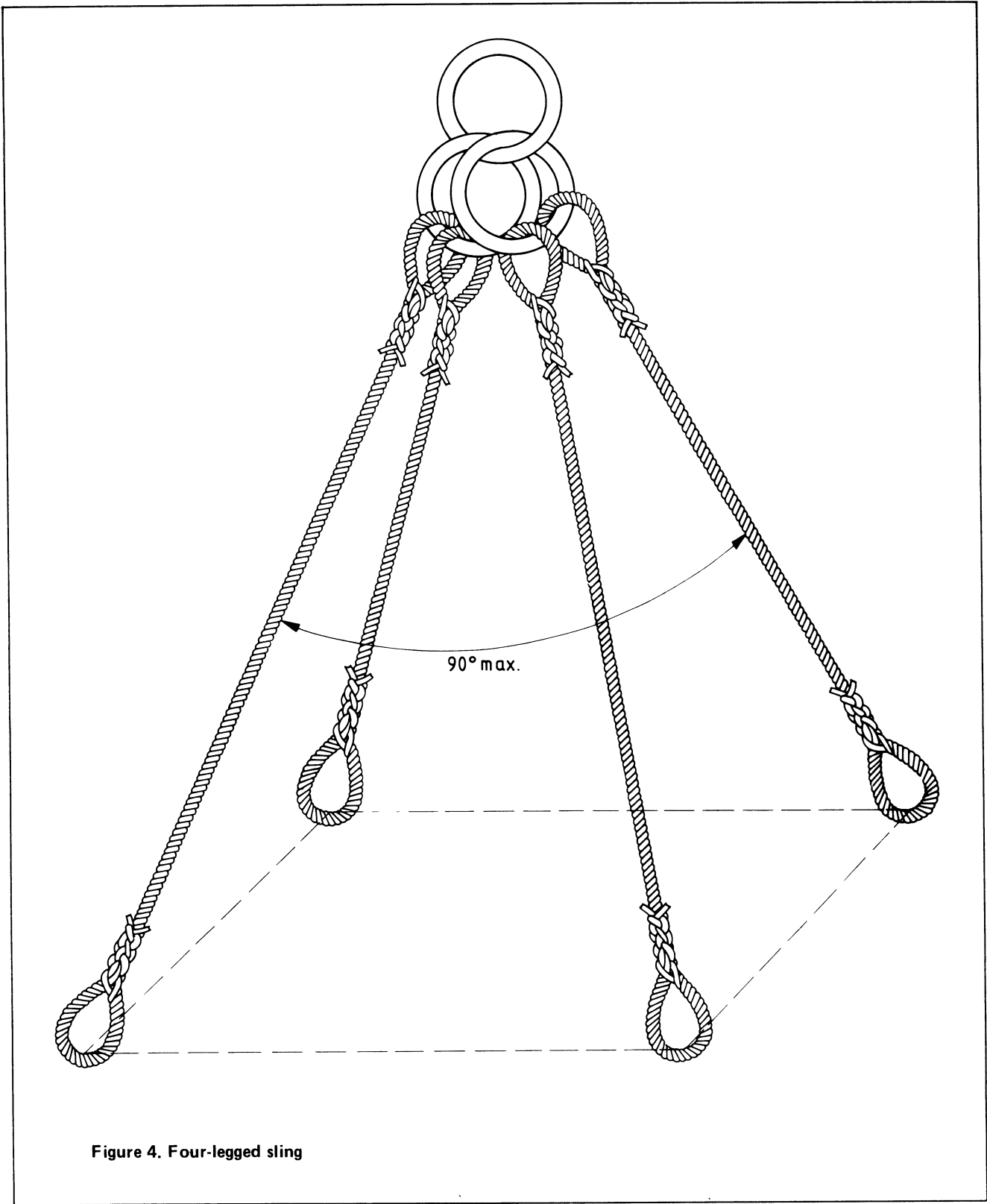


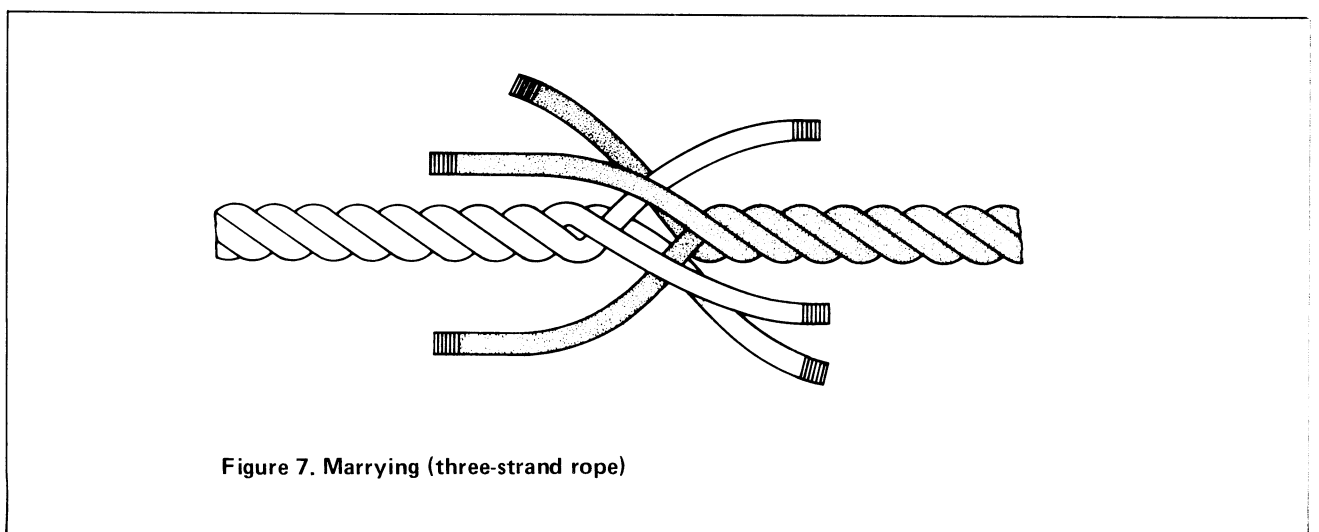
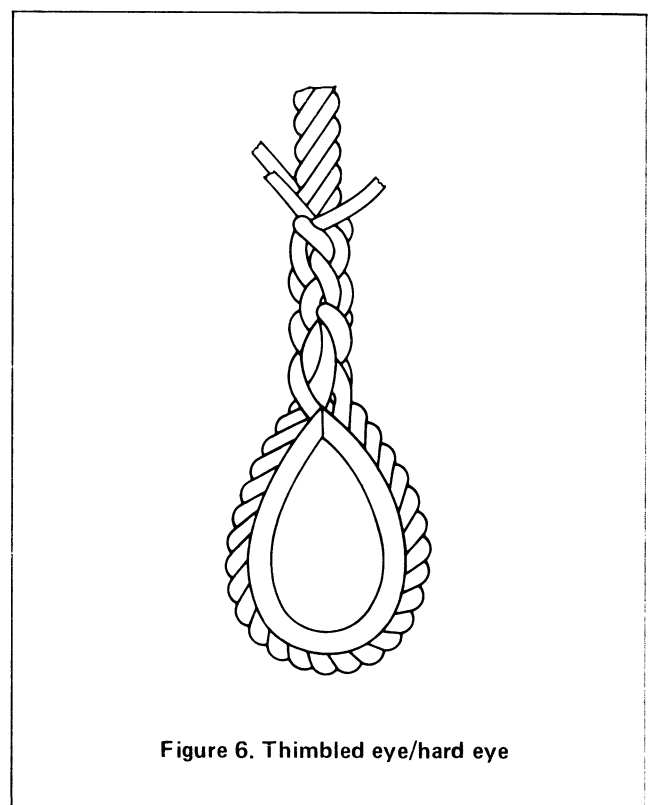
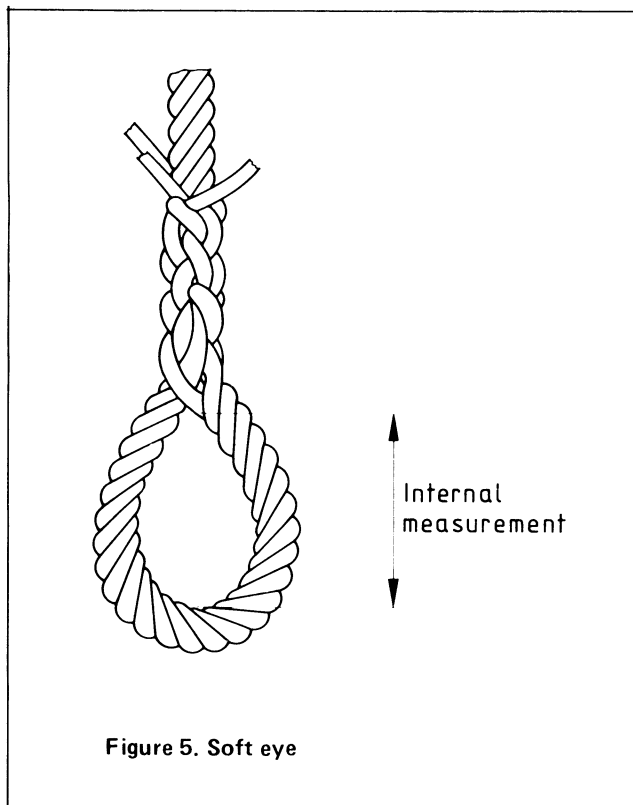
Figure 3. Two-legged sling



2.6 soft eye. An eye made by forming the end of the rope into a loop and by splicing the end into the standing part (see figure 5 and also 3.2.1 and clause 6). The internal measurement of a soft eye is the internal length in a collapsed condition.

2.7 thimbled eye/hard eye. An eye spliced into the rope, containing a rigid thimble (see figure 6).

2.8 marrying. That part of the operation employed in producing a splice in a rope for an endless sling (2.3) where the unlaid strands of one end of a rope are laid in between the unlaid strands of the other. The procedure for three-strand rope is illustrated in figure 7.



2.9 dogging. The practice of finishing a splice by separating the emergent strands into identical portions and binding (seizing) one half of one whole emergent strand to the adjacent half of the next emergent strand and so on around the rope. This does not apply to tapered splices (see item (d) of clause 6). The procedure for a three-strand rope is illustrated in figure 8.

2.10 eye or rope protection. Reinforcement material secured in the eye or on the standing part of the sling, typically of leather, woven fabric or other material, to provide protection to the rope, but having no adverse effect on the strength of the sling.

2.11 thimble. A rigid, shaped component for insertion into an eye for the purpose of protecting the eye from contact damage (see 3.2.2 and figure 9).

2.12 end fitting. A fitting (e.g. a hook, link or ring) to which the rope is connected permanently by splicing, and which forms part of the load-bearing connection between the load and the lifting or supporting device.

NOTE. Thimbles are not included within the term 'end fitting' (see 2.11).

2.13 effective length. The distance between the bearing points of the sling stretched out by hand on a flat surface. See 3.1.

2.14 minimum breaking load of the rope. The breaking load of the rope from which the sling is made, as given in the appropriate British Standard.

2.15 reduction factor. The factor used to derive the working load limit of a single part of spliced rope from the minimum breaking load of the unspliced rope. It takes account of loss of strength due to splicing and also of increasing susceptibility to mechanical damage with decreasing rope size.

2.16 working load limit. The maximum mass, in kilograms or tonnes, which a single part of spliced rope is permitted to sustain in straight tension.

2.17 mode factor (M). The factor which takes into account the geometry of the assembly, the multiplicity of parts, and empirically determined constants. It is a constant by which the working load limit in straight pull of a single part of spliced rope is multiplied to give the maximum safe working load of the sling (see 4.4).

NOTE. The mode factors of sling configurations in common use are illustrated in figure 11.

2.18 maximum safe working load (maximum SWL).

The maximum mass, in kilograms or tonnes, which the sling is permitted to lift in a given mode (subject to the considerations of 2.19 not applying) after applying the mode factor to the working load limit.

2.19 safe working load (SWL). The maximum mass, in kilograms or tonnes, which the sling is permitted to lift in use, taking account of exceptional and/or environmental conditions which may affect adversely the sling (e.g. heat, abrasion, chemical contamination etc). The safe working load never exceeds the maximum SWL.

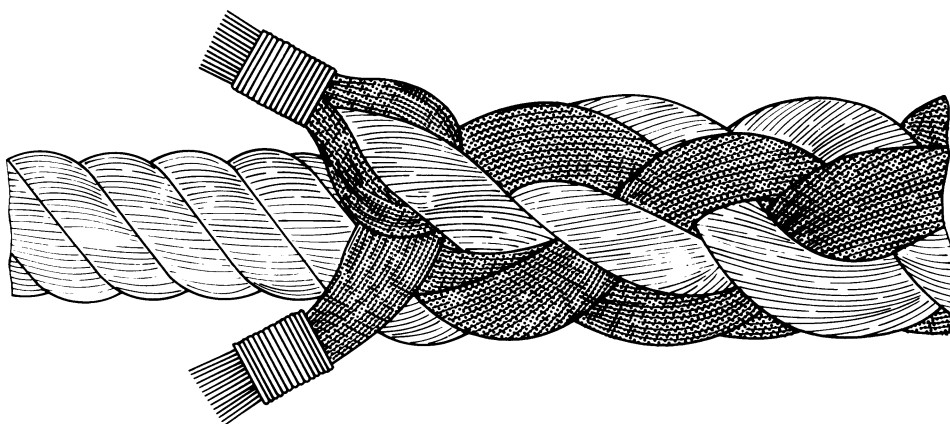
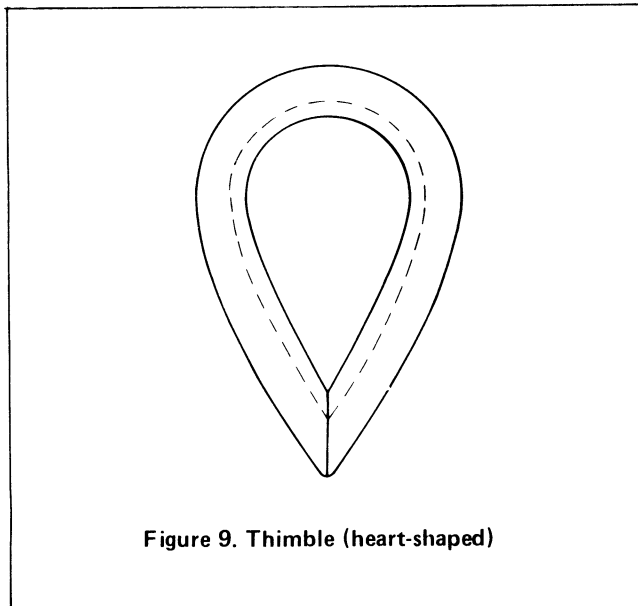


Figure 8. Dogging (three-strand rope)

**Table 1. Minimum internal measurements for soft eyes**

Nominal diameter of rope (three-strand hawser laid)	Size number (eight-strand plaited)	Internal measurement of soft eye
mm		mm
12	1½	135
14	1¾	140
16	2	150
18	2¼	155
20	2½	160
24	3	170
28	3½	185
32	4	195
36	4½	210
40	5	220
44	5½	232
48	6	245

NOTE. The use of thimbled/hard eyes is recommended when end fittings (see 2.12) form part of the fibre rope sling. The fitting of heart-shaped thimbles will prevent the sling from being used in choke hitch (see figure 9). In such cases either soft eyes or thimbles suitable for reeving may be used.

3 Construction

3.1 Slings and sling legs

Ropes for sling legs shall be selected from the three-strand hawser laid or eight-strand plaited constructions in BS 2052 and BS 4928, excluding hemp, coir and polyethylene.

Slings shall be made up only in the forms described in 2.2 to 2.5.

A multi-leg sling shall be constructed so that all corresponding items comprising it are identical. The components of a multi-leg sling shall be identical in respect of rope construction, nominal diameter, material, terminations and end fittings (if any).

The length of a single sling and the leg lengths of a multi-leg sling shall be within $\pm 5\%$ of the marked length (see item (d)(4) of clause 8). In addition, the length of the legs of a multi-leg sling shall be matched to within $\pm 2.5\%$ of the marked length.

For slings other than endless slings there shall be a spliced eye at each end of each part of rope and no other splices. Endless slings shall have only a single splice.

NOTE. The use of three-strand hawser laid ropes of nominal diameter outside the range 12 mm to 48 mm, of eight-strand plaited ropes outside the size range 1½ to 6 or of ropes made of hemp, coir or polyethylene for the manufacture of slings is outside the scope of this standard (see clause 1).

3.2 Eye terminations

3.2.1 Soft eyes. When a rope sling is made with soft eyes the minimum internal measurement, in millimetres, of the soft eye (see 2.6) shall be not less than the appropriate value from table 1. When in use, the included angle between the two parts of the rope at the splice of a soft eye shall not exceed 30° (see 3.3.1).

3.2.2 Thimbled/hard eyes. When a rope sling is fitted with thimbled/hard eyes (see 2.7), the thimbles shall be either protected against corrosion or made of a corrosion resistant material.

3.3 End fittings

3.3.1 General. The seating of the end fitting where the rope rests during lifting shall be free from roughness and sharp edges that would be liable to injure the rope. The seating shall have a diameter not less than that of the rope and preferably not less than twice the diameter of the rope.

3.3.2 Hooks. Hooks shall at least comply with the requirements of BS 2903.

The working load limit of the hook shall be not less than that of the sling leg to which it is attached.

NOTE 1. Where hooks of higher grade material are fitted, their dimensions may be smaller than those given in BS 2903 for the equivalent rating, and care should be taken to ensure that adverse effects upon the rope are avoided.

NOTE 2. Hooks designed to prevent accidental disengagement of the load are recommended.

3.3.3 Rings complying with BS 2902 or BS 3458, as appropriate, shall be included in two-legged and four-legged slings unless rings of a larger internal diameter are required, e.g. to accommodate a particular size of hook.

NOTE. Further advice on the design of links will be found in BS 1290. The recommendations of A.2(c) and A.2(d) should also be noted.

3.3.4 Proof testing. Prior to assembly into a sling, hooks, rings and links, if fitted, shall have been proof tested using a force equivalent to at least, twice the working load limit of the sling leg of which it is part, or at least twice the maximum safe working load of the sling. They shall exhibit no permanent deformation, cracks, flaws or other defects when examined after testing.

NOTE. In certain cases statutory requirements exist concerning the proof testing of lifting equipment, e.g. SI 1934/279 Dock Regulations and SI 1961/1581 Construction Regulations, and reference should be made to these.

4 Calculation of safe working load

NOTE. The procedures described in 4.2 to 4.6 are shown diagrammatically in figure 10.

4.1 General

For new rope slings for lifting purposes, the maximum safe working loads shall be derived from the minimum breaking load of ropes made in accordance with BS 2052 or BS 4928. These are given in tables 2 to 13 of this standard for slings of three-strand hawser laid or eight-strand plaited polyamide (nylon), polyester, polypropylene ropes and three-strand hawser laid grade 1 manila, sisal or cotton ropes respectively.

NOTE. The calculations are described in more detail in 4.2 to 4.5. The values for nominal diameter or size number are also taken from these two standards. Tables 2 to 13 comprise slings of the more common rope sizes. Intermediate rope sizes specified in BS 2052 and BS 4928 may be used. See also the note to 3.1. The calculations summarized in figure 10 and given in detail in 4.2 to 4.5 are based on the assumption that the rope is used and stored strictly in accordance with the recommendations given in appendix A.

4.2 Calculation of reduction factor

The reduction factor (see 2.15) shall be calculated from equations (1) or (2) as appropriate:

Reduction factor = $\frac{72}{d} + 3$

Reduction factor = $\frac{9}{N} + 3$

where

d is the numerical value of the nominal diameter (in mm) of a three-strand rope;

N is the size number of an eight-strand plaited rope.

4.3 Calculation of working load limit

The working load limit (see 2.16) of the single part of a spliced rope shall be calculated by dividing the minimum

breaking load of the rope by the reduction factor.

NOTE. The following are given as examples.

(a) 24 mm diameter three-strand rope.

Breaking load
(from the appropriate British Standard) = 12 t
Reduction factor
(from equation 1 of 4.2) = $(72/d) + 3$
= $(72/24) + 3$
= 6
Working load limit = Breaking load/
Reduction factor
= 12/6
= 2 t

(b) No. 3 eight-strand plaited rope

Breaking load
(from the appropriate British Standard) = 12 t
Reduction factor
(from equation 2 of 4.2) = $(9/N) + 3$
= $(9/3) + 3$
= 6
Working load limit = Breaking load/
Reduction factor
= 12/6
= 2 t

4.4 Calculation of maximum safe working load

- (1) The maximum safe working load (see 2.18) of the sling or sling configuration shall be calculated by multiplying the working load limit by the appropriate mode factor.
- (2)

NOTE. The following is an example for 24 mm diameter three-strand or No. 3 eight-strand plaited rope to be used as a single sling in choke hitch

Working load limit = 2 t
Mode factor, *M* = 0.8
Maximum safe working load = 2 × 0.8 = 1.6 t

4.5 When the sling is intended for use in adverse conditions, the advice of the sling supplier shall be sought as to whether it is necessary to derive a safe working load reduced from the maximum safe working load.

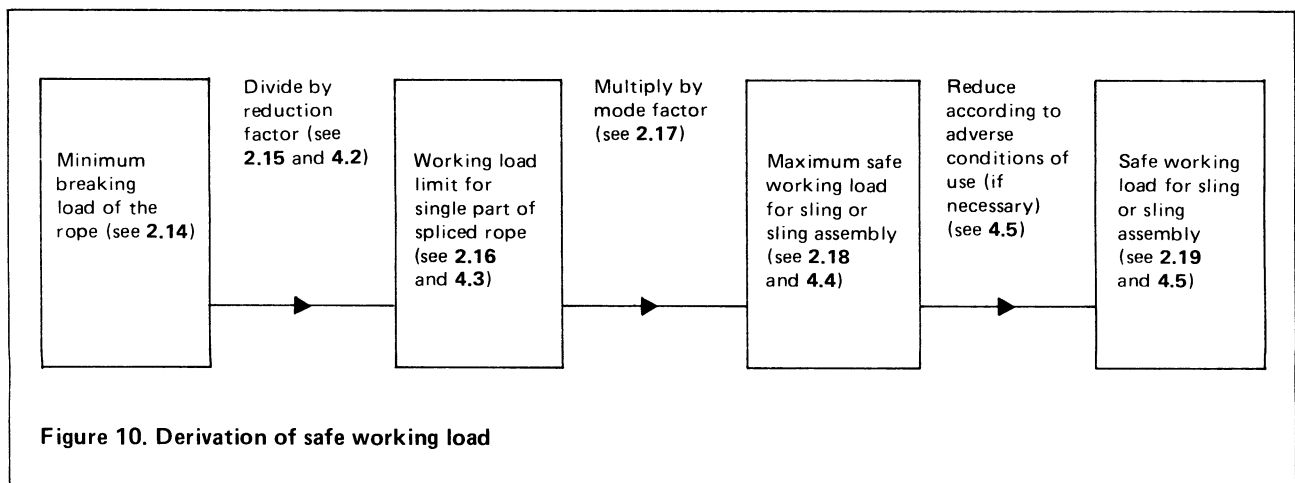


Figure 10. Derivation of safe working load