BRITISH STANDARD

BS 6166-3: 1988

Lifting slings —

Part 3: Guide to selection and safe use of lifting slings for multi-purposes

UDC 621.86.065

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mechanical Handling Standards Committee (MHE/-) to Technical Committee MHE/11, upon which the following bodies were represented:

British Ports Association and National Association of Port Employers
Chain Testers' Association of Great Britain
Engineering Equipment and Materials Users' Association
Health and Safety Executive
Ministry of Defence

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Chain Manufacturers' Association
National Coal Board

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Contents

Foreword

This Part of BS 6166 has been prepared under the direction of the Mechanical Handling Standards Committee.

The revision of BS 6166:1981 is published in the following three Parts.

— *Part 1: Methods of rating*[1)];

— *Part 2: Specification for marking*[1)];

— *Part 3: Guide to selection and safe use of lifting slings for multi-purposes.*

BS 6166-3 is based to a great extent on appendix 1.6 of the *Code of practice for safe use of lifting equipment,* published by the Chain Testers' Association of Great Britain to whom acknowledgement is made. Users wishing to obtain more detailed information are recommended to refer to the code[2)].

Attention is also drawn to a publication entitled: *Recommendations for safe slinging*[3)].

Although there is a considerable variety in the type, characteristics and performance of the wide range of slings at present available, e.g. chain, wire rope, webbing, fibre rope both natural and man-made, etc., there are certain principles in the selection and use which are common to all types. This Part of BS 6166 identifies these principles and makes general recommendations, but for specific details reference is necessary to the relevant British Standards and the manufacturer's published literature.

This Part of BS 6166 is concerned first with the selection of suitable multi-purpose slings for a lifting application and, secondly, with the safe use of those slings. Only matters common to all constructions of sling are dealt with in this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 26, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

[1)] Superseded BS 6166:1981.

[2)] Available from the Chain Testers' Association of Great Britain, 21-23 Woodgrange Road, Forest Gate, London E7 8BA.

[3)] Available from the National Association of Port Employers, Commonwealth House, 1-19 New Oxford Street, London WC1A 1DZ, or the General Council of British Shipping, 30-32 St Mary Axe, London EC3.

1 Scope

This Part of BS 6166 gives basic principles and provides guidance on the selection and safe use of lifting slings for multi-purposes which have been rated in accordance with section 2 of BS 6166-1:1986, and marked as specified in BS 6166-2.

NOTE 1 The guidance in this Part of BS 6166 may also be applicable to other slings and items of lifting equipment.
NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6166 the following definitions apply.

2.1
lifting slings for multi-purposes

a sling that is intended for a variety of lifting operations and not designed for one specific lifting application

2.2
safe working load (SWL)

the maximum mass [as certified by a competent person (see **2.3**)] that a lifting sling may raise, lower or suspend under particular service conditions

2.3
competent person

the person concerned with the testing, examination and certification of a lifting sling, who has the requisite knowledge and experience to certify with confidence whether it is free from patent defect

3 Principles to be observed in the selection of slings

3.1 General

There are numerous factors to be considered in the selection of a sling for a particular task or range of tasks. These will include sling type, i.e. material; configuration, e.g. number of legs; terminal fittings, e.g. hooks; type and size of load and environmental conditions.

3.2 Sling materials and types

3.2.1 *Chain*. Chain and chain slings are available in a number of grades and these are detailed in the following British Standards. Grades 40, M(4) and T(8) are in most common use: grades 40 and M(4) are normally assembled into slings by welding complying with BS 6304, whereas grade T(8) is usually mechanically assembled in accordance with ISO 7593[4)].

BS 1663	Specification for higher tensile steel chain grade 40 (short link and pitched or calibrated) for lifting purposes
BS 2902	Specification for higher tensile steel chain slings and rings, links alternative to rings, egg links and intermediate links
BS 3458	Specification for alloy steel chain slings
BS 4942	Short link chain for lifting purposes
	Part 1 Specification for general conditions of acceptance
	Part 2 Specification for grade M(4) non-calibrated chain
	Part 4 Specification for grade S(6) non-calibrated chain
	Part 5 Specification for grade T(8) non-calibrated chain
BS 6304	Specification for chain slings of welded construction: grades M(4), S(6) and T(8)

Grade T(8) has, size for size, a breaking load twice that of grade M(4) or grade 40 and is therefore lighter for the same strength. In any grade T system, there is usually a wide range of specially designed sling components available from suppliers, e.g. shackles, hooks and shortening clutches.

3.2.2 *Wire ropes and slings.* Wire rope slings are generally available and should comply with BS 1290, using ropes complying with BS 302-1 and BS 302-2 for general purposes, and BS 302-1 and BS 302-3 for galvanized constructions. Details of the various constructions of wire rope slings are given in BS 1290.

Further information on the use of wire rope slings is given in BS 6210.

3.2.3 *Other wire slings.* Slings are also available made from wire coil in the form of a belt and from plaited small diameter wire rope.

[4)] British Standard in preparation.

3.2.4 *Textile slings*

3.2.4.1 *Fibre ropes.* Fibre rope slings are generally available and should comply with BS 6668-1. Natural fibre ropes made from manila and sisal are covered in BS 2052 while man-made fibre ropes, e.g. polypropylene, polyamide (nylon), polyester are dealt with in BS 4928.

The order of increasing strength, size for size, is as follows:

sisal;

manila;

polypropylene;

polyester;

polyamide (nylon).

Nylon is approximately two and a half times as strong as manila grade 1 of the same diameter.

3.2.4.2 *Webbing.* Webbing slings are generally available and should comply with BS 3481-2 or BS 3481-3[5]. They are manufactured in a variety of man-made fibre materials similar to fibre ropes (see **3.2.4.1**).

3.2.4.3 *Roundslings.* Although not strictly a different material, the construction of roundslings is so different as to merit a separate classification. These slings are endless man-made fibre slings formed by winding one or more yarns round a former to produce a hank of many turns with the ends of the hank joined together. The hank is placed inside a protective tubular sheath. BS 6668-2[6] covers this type of sling, and there are well established manufacturing standards in common use.

3.3 Sling configurations

3.3.1 *General.* Each of the four different types of sling described in **3.2** may be encountered in any one of the five different basic configurations for general purpose slings, i.e. single leg, two-legged, three-legged, four-legged and endless slings.

However, roundslings are usually manufactured in the endless configuration. Webbing and fibre rope slings are not common in the three-legged and four-legged configurations.

Selection of a suitable sling configuration depends predominantly on the type of load and examples of the use of the different types are detailed in **3.3.2** to **3.3.6**.

For certain types of load such as wooden cases, drums, long pipes and logs, purpose designed slings are available and recommended. Users should seek the advice of their supplier if in doubt.

3.3.2 *Single-leg sling.* A single-leg sling may be used to connect a lifting appliance to a load with a single lifting point such as the eyebolt on an electric motor [see Figure 1(a)] (see note 1). Additionally a single-leg sling may be selected for use in choke hitch either by back hooking [see Figure 1(b)] or reeving one end of the sling through the other.

NOTE 1 Attention is drawn to the subject of "Lifting points" which is covered in the Engineering Equipment and Materials Users' Association (EEMUA) *Publication No. 101,* 1984[7].

NOTE 2 Two single-leg slings used as a two-legged sling are subject to the requirements of the Construction (Lifting Operations) Regulation 37(2) (a), which requires the upper end of the sling legs to be connected by a shackle, ring or link. (See Figure 3(a).)

Two single-leg slings may be used in combination to form, in effect a two-legged sling [see Figure 2(a) and Figure 2(b)]. Where this is done the included angle between the sling legs should not exceed 90° and care is necessary to ensure that the hook is not "overcrowded" [see Figure 3(b)]. The method of attaching the slings to the crane hook should ensure that the sling's eyes, links or rings are not damaged. Two single-leg slings used as a two-legged sling are to be treated as a two-legged sling for rating purposes and the combined SWL when used at 90° is 1.4 times the SWL of the single leg.

3.3.3 *Two-legged slings.* A two-legged sling comprises two legs connected at their upper ends by a suitable ring or link and marked as an assembly. Two-legged slings may be used to handle a wide range of loads [see Figure 4(a) and Figure 4(b)].

3.3.4 *Three-legged slings.* A three-legged sling comprises three legs connected at their upper ends by a suitable ring or link assembly and marked as an assembly. Three-legged slings are commonly used to handle circular or irregularly shaped loads where the legs can be equally spaced [see Figure 5(a) and Figure 5(b)].

3.3.5 *Four-legged slings.* A four-legged sling comprises four legs connected at their upper ends by a suitable ring or link assembly and marked as an assembly. Four-legged slings are mainly used to handle square or rectangular (four-cornered) loads (see Figure 6).

3.3.6 *Endless slings.* An endless sling is usually used in choke hitch (see Figure 7).

[5] Under revision as BS 6668-3.

[6] In preparation.

[7] Available from EEMUA, 14 Belgrave Square, London SW1 × 8PS.

3.4 Sling terminal fittings

Slings may be terminated in a variety of ways. A single-legged sling in its basic form may have soft eyes at each end, this being particularly likely in the case of rope or webbing. More elaborately it may have a ring or link at the upper end and either a hook, ring, link or possibly a shackle as the lower termination. Multi-legged slings may be similarly equipped. If users are unsure of the most suitable terminal for their particular application they should consult a competent person (see **2.3**).

3.5 Factors influencing selection of sling

3.5.1 *General.* Anyone faced with lifting for example, a grand piano, will select a different type of sling (probably of man-made fibre webbing) from that chosen for lifting hot metal ingots (probably a chain sling).

The factors detailed in **3.5.2** to **3.5.6** are not necessarily in order of importance, nor do they represent an exhaustive list, but are some of the considerations which may be appropriate in selecting a sling. Users are advised to consult a supplier if in any doubt as to the suitability of a sling for any lifting purpose, environment, etc. In making a selection, a balance will be struck between various, sometimes conflicting, considerations and the final decision may be one of several compromise solutions.

3.5.2 *The nature of the load.* With regard to the nature of the load, the aspects to be considered include the temperature of the load, the presence of sharp corners and polished surfaces. Textile slings are unlikely to be suitable for a hot load. If the load has sharp corners, a chain might be more durable, but even so, edge protection will be necessary. If the load is polished or delicate in some other way then man-made fibre webbing, a roundsling or fibre rope is likely to be best (see note 1 to **3.3.2**).

Attention is drawn to BS 2770 which specifies the pictorial marking of goods in transit, and in particular handling instructions for non-dangerous goods.

3.5.3 *The environment in which the sling operates.* Hot, corrosive and outdoor environments might be encountered. If the atmosphere is hot, e.g. near a furnace, a chain sling is likely to be most suitable.

If a corrosive environment is involved, e.g. use in a plating shop, then this is a complex problem and specialist advice should always be sought. It should also be remembered that laundries, swimming baths, pumping stations, sewage works, etc. can also give rise to corrosive conditions.

If outdoor use is involved then natural fibre ropes may be liable to rotting and mildew attack and wire ropes to corrosion. Marine conditions, atmospheric pollution, construction sites involving rock, mud, etc. will aggravate outdoor environmental problems.

Natural fibre ropes are not recommended for use in chemical environments. Man-made fibre ropes have varying resistance to chemicals, e.g. acids, alkalis and solvents; for information on this and other usage aspects reference should be made to the Cordage Manufacturers' Institute booklets *Lifting tackle*[8] and *Recommendations for rope safety*[8] or advice should be sought from a rope sling manufacturer/supplier.

It should be noted that polypropylene ropes will float.

Textile slings are prone to deterioration at high temperatures. Man-made fibres rarely show a sharp melting point: they will either soften over a range of temperatures or they will char or decompose before melting. Textile lifting slings should never be stored where they may be exposed to radiated heat. If the slings have become wet, they should never be placed before a fire or near steam pipes to dry. Overheating or embrittlement may occur.

3.5.4 *Handling of the sling.* Weight flexibility, hand contact and length adjustment are some of the factors likely to be important when handling the sling. Fibre slings are lightest for a given lifting capacity and may be most suitable where frequent lifting and carrying of the sling is necessary. It should be remembered that chain and roundslings flex easily but cannot readily be pushed through a narrow gap, whereas wire ropes may. The effect of hand contact may be a consideration. If so, wire rope or chain is hard and cold to the touch, whereas fibre is relatively larger in diameter (useful if pulling is involved) and warmer to handle. Wire rope is prone to broken wires.

Chain slings may be provided with shortening clutches which facilitate length adjustment.

3.5.5 *Durability.* Abrasion, storage, etc. will all influence durability. If abrasion is likely then chain is most durable and fibre slings are most susceptible to abrasion damage. If storage for long periods between use is contemplated, a chain sling might be most suitable as other types are prone to various forms of deterioration unless stored under ideal conditions.

3.5.6 *Extension (stretch).* Man-made fibre ropes may be less suitable if stretch is likely to be a problem, e.g. for precise positioning.

[8] Available from the Cordage Manufacturers' Institute, Anchor and Hope Lane, Charlton, London SE7 7SB.

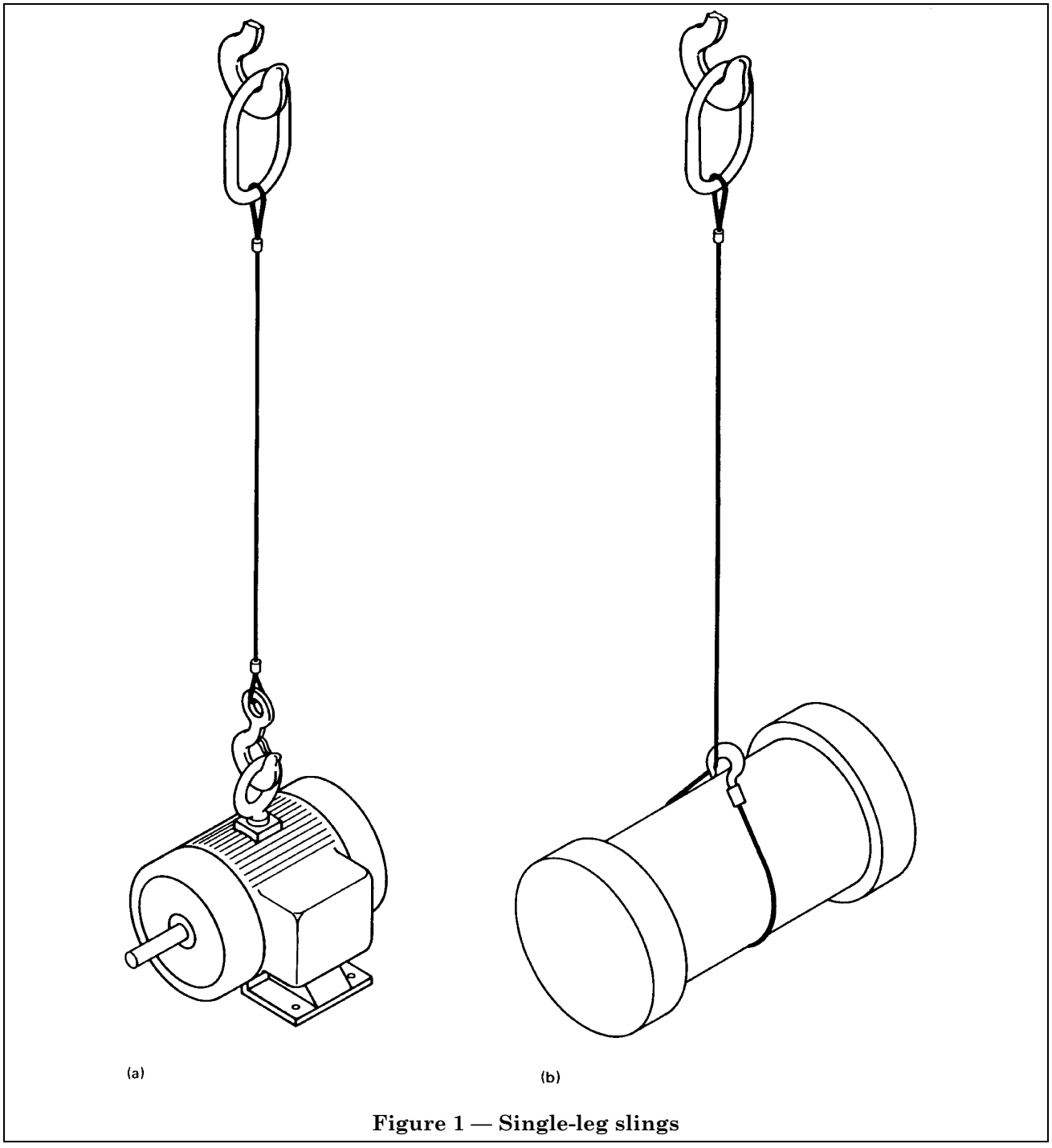


Figure 1 — Single-leg slings

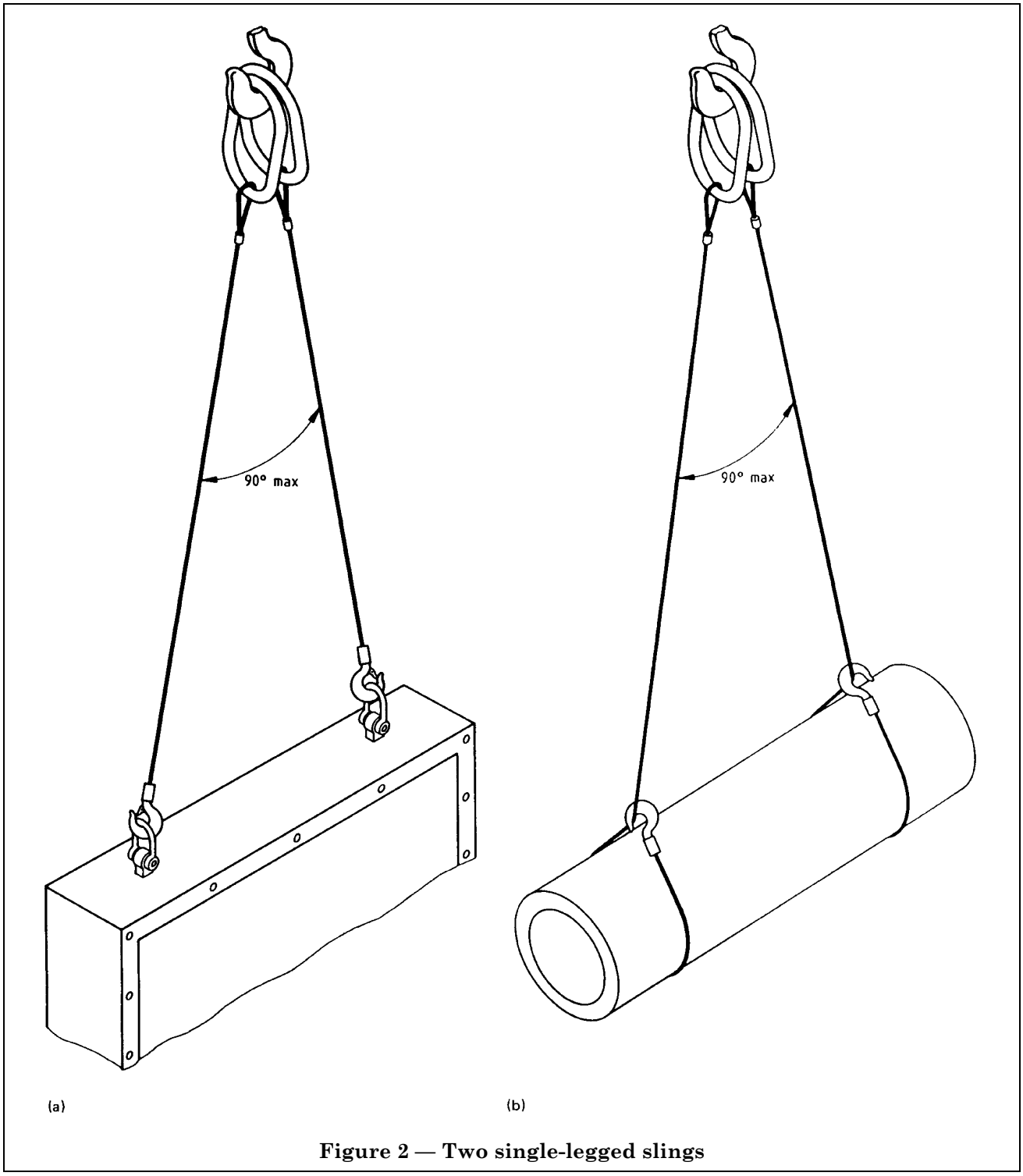
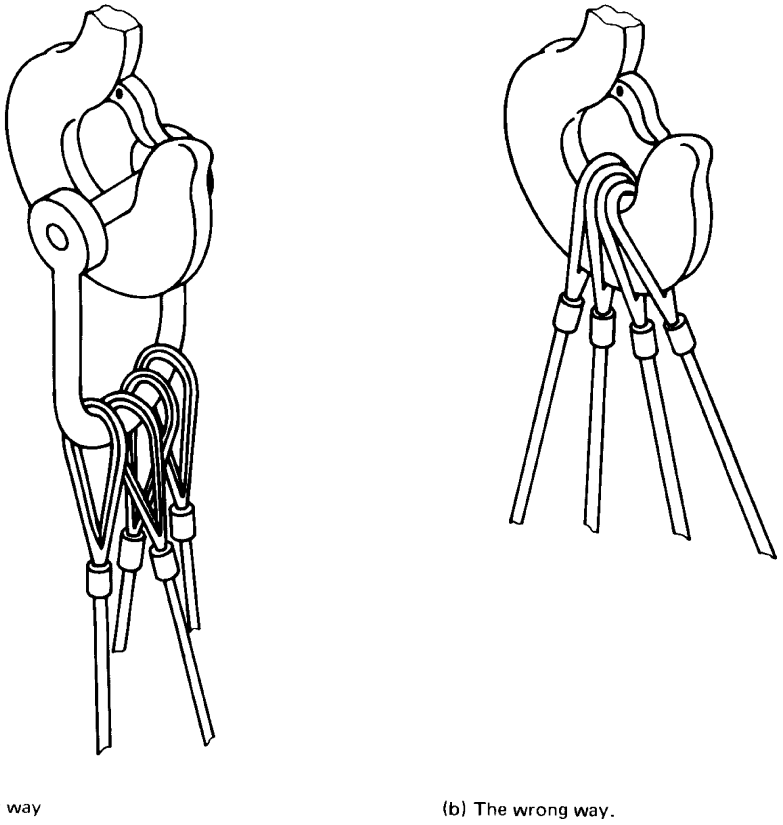


Figure 2 — Two single-legged slings



(a) The right way

(b) The wrong way.

NOTE To attach two or more slings to the hook use a shackle.

NOTE Overcrowding the hook is dangerous.

Figure 3 — Hook loadings

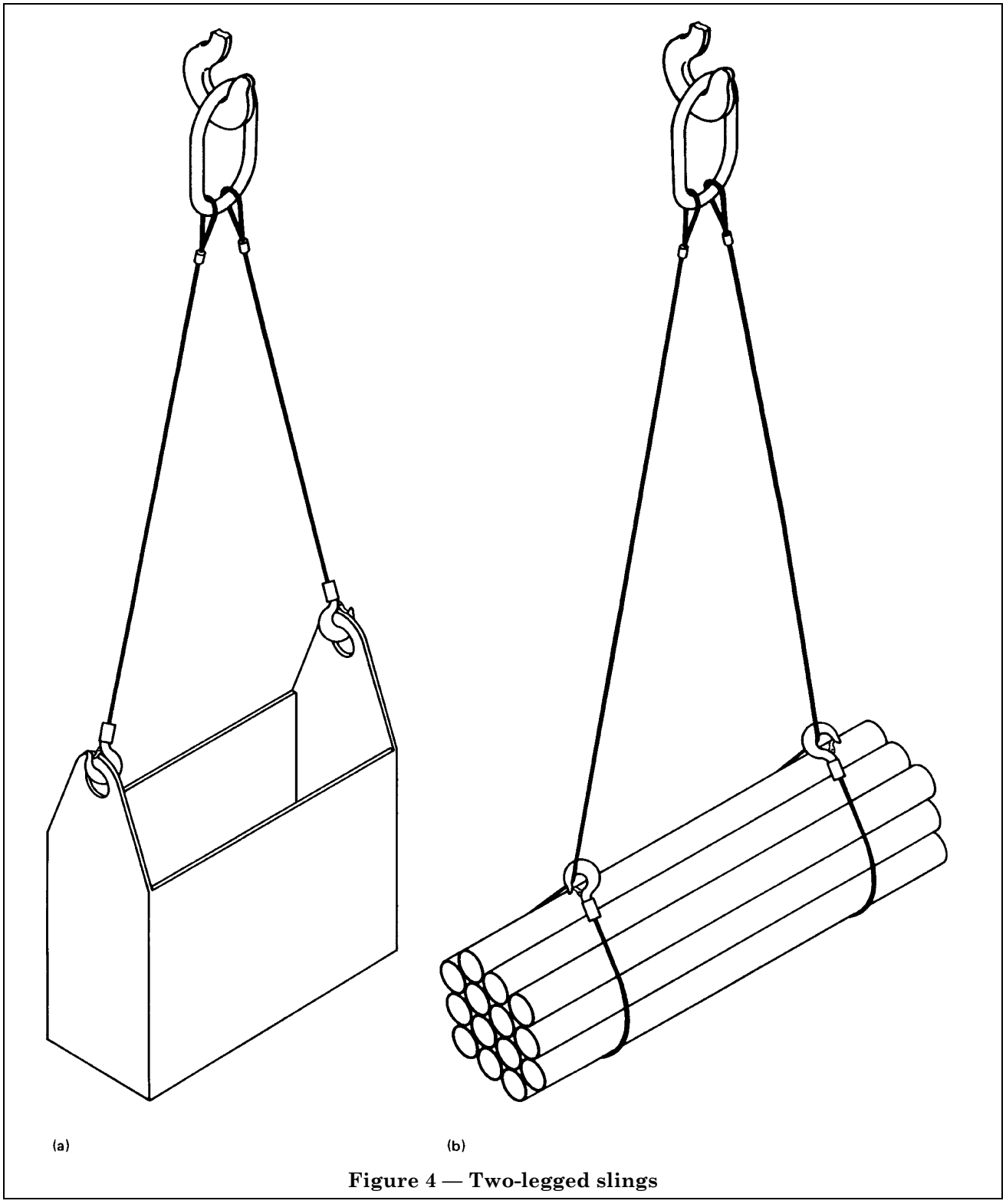


Figure 4 — Two-legged slings

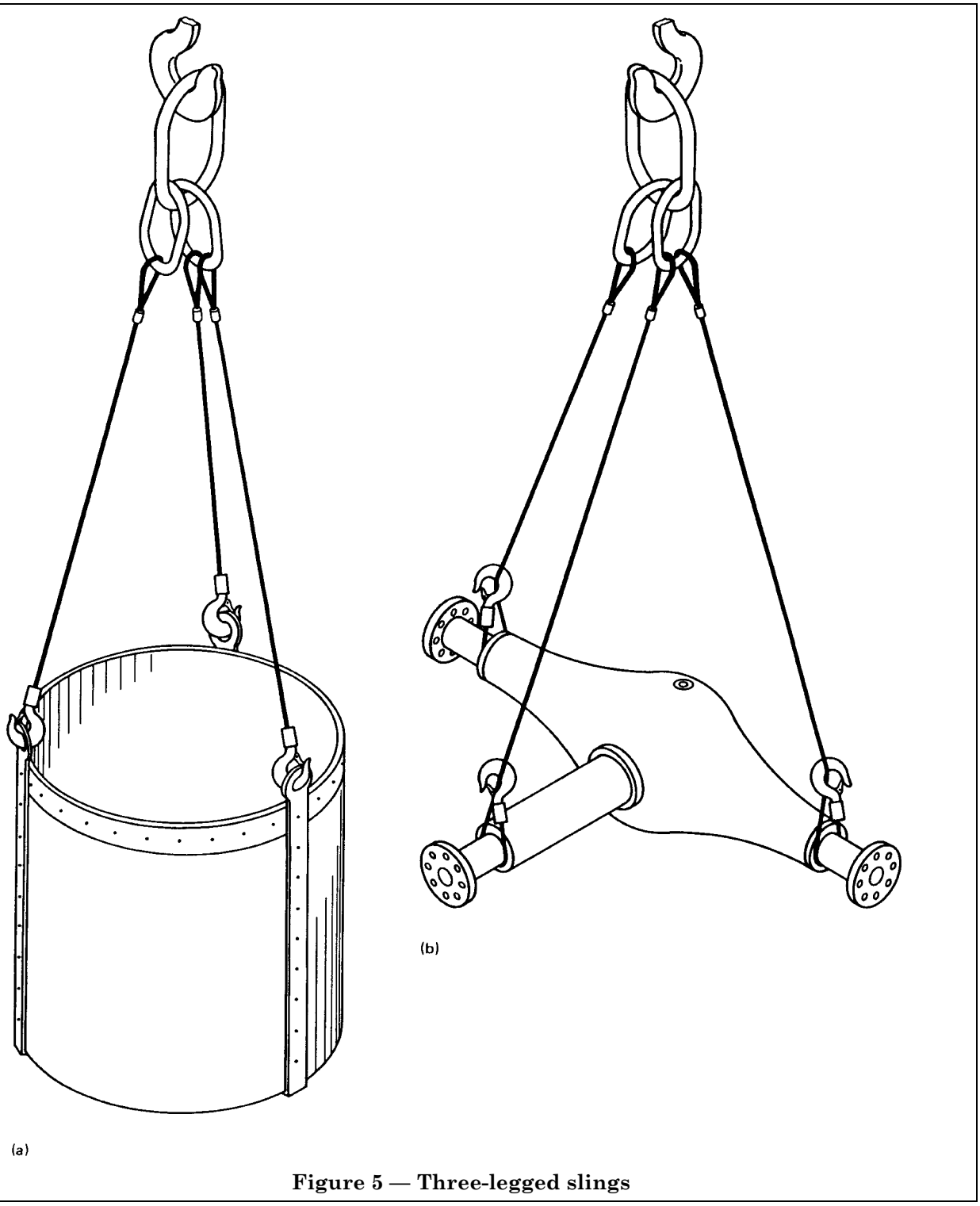


Figure 5 — Three-legged slings

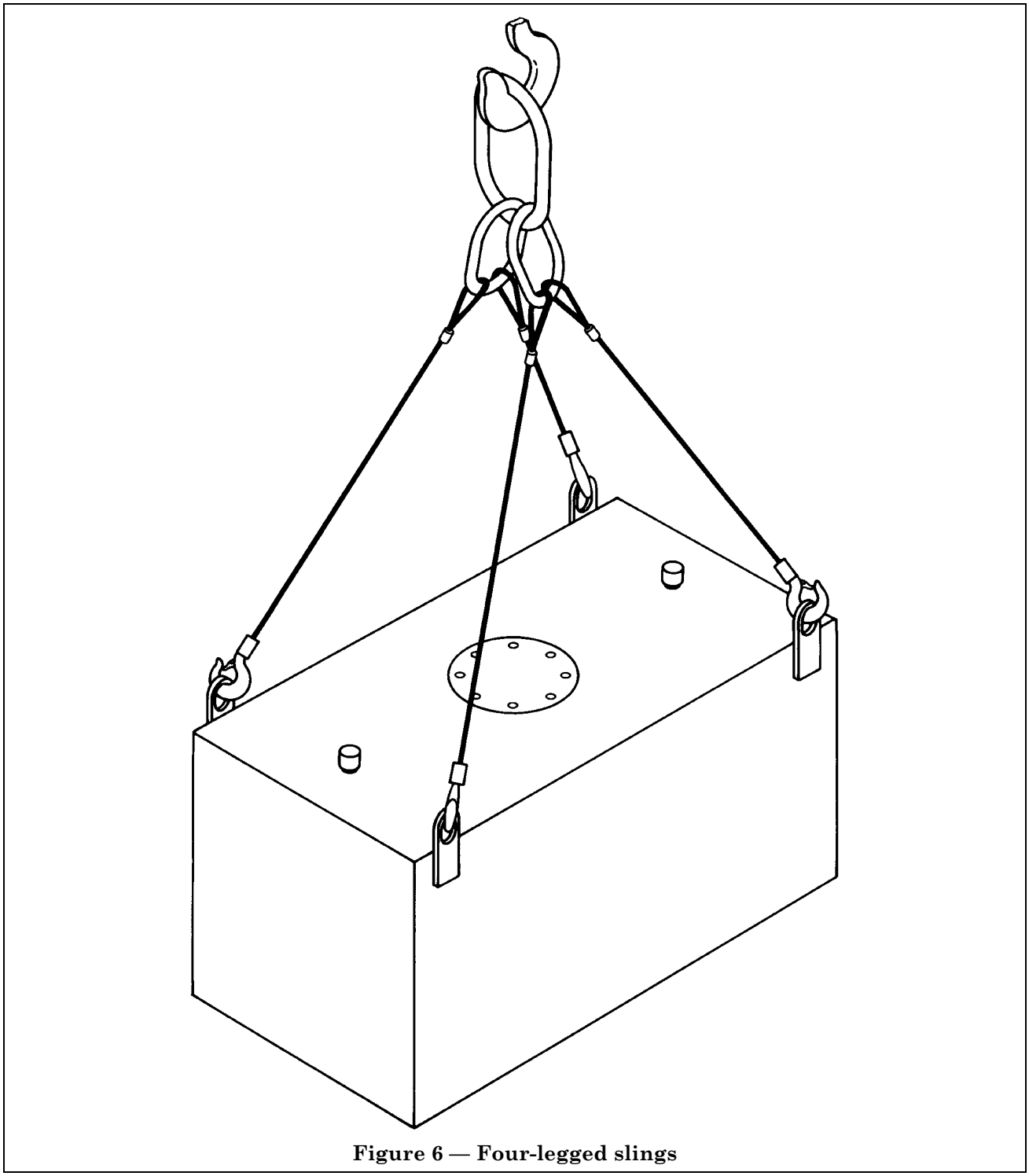


Figure 6 — Four-legged slings

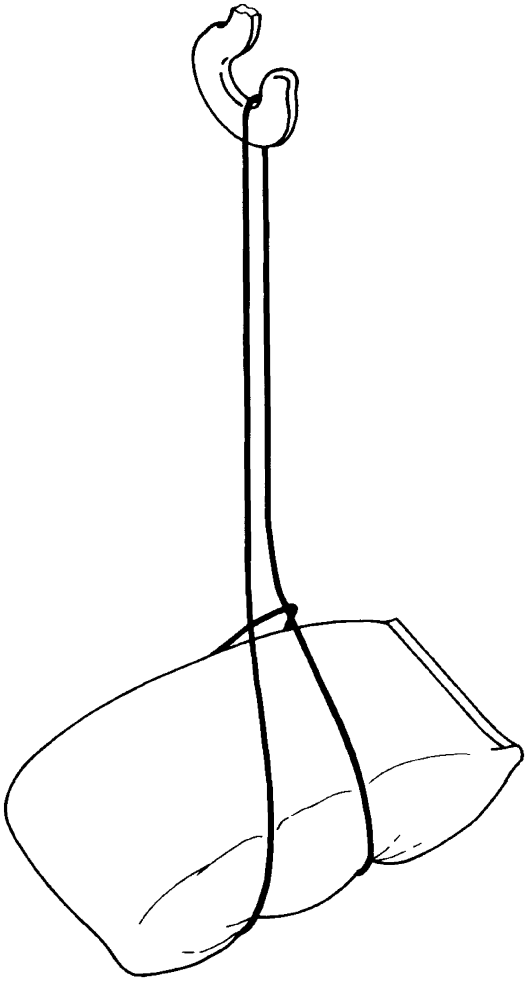


Figure 7 — Endless sling in choke hitch

4 Use of slings

4.1 Objective and basic principles

The basic objective of good slinging practice is to ensure that the load is safe and, when slung, is as secure in the air as it was on the ground.

The basic principles are as follows.

a) The sling and its method of use should be suitable for the load.

b) The method of attachment of the sling to the load and the sling to the lifting appliance should be secure.

c) No part of the sling should be overloaded either by the mass of the load or by the method of slinging.

d) The slinging method should ensure that the load is secure and the load will not fall from the sling.

e) The load should be balanced and stable and should not violently change its attitude when lifted.

f) The load is not to be damaged by, or cause damage to, the sling.

4.2 Rating of slings and deviations from assumed conditions

4.2.1 *Rating.* The methods of rating slings and the assumptions on which they are rated are given in **1.4** of BS 6166-1:1986. It is important to understand that if the assumed conditions are not complied with one part of the sling may be overloaded even though the load to be lifted is within the maximum lifting capacity of the sling.

There are two recognized methods of rating: the uniform load method, which is for multi-purpose slings, and the trigonometrical method which is reserved for single purpose slings where the designer wishes to take best advantage of the capacity of the sling for a particular application.

Although deviations from the assumed conditions have the same effect whichever method of rating is used, it varies in degree and it is with the multi-purpose slings where the designer has least information about possible applications and where the onus to make allowance for the actual method of slinging employed therefore falls on the user.

4.2.2 ***Assumptions***

4.2.2.1 *General.* The assumptions for rating fall into two main groups:

a) those dealing with the way the sling is attached to the load;

b) those dealing with the geometry of the sling, i.e. the angles between the various legs (parts) of the sling and also between the legs (parts) and the vertical.

There is also a further assumption particularly applicable to multi-legged slings but also applicable to single leg and endless slings where more than one are used, that all legs are of identical materials, meaning that they have the same load bearing capacity.

4.2.2.2 *Methods of attachment.* With regard to **4.2.2.1** a), single and multi-legged slings are rated for use with the leg or legs in a "straight pull", i.e. the legs are not bent around the load, choked, back hooked or otherwise prevented from taking up a straight line under load.

There may be some variation from these assumptions, and this may in fact be desirable offering a more secure way of attaching to certain loads. The options together with the appropriate changes to the slinging factors to be applied to the standard ratings are given in Table 1.

Endless slings have fewer variations of use but it should be remembered that the slinging factor for endless chain and wire rope slings assumes choke hitch whereas the standard rating for textile slings assumes an in-line mode of use, i.e. "straight pull".

In all cases it is also assumed that at the points of attachment to both the lifting appliance and the load, the radii around which the sling passes are large enough to avoid damage to the sling. In the case of chain and wire rope endless slings, the rating takes account of the chain or wire rope being bent around itself on the bight.

The variations on the assumptions together with the slinging factors are given in **4.3**.

4.2.2.3 *Sling geometry*

4.2.2.3.1 *General.* With regard to **4.2.2.1** b), if the geometry of the sling does not comply with the assumptions given in **1.4.3** of BS 6166-1:1986 then the load will not usually be evenly distributed amongst the legs.

The amount of load that will be imposed on an individual leg depends upon the following:

a) the angle between each of the legs and the vertical;

b) the number of legs in the sling, or in use;

c) the distribution of the legs in plan view;

d) the total load being lifted.

The relationship between these factors is a complex one especially for three and four-legged slings. What happens as these factors vary can be identified in general terms although to quantify the effect requires complex calculation.

4.2.2.3.2 *Multi-legged slings.* When a multi-legged sling is used with the sling legs at an angle, the load in the legs increases as the angle between the legs increases. This is shown for a two-legged sling in Figure 8. The trigonometrical method of rating changes the rating according to the angle, whereas the uniform load method gives a rating which is suitable for a range of angles, i.e. 0° to 90° or 90° to 120°. Thus for the multi-purpose slings rated by the uniform load method the slinger needs only decide if the angle is within the range or ranges marked upon the sling.

4.2.2.3.3 *Two legged slings.* For a two-legged sling, if each leg subtends the same angle to the vertical, then the load will be shared equally between them. If however one leg subtends a smaller angle to the vertical than the other, that leg will have a larger share of the load imposed upon it. The situation is sometimes referred to as a "tilt condition" as it occurs if the load, having been slung with the sling legs symmetrically disposed, tilts on being lifted due to the position of the centre of gravity being misjudged. Unequal angles to the vertical may also occur because of the position of attachment points on the load, particularly with an irregularly shaped load.

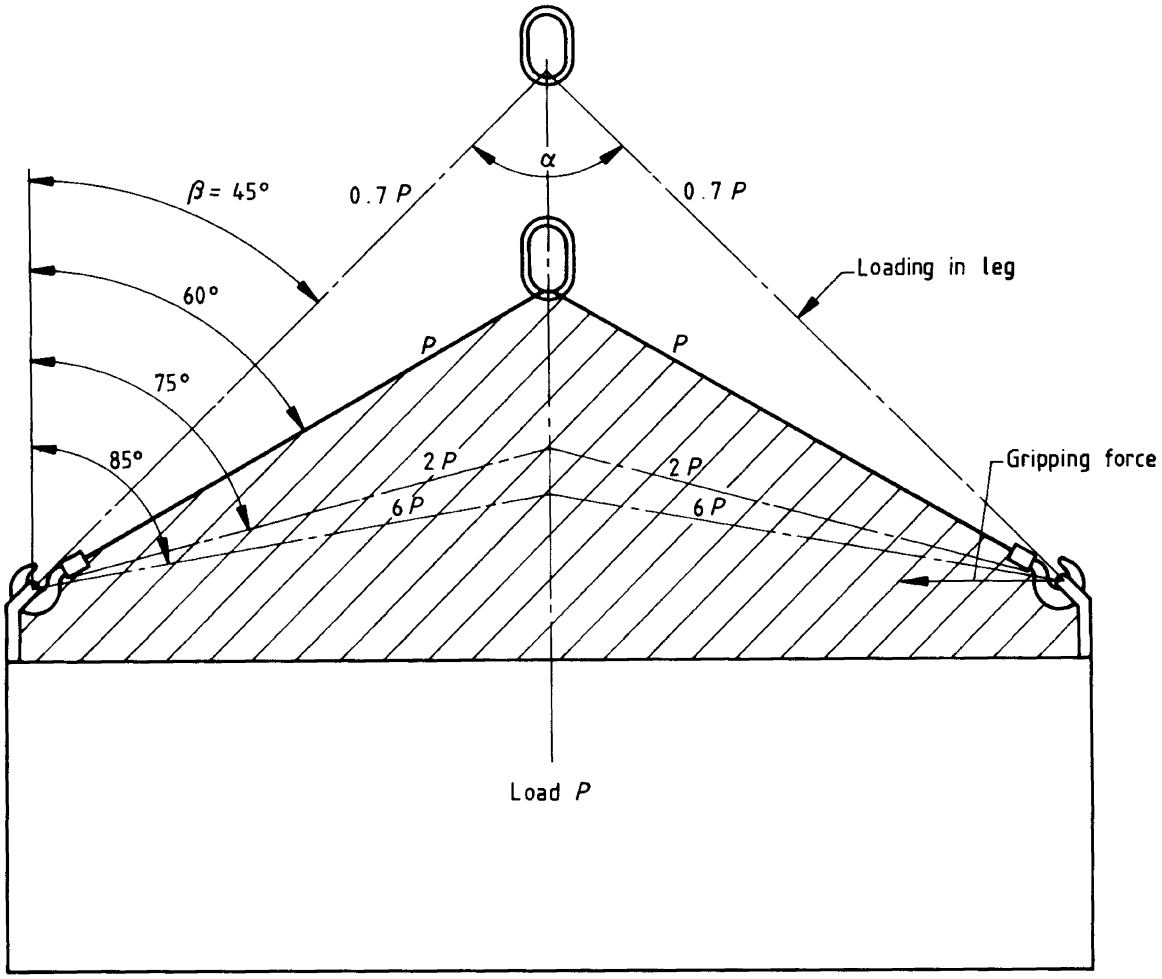
The effect of unequal angles increases as the difference between the angles increases. Additionally the effect is more significant as the angle between the legs decreases although with a uniform load rated sling this is offset to a certain extent because at such an angle there is a degree of reserve strength available. This reserve strength is however insufficient to fully counter the effect.

As a guide, at an included angle of 30° a difference of angles to the vertical of 12°, i.e. equal to 6° of tilt, will load the downhill leg, i.e. the leg with the smaller angle to the vertical, to its maximum rating if the sling is lifting to its maximum rated capacity.

This effect becomes even more significant for three and four-legged slings.

4.2.2.3.4 *Three and four-legged slings.* For three and four-legged slings a difference between the angle each leg subtends to the vertical has a similar effect to a different degree, but in addition the problem becomes three dimensional in that the distribution of the legs, when viewed in plan, also affects the share of the load imposed on each leg. The sling geometry of three and four-legged slings is as follows.

a) *Three-legged slings.* With a three-legged sling it is assumed that viewed in plan, the legs are at 120° to each other. If two of the legs are closer than that, the third leg will receive a greater share of the load. Ultimately if two of the legs are side by side, i.e. at zero angle to each other then they will receive only half the load between them leaving the third leg to take the other half on its own and thus be overloaded.



NOTE The hatched area indicates included angles between branches of greater than 120° (60° to the vertical) at which angles' slings should not be used.

Figure 8 — Variation of loading of multi-legged slings with leg angle for a given load, *P*

b) *Four-legged slings.* With a four-legged sling it is assumed that viewed in plan, the legs are symmetrically disposed, the lower attachment points making the corners of a rectangle. Ideally the nearer the rectangle is to a square the better, but this is by no means essential. However as for the two-legged slings, the smaller the included angle between the legs the greater the effect of unequal angles. On a four-legged sling the unequal effect can occur across either or both of the horizontal axes, i.e. along the length of the rectangle and/or across the width of the rectangle.

The four-legged sling is also affected by the rigidity of the load. Even if all the legs have the same angle to the vertical and are symmetrically disposed in plan, small differences in the leg lengths due to manufacturing tolerances or the positions of the attachment points may prevent the load being equally distributed. The uniform load method of rating takes some account of this by assuming that only three of the legs are bearing the load. However in extreme cases the load may be carried on only two diagonally opposite legs with the other two providing balance only. In such cases the sling should be derated to two-thirds of its standard rating.

NOTE Although outside the scope of this Part of BS 6166, the following should be noted for multi-leg slings rated by the trigonometrical method in accordance with section 3 of BS 6166-1:1986. A two or three-legged sling rated by the trigonometrical method, used at an angle less than 90°, or a four-legged sling rated by the trigonometrical method used at any angle has less reserve strength to accommodate the effects of tilt than an otherwise identical sling used at the same angle, but rated by the uniform load method.

Slings rated by the trigonometrical method should not therefore be used under tilt conditions without considering derating, taking into account the specific application.

4.2.2.4 *Multi-legged slings with less than the full number of legs in use.* If a multi-legged sling is used with less than its actual number of legs attached to the load then the SWL of the sling is to be reduced. The amount by which it should be reduced can be calculated exactly, but it is rather complex as a number of factors need to be taken into account including the method of rating. An easy way of ensuring that the sling is never overloaded is to reduce the SWL from that marked on the sling according to the number of legs in use:

a) e.g. a four-legged sling with only two legs in use:

reduced SWL = 2/4, i.e. ½ × SWL marked; or

b) e.g. a three-legged sling with only two legs in use:

reduced SWL = 2/3 × SWL marked.

This inevitably means that in some cases the sling will be under utilized. If maximum utilization is required reference should be made to a competent person who understands the factors involved and can therefore perform the necessary calculations.

In this case the idle leg(s) should be hooked back (see Figure 9). If such use is frequent then a sling with a suitable number of legs should be substituted.

4.3 Methods of slinging

4.3.1 *General.* Slings can be used in a variety of ways according to the requirements of the job. These ways are closely dependent on the six basic principles in **4.1**. Slinging factors are summarized in Table 1.

NOTE These slinging factors are for use by the slinger and should not be confused with mode factor as defined in **1.2.7** of BS 6166-1:1986.

4.3.2 *Straight-legged slings.* A single or multi-legged sling may be used with the legs straight if, for example, the legs are terminated in a hook(s) that can be attached directly to a suitable lifting point on the load as shown in Figure 1(a), Figure 2(a), Figure 4(a), Figure 5(a) and Figure 6. There is no particular problem in this method of use provided of course, that normal precautions are observed and the angle factor, in the case of multi-legged slings, is considered.

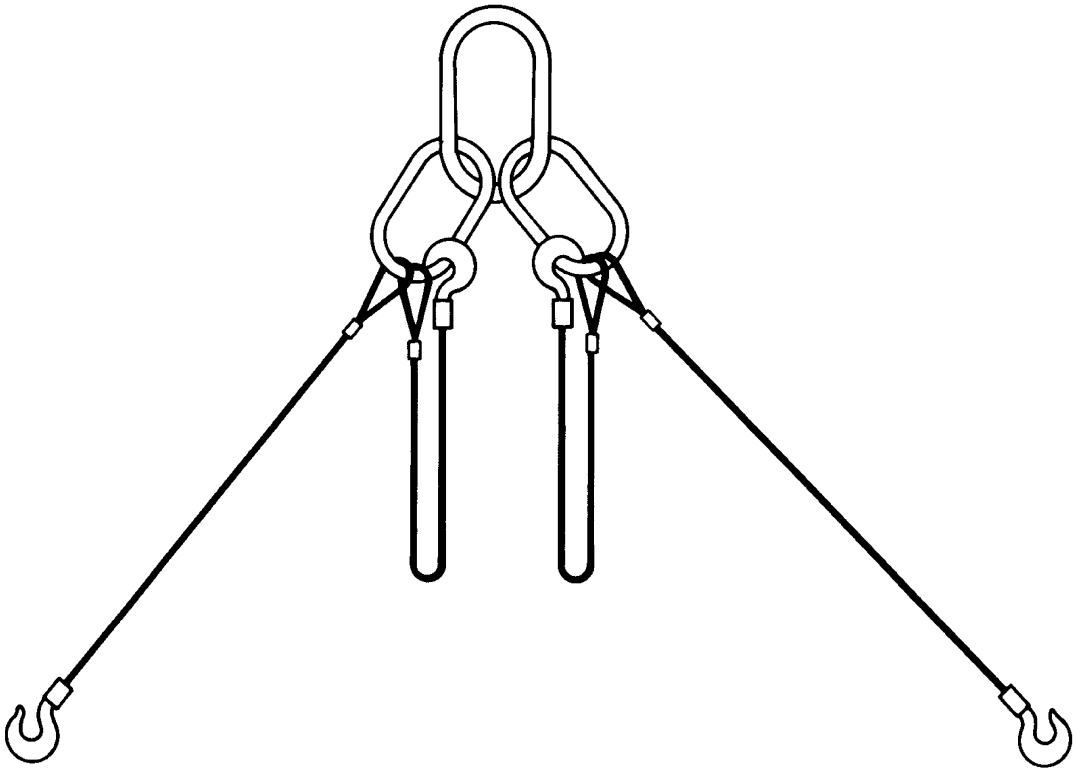
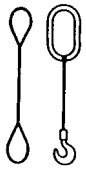
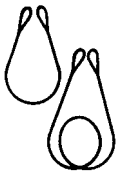
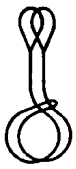
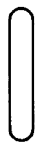
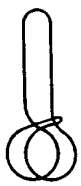
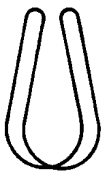


Figure 9 — Hooked back idle legs

Table 1 — Summary of slinging factors[a] for different methods of use

Maximum load to be lifted = slinging factor × SWL marked on the sling
Key: NP = Non-preferred, NA = Non-applicable

1 Material	2 Single leg in-line, i.e. straight pull	3 Single leg choked	4 Single leg basket 0° to 90°	5 Single leg back hooked	6 Single leg halshed	7 Endless in-line, i.e. straight pull	8 Endless choked	9 Endless basket 0° to 90°
								
Chain (BS 6304) (ISO 7593[b])	1	0.8	1.4	1	1.5	NP	1	NP
Wire rope (BS 1290) (BS 6210)	1	1	1.4	1	2	1	1	1.4
Webbing (BS 3481-2)	1	0.8	1.4	NA	NP	1	0.8	1.4
Fibre rope (BS 6668-1)	1	0.8	1.4	1	NP	1	0.8	1.4
Roundsling (BS 6668-2)	NA	NA	NA	NA	NA	1	0.8	1.4

[a] These slinging factors should not be confused with the mode factors as defined in **1.2.7** of BS 6166-1:1986.
[b] British Standard in preparation.

4.3.3 *Choke hitch.* Single-leg or multi-legged slings may both be used in choke hitch which is illustrated in Figure 1(b), Figure 2(b), Figure 4(b) and Figure 5(b). The basic advantages of a choke hitch are first that a sling may be attached to a load that has no suitable lug, eyebolt, etc. and secondly that the sling tends to bind the load together. Choke hitch using a hook is sometimes known as "snickling".

In forming a choke hitch the sling is bent round a small diameter which may be the eye of the sling itself or the saddle of a hook, link or other fitting. In these circumstances, the load in the sling will be increased at the point of choke and for this reason some derating may be necessary in order to prevent the sling being locally overloaded. Any derating required for slings used in choke hitch depends on the materials of the sling and is normally specified in the relevant British Standard. For instance, for chain slings, fibre rope slings and webbing the SWL is reduced to 0.8 of the SWL of the straight leg. No derating is considered necessary for wire rope slings used in choke hitch. Care should be taken when applying choke hitch to select a sling of sufficient length to ensure that the angle at the choke does not exceed 120° (see Figure 10) and that the sling positions itself naturally. Slings should never be forced down to achieve an angle greater than 120°. Care should be taken that any force applied will not damage the sling.

NOTE Frictional heat will be generated particularly for textile slings by the sling running over itself, e.g. when lifting a compressible load such as a sack of beans in choke hitch. Damage may be minimized by limiting such movement as far as possible, avoiding snatch loading or using reeving thimbles in the eyes.

Endless slings are generally used in choke hitch and may need derating as recommended by relevant standards or the manufacturer or supplier. For instance, fibre slings should be derated to 0.8 × SWL for in-line mode, i.e. straight pull. Endless chain and webbing slings require no derating when used in choke hitch as the sling is designed for this method of use. It is assumed that at the points of adjustment to both the lifting appliance and the load, the radii around which the sling passes are large enough to avoid damaging the sling.

4.3.4 *Double-wrap choke hitch.* Double-wrap choke hitch is a variation on choke hitch where the sling is passed one complete turn around the load before being choked (see Figure 11). This increases the binding effect and should be used on loose loads such as bundles of tubes. The sling should be derated by the same amount as for ordinary choke hitch (see **4.3.3**).

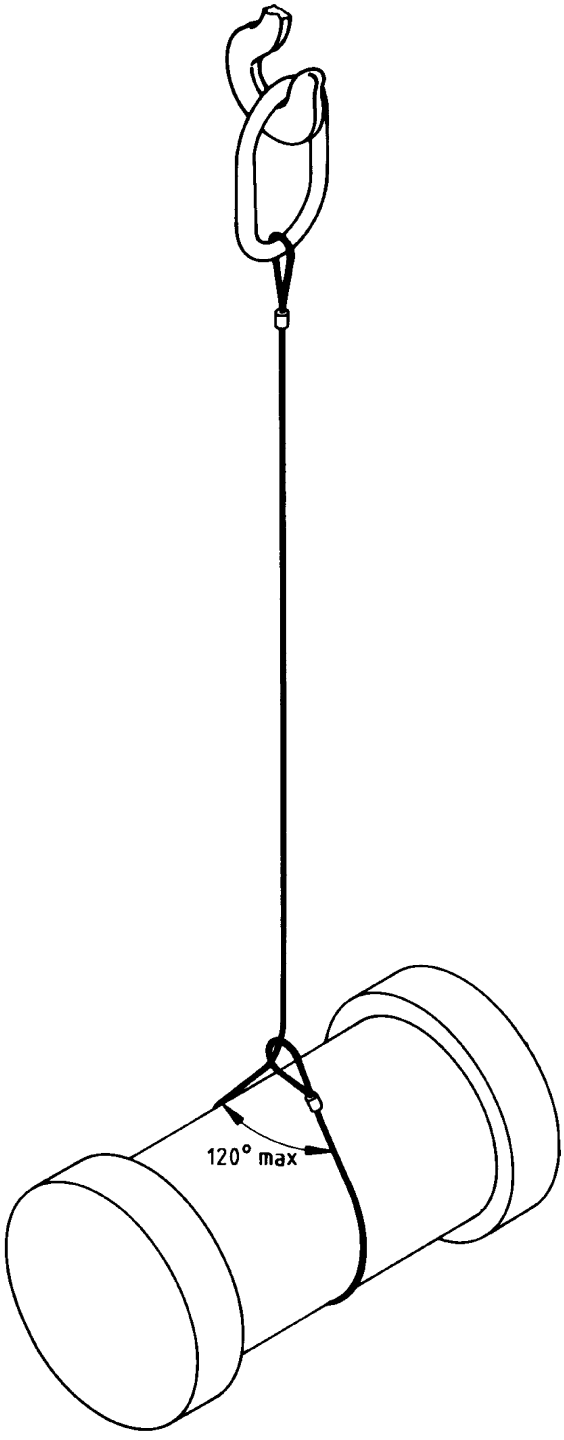


Figure 10 — Choke hitch

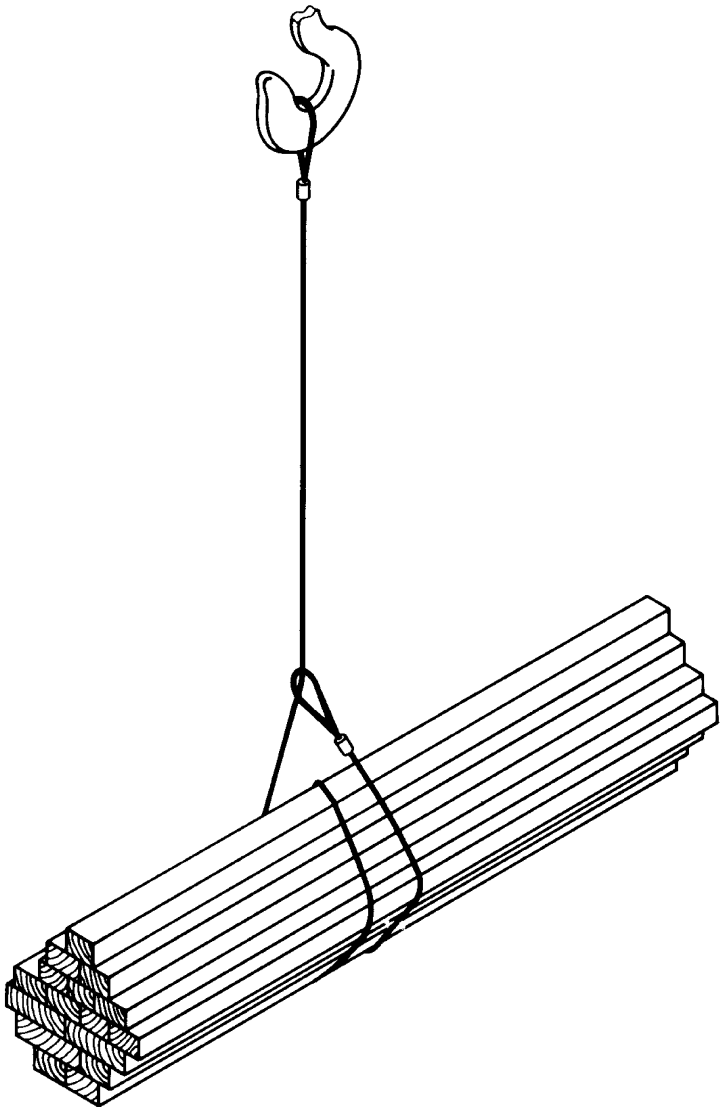


Figure 11 — Double-wrap choke hitch

4.3.5 *Basket hitch.* The basket hitch is normally used with slings in pairs for handling loads such as a large roller but it is not suitable for cradling loose bundles. If only one sling is used this should be passed through the load at a point above the centre of gravity to ensure it is safely secured (see Figure 12).

If a sling is used with both legs parallel, i.e. with an included angle of 0° between the legs of the basket, then twice the safe working load may be lifted. With the terminations of both ends of the sling on the hook (see Figure 12) the load lifted may be increased to not more than 1.4 × SWL provided the included angle does not exceed 90°. If two slings are used in basket hitch in the same manner (see Figure 13) the load lifted may be increased to 2.1 × SWL again provided that no included angle between adjacent or diagonally opposite legs exceeds 90°. The factors for basket hitch already detailed assume that all sharp edges are adequately packed.

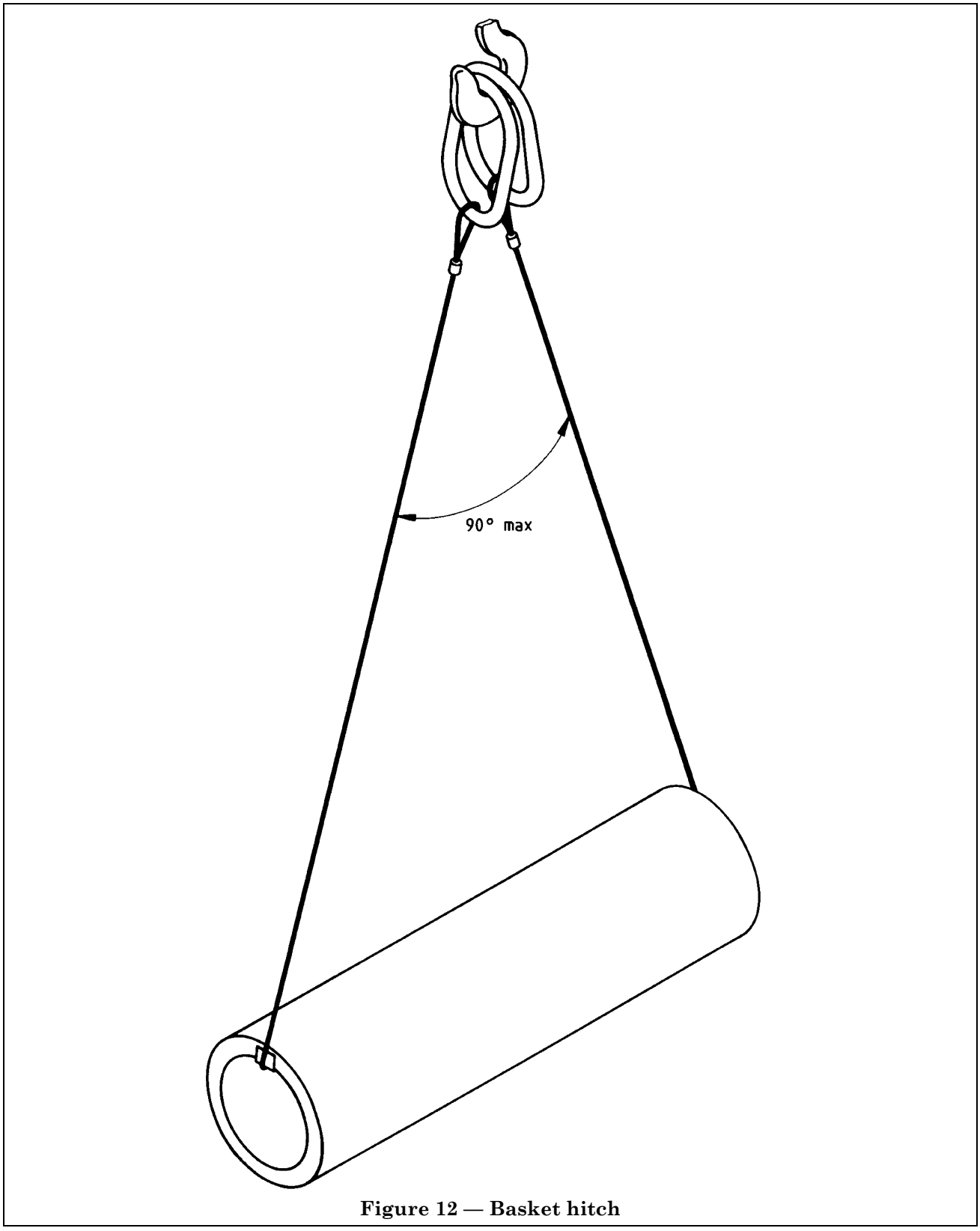


Figure 12 — Basket hitch

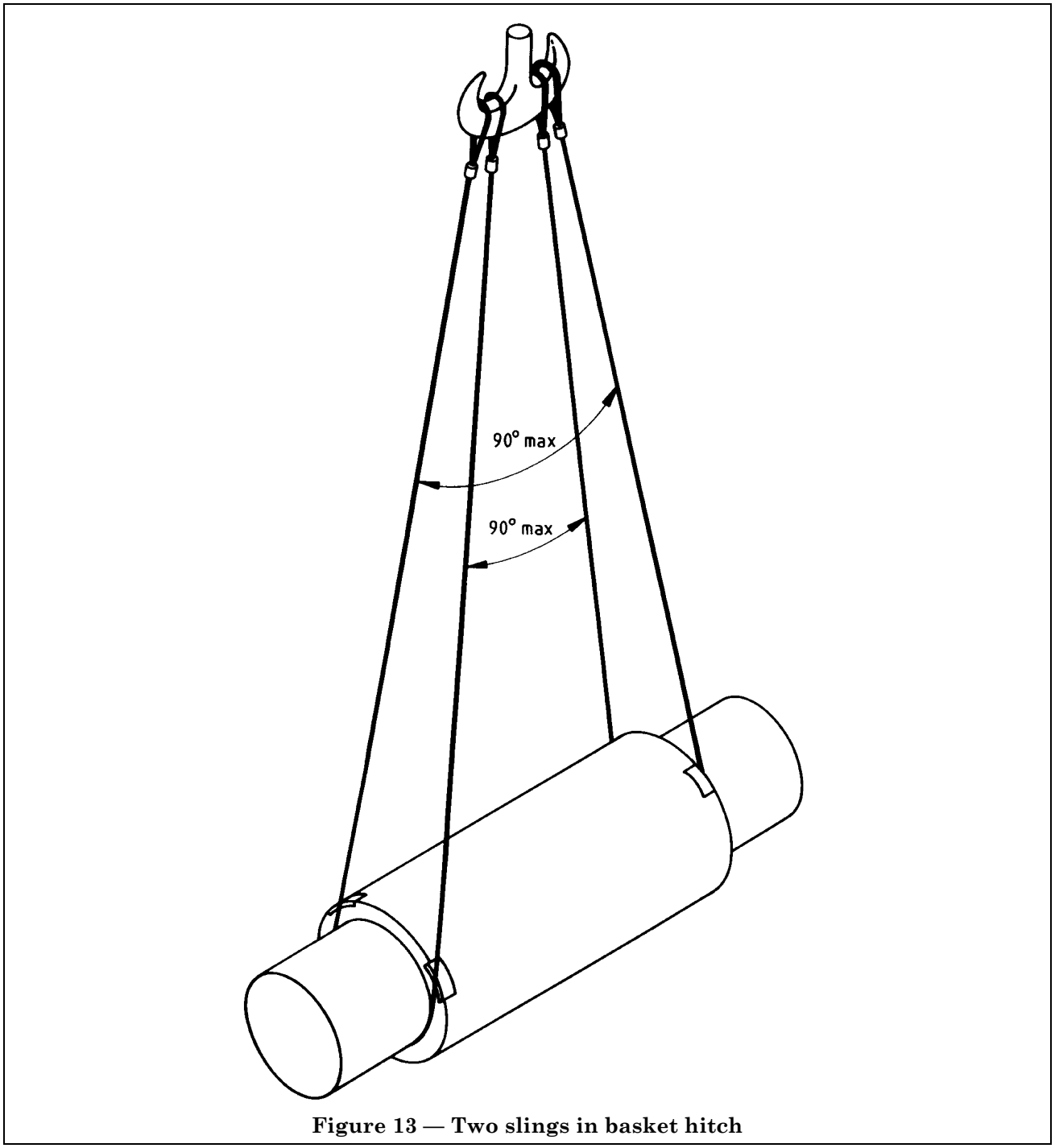


Figure 13 — Two slings in basket hitch

4.3.6 *Double-wrap basket hitch.* A double-wrap basket hitch is when the sling is passed completely around the load as shown in Figure 14. This will help to ensure the security of loose bundles. Factors are the same as for basket hitch. If security of the load is the prime consideration then double-wrap choke hitch is recommended.

4.3.7 *Doubled and choke hitch.* Doubled and choke hitch is a variation of choke where the load is carried on two parts and for this reason the SWL in choke hitch may be varied in accordance with the manufacturer's or supplier's advice. Where this is not available the single choke hitch rating should be used (see Figure 15). This is sometimes known as "halshing".

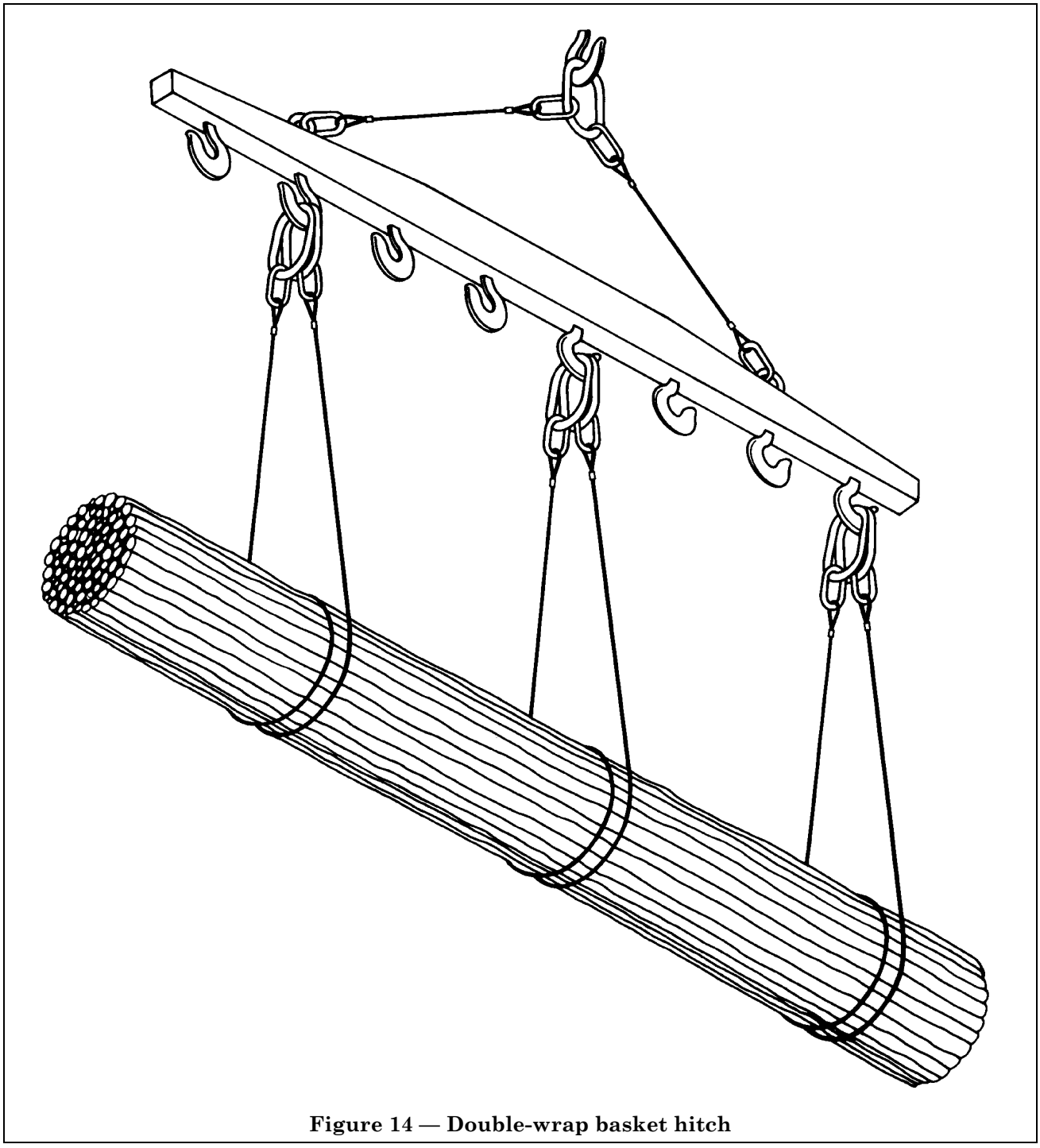


Figure 14 — Double-wrap basket hitch

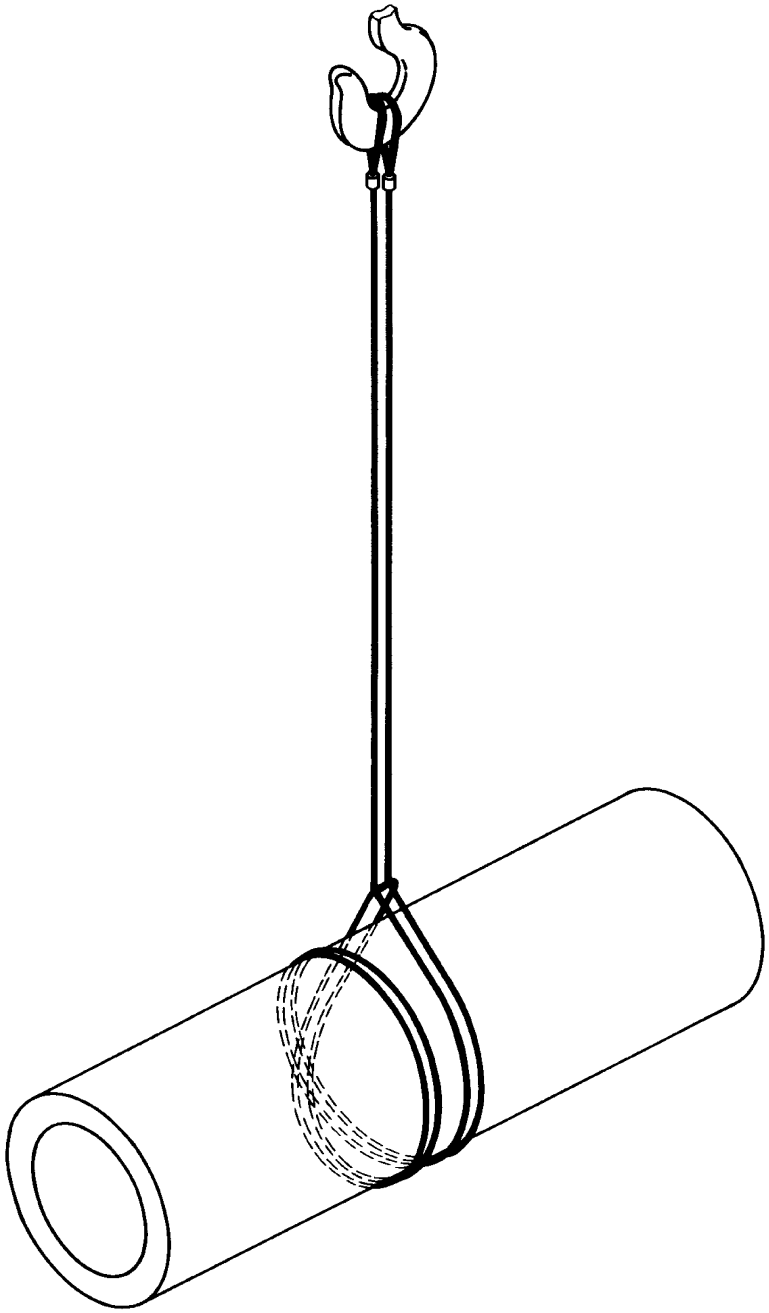


Figure 15 — Doubled and choke hitched

4.4 Essential precautions

4.4.1 *Before lifting the load.* The mass of the load should be determined before lifting. The lifting method selected should be suitable for the load. The sling should be strong enough for the load, both in terms of its SWL and its actual condition. The sling should be carefully inspected for obvious defects before use.

The load should be secure, stable and balanced when lifted so an assessment of the position of its centre of gravity will be necessary to ensure that the lifting point is approximately over it. Failure to do this is likely to cause the load to swing wildly on being lifted, or even to fall out of the sling.

Any loose parts of the load should be adequately secured either by the lifting method or by other means.

4.4.2 *When attaching the sling to the load.* The sling is to be firmly secured to the load, e.g. by means of hooks on to purpose-designed lifting points or eyebolts, or by a suitable method of slinging. The sling is not to be twisted, knotted or kinked in any way nor should the lifting points be overloaded by the slinging method. The rated included angle (90° or 120°) is not to be exceeded; the angle at any choke is not to exceed 120°; and the angle at any basket is not to exceed 90°.

When using three or four-legged slings with out-of-balance loads or with unequally spaced legs, two legs may support the majority of the mass while the other leg or legs merely act as a balancer. If the lifting points on the load are not in the same horizontal plane, the load, if it is flexible enough, will distort to accommodate the equal leg length of the sling. Alternatively, if the load is rigid, two legs will be likely to support the majority of the mass and may be overloaded while the remainder provide the balancing load. It is essential that any sharp corners on the load are adequately packed by dunnage etc., to prevent damage to the sling.

A tag line or lines may be necessary to help control bulky or lengthy loads (see Figure 16). The slinger should always ensure that everyone, including himself, is clear before giving the signal to lift. Trapped fingers are a common injury.

4.4.3 *On raising or lowering the load.* Before commencing a lift, a recognized code of signals should be used between the slinger and the crane driver see CP 3010[9)] and BS 5744[9)]. Ensure that the load is free to be lifted, e.g. all holding-down bolts have been released. Check for overhead obstacles such as power lines and pipework. Unless unavoidable, no one should be allowed under a suspended load and, as far as possible, all people should be kept clear of the area of operations. A trial lift should be made. People should not ride on loads except in very exceptional circumstances and only when authorized by a responsible person.

A suitable setting-down area should be selected before lifting. When lowering, be sure that the load is placed on battens, etc. so that the slings can be readily withdrawn. Trapped slings should never be dragged out from under a load nor should slings be used to drag a load (see Figure 17).

The slinger should always be careful not to set the load down on his own or anyone else's toes, another common accident. Having set the load down correctly the empty sling legs should be manually withdrawn by the slinger and hooked back onto the crane hook or upper terminal fitting to prevent the slinging leg(s) inadvertently becoming hooked onto surrounding objects or striking an individual (see Figure 18).

4.5 Control of lifting equipment, storage, handling and inspection

For information on the control of lifting equipment, storage, handling and inspection refer to British Standard and manufacturer's literature; statutory requirements may also be applicable.

[9)] Under revision.

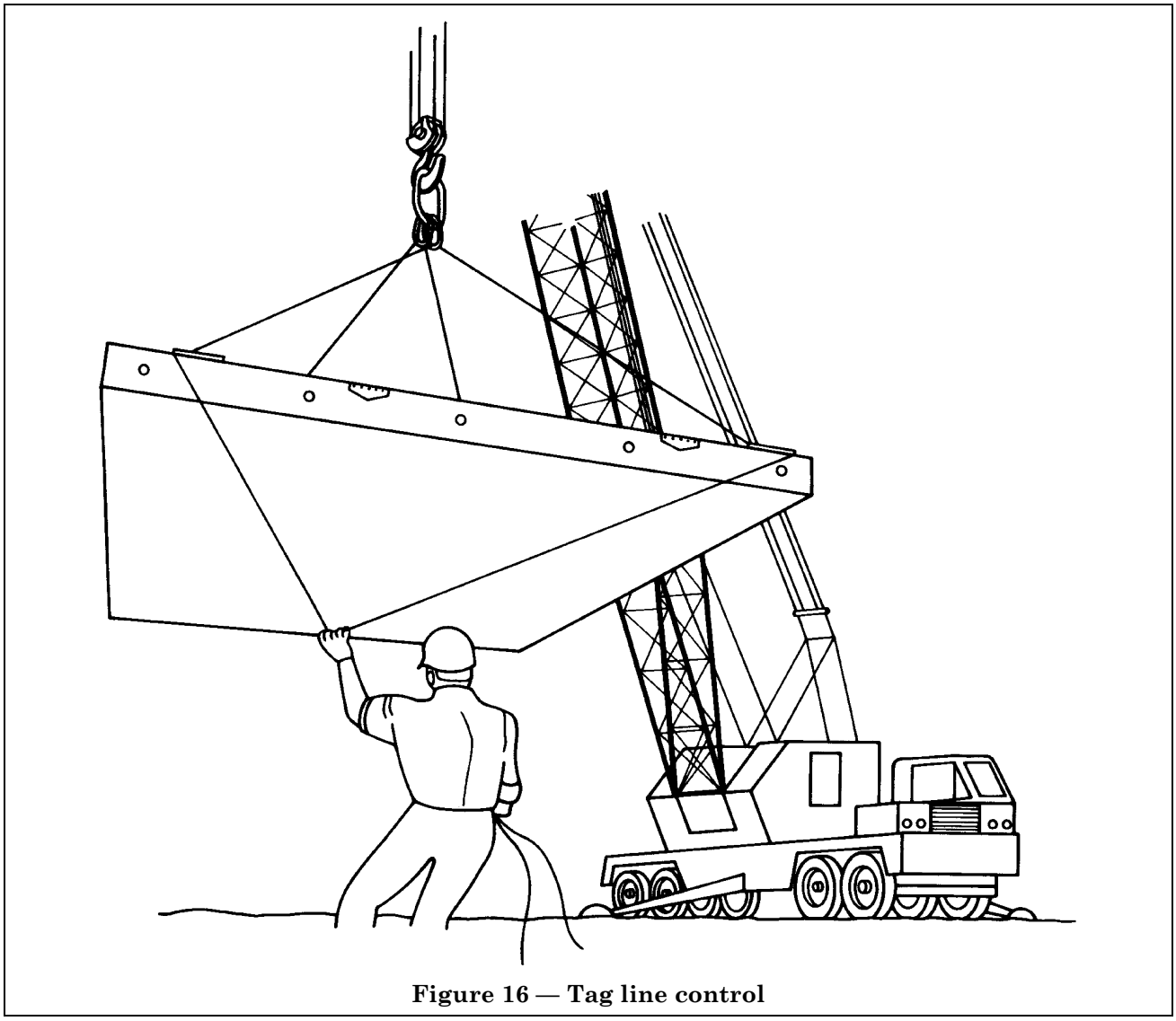
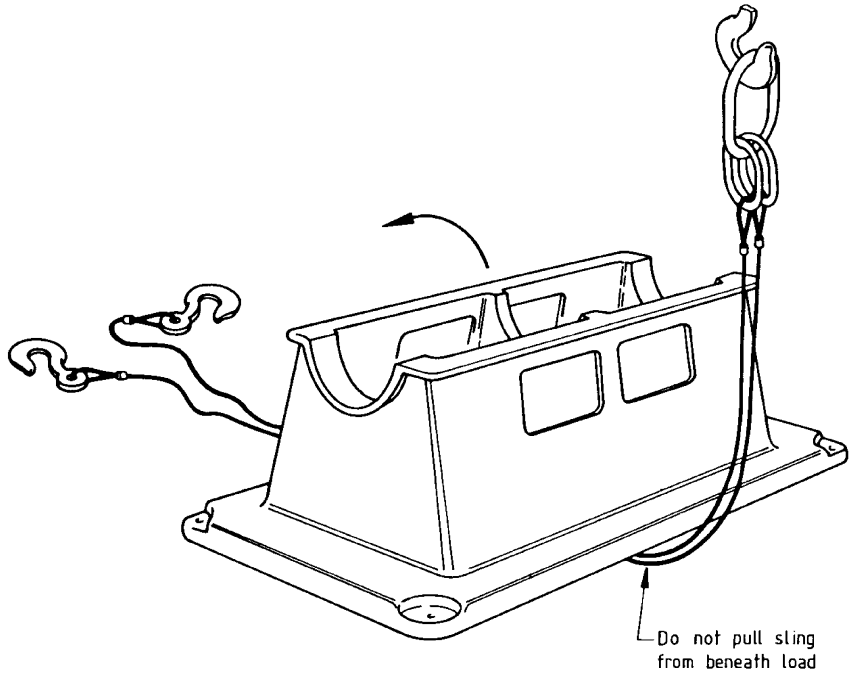
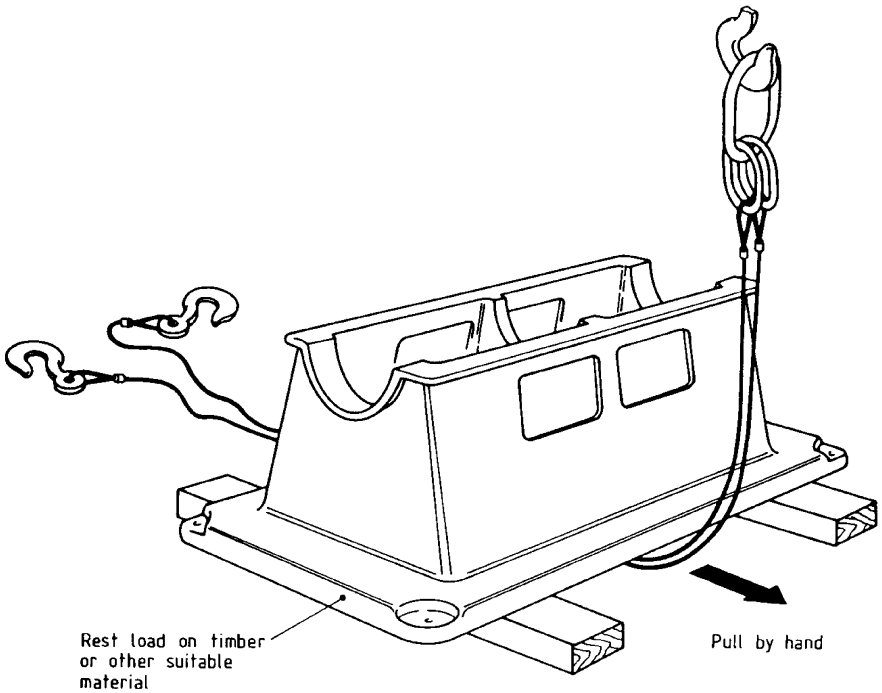


Figure 16 — Tag line control



(a) Incorrect



(b) Correct

Figure 17 — Misuse of slings

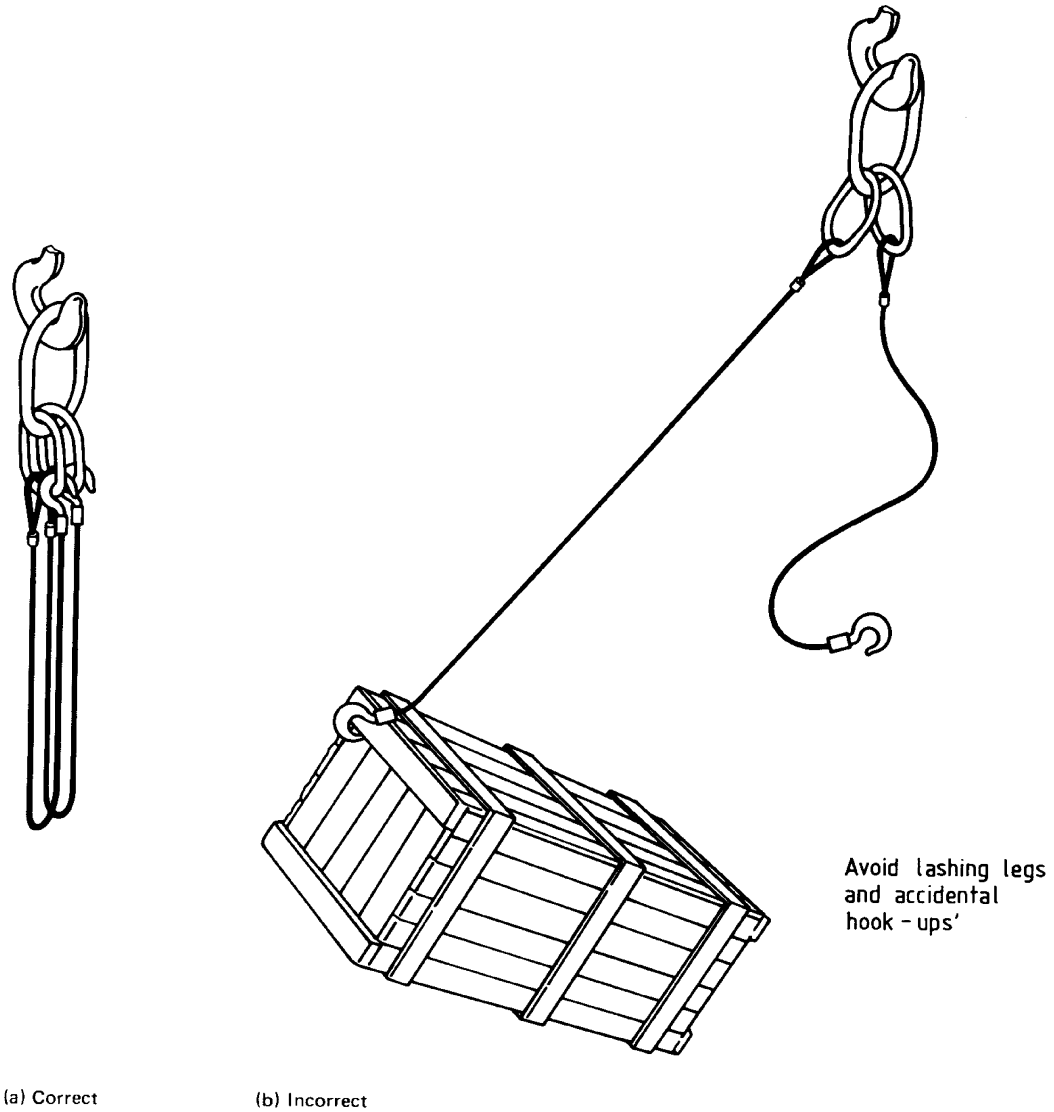


Figure 18 — Stowage of slings on the hook

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Publications referred to

BS 302, *Stranded steel wire ropes.*

BS 302-2, *Specification for ropes for general purpose.*

BS 302-3, *Specification for zinc coated ropes for ships.*

BS 1290, *Specification for wire rope slings and sling legs for general lifting purposes.*

BS 1663, *Specification for higher tensile steel chain grade 40 (short link and pitched or calibrated) for lifting purposes.*

BS 2052, *Specification for ropes made from manila, sisal, hemp, cotton and coir.*

BS 2770, *Specification for pictorial marking of handling instructions for goods in transit.*

BS 2902, *Specification for higher tensile steel chain slings and rings, links alternative to rings, egg links and intermediate links.*

BS 3458, *Specification for alloy steel chain slings.*

BS 3481, *Flat lifting slings.*

BS 3481-2, *Specification for flat woven webbing slings made of man-made fibre for general service.*

BS 3481-3, *Disposable flat lifting slings.*

BS 4928, *Specification for man-made fibre ropes.*

BS 4942, *Short link chain for lifting purposes.*

BS 4942-1, *Specification for general conditions of acceptance.*

BS 4942-2, *Specification for grade M(4) non-calibrated chain.*

BS 4942-4, *Specification for grade S(6) non-calibrated chain.*

BS 4942-5, *Specification for grade T(8) non-calibrated chain.*

BS 5744, *Code of practice for safe use of cranes (overhead/underhung travelling and goliath cranes, high pedestal and portal jib dockside cranes, manually-operated and light cranes, container handling cranes and rail mounted low carriage cranes)*[10)].

BS 6166, *Lifting slings.*

BS 6166-1, *Methods of rating.*

BS 6166-2, *Specification for marking.*

BS 6210, *Code of practice for the safe use of wire rope slings for general lifting purposes.*

BS 6304, *Specification for chain slings of welded construction: grades M(4), S(6) and T(8).*

BS 6668, *Textile lifting sling.*

BS 6668-1, *Specification for lifting slings for general service made from certain natural and man-made fibre ropes.*

BS 6668-2[11)].

BS 6668-3[11)].

CP 3010, *Code of practice for safe use of cranes (mobile cranes, tower cranes and derrick cranes)*[11)].

ISO 7593, *Chain slings assembled by methods other than welding — Grade T(8).*

Chain Testers' Association of Great Britain. *Code of practice for safe use of lifting equipment*[12)].

[10)] Under revision.
[11)] In preparation.
[12)] Available from the Chain Testers' Association of Great Britain, 21-23 Woodgrange Road, London E7 8BA. (Referred to in the foreword only.)

Cordage Manufacturers' Institute. *Lifting tackle*[13)].

Cordage Manufacturers' Institute. *Recommendations for rope safety*[13)].

Engineering Equipment and Materials Users' Association. *Publication No. 101,* 1984[14)].

National Association of Port Employers. *Recommendations for safe slinging*[15)].

[13)] Available from the Cordage Manufacturers' Institute, Anchor & Hope Lane, Charlton, London SE7 7SB.
[14)] Available from EEMUA, 14 Belgrave Square, London SW1X 8PS.
[15)] Available from the National Association of Port Employers, Commonwealth House, 1-19 New Oxford Street, London WC1 A 1DZ, or the General Council of British Shipping, 30-32 St Mary Axe, London EC3. (Referred to in the foreword only.)

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