

Lifting slings —

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

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- 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

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- British Chain Manufacturers' Association
- National Coal Board

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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 code²⁾.

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 7593⁴⁾.

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 3481-3⁵⁾. 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 6668-2⁶⁾ 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*, 1984⁷⁾.

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 7SR.

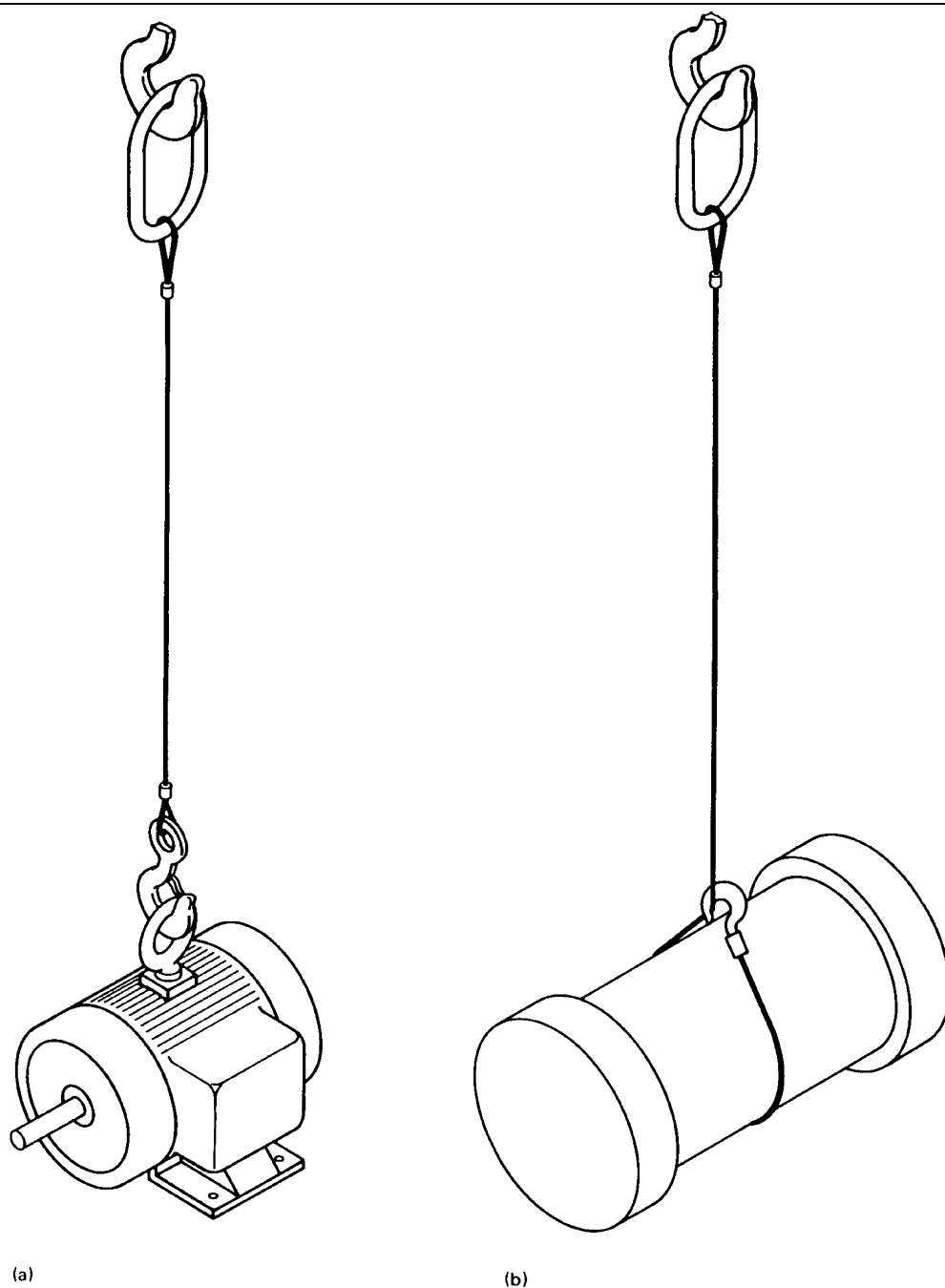


Figure 1 — Single-leg slings

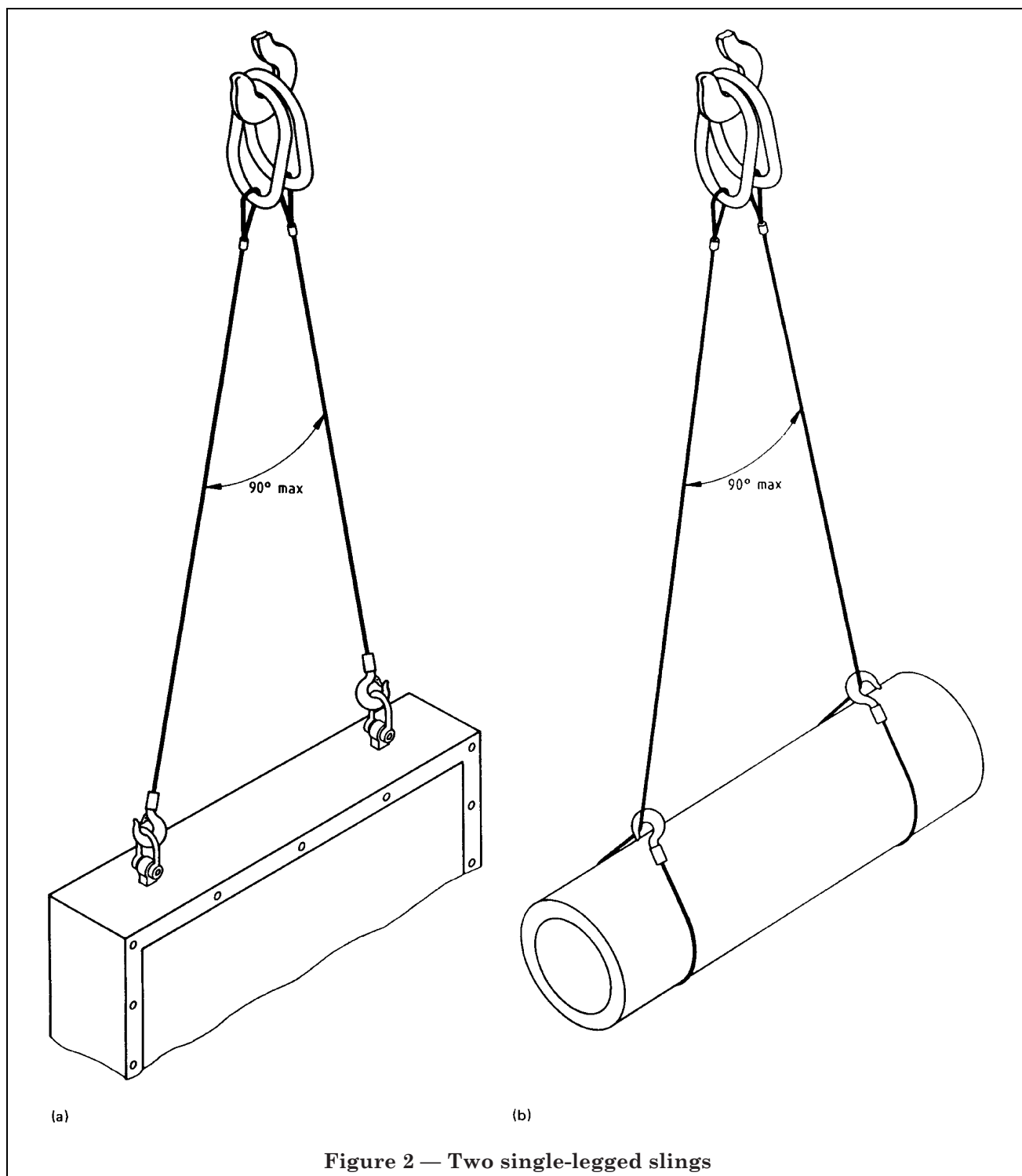
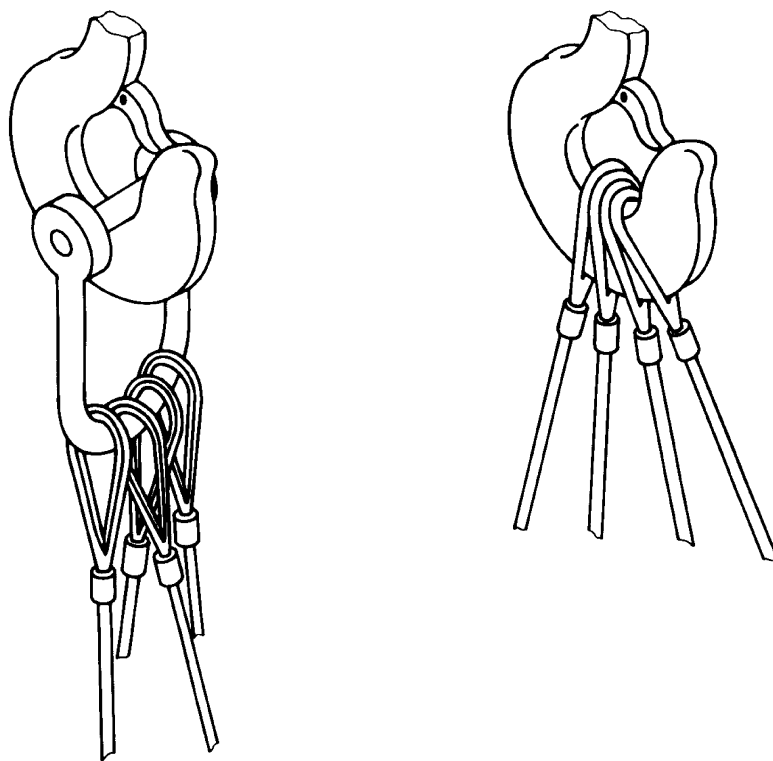


Figure 2 — Two single-legged slings



(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