BRITISH STANDARD

BS 6210:1983

Code of practice for

The safe use of wire rope slings for general lifting purposes

UDC 621.86.065.3:614.822

Cooperating organizations

The Mechanical Engineering Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

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Institution of Mining Engineers
National Association of Lift Makers
National Association of Port Employers

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Contents

Foreword

This code of practice, prepared under the direction of the Mechanical Engineering Standards Committee, is intended to complement BS 1290.

Its aim is to prevent accidents due to the misuse of slings and bad slinging techniques, by giving guidance on good practice and on the safe use of wire rope slings. The code restricts itself to the use of slings for general lifting purposes as covered by BS 1290. It is suggested however, that many other slinging operations, not specifically covered here, can be resolved by reference to the general principles applied in this code.

BS 6166 gives additional assistance on rating with respect to clause **4** of this code.

Throughout this code it has been assumed that essentially balanced loads are being lifted and that the load in each leg of a multi-leg sling is broadly equal.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, 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 Scope

This code of practice provides guidance on the safe use of slings manufactured in accordance with BS 1290.

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

2 Definition

For the purposes of this code the following definition applies.

2.1
safe working load (SWL)

the value marked on the sling in mass units. BS 1290 explains the method by which the safe working load is calculated

3 Marking, control and issue of slings

Facilities and procedures should be established to ensure that the following is carried out.

a) Each sling, before being issued for use, is marked in accordance with BS 1290.

b) The statutory test certificate stating the SWL and the statutory record of thorough examinations are kept readily available for inspection.

c) All persons using slings and all supervisors of slinging operations are adequately trained in the methods of slinging and the safe use of slings appropriate to their duties[1]. This should include the identification of obvious defects likely to affect the safe use of the sling.

d) Suitable facilities exist for the storage of slings.

e) A visual inspection of the sling is carried out during use at intervals whose frequency will be governed by the conditions of use (see **6.2**).

f) Routine thorough examinations are carried out by a competent person (see **6.3**).

4 Methods of slinging

4.1 General. A number of methods of slinging are shown in Figure 1 to Figure 14 using single-leg slings, two single-leg slings used together and multi-legged slings, complying with BS 1290. The methods and loads shown are intended to be typical examples and the methods of lifting are not intended to be exhaustive.

4.2 Single-leg slings. Figure 1 to Figure 5 show basic methods of using a single-leg sling.

In Figure 3 and Figure 4 a noose is formed in the rope which tightens as the load is lifted. This does not grip the load completely and should be used only when the load is easily stabilized or cannot slip out of the sling. Stability can be improved by slinging from a position away from the point of balance (see Figure 5).

The same general limitations apply to Figure 6 as to the simple choke hitch shown in Figure 3, except that with the double wrapped choke hitch the load is gripped more fully, and hence is secured more effectively.

A choke hitch should not, however, be used for handling composite loads such as loose bundles of tubes or bars, unless the friction grip between the parts is sufficient to prevent them slipping from the sling. In such circumstances, two single-leg slings, of the type shown in Figure 10 and Figure 11, should be used.

4.3 Two single-leg slings used together[2]. Two single-leg slings used at an angle (or a multi-leg sling having two legs similarly used) provide a more stable lifting arrangement than a single-leg sling.

When using two single-leg slings, as shown in Figure 7 to Figure 11, the included angle α between the legs should be restricted to 90° maximum to avoid the risk of displacing one of the slings from the hook or distorting the hook.

Whilst the multi-leg slings in BS 1290 are designed for the uniform load method of rating (see clause **1** and **6.1** of BS 1290:1983), when two single-leg slings are used together they may be rated by the trigonometrical method, in which case the load that may be lifted is given by the following formula.

$$2 \times \text{SWL of single leg} \times \cos \frac{\alpha}{2}$$

Included angle	30°	60°	90°
$\text{Cos} \frac{\alpha}{2}$	0.97	0.87	0.71

When using two single-leg slings together, care should be taken to ensure that:

a) the slings are of the same length;

b) where the slings have different SWL ratings then the load that can be lifted is related to the lesser SWL;

[1] Guidance is given in clause **16** and Appendix A of BS 5744:1979.

[2] Attention is drawn to the requirements of the Construction (Lifting Operations) Regulations 1961. Regulation 37(2) relates to the use of two single-leg slings.

c) the attachment points of the slings to the load are far enough apart to give stability without exceeding 90°. In the case of two single-legs used in basket hitch, the angle between any two diagonally opposite legs should not exceed 90° (see Figure 9 and Figure 11);

d) when lifting unbalanced loads the individual legs are not overloaded (see Appendix A).

Where loose bundles or smooth objects are to be lifted, double wrap choke hitch or double wrap basket hitch is preferable.

4.4 Multi-leg sling. A multi-leg sling may have two, three or four legs (see Figure 12 to Figure 14). A two-leg and four-leg sling should not be used at an included angle greater than 90° unless the sling is so marked. In no circumstances should the included angle exceed 120°.

A three-leg sling should not be used if any one leg makes an angle to the vertical greater than 45°.

5 Use of wire rope slings by persons responsible for lifting loads

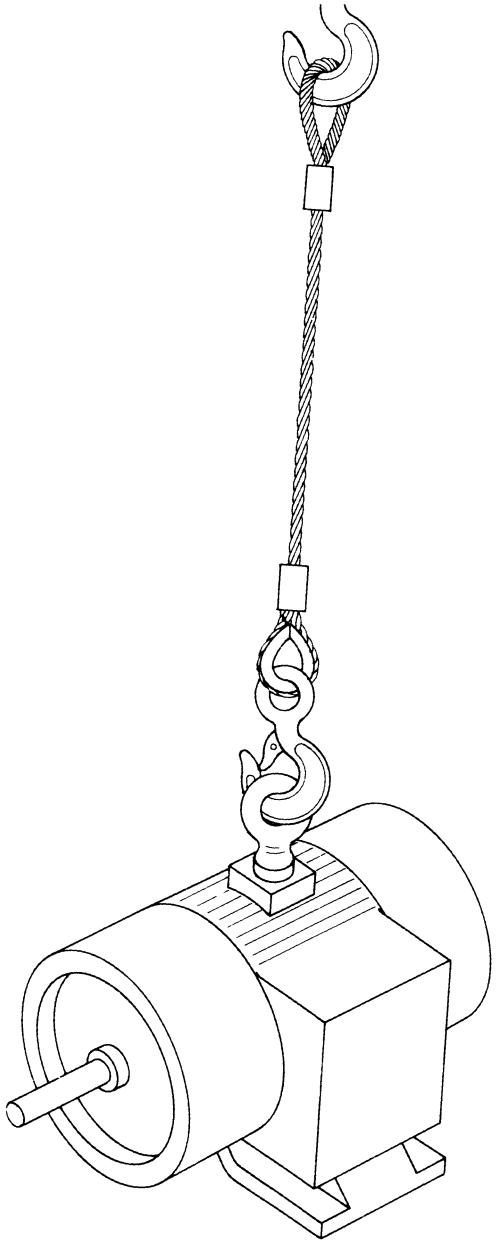
5.1 Before lifting a load

5.1.1 Ensure that the load is suitable for lifting with a wire rope sling. The sling should not be allowed to damage the load, nor should 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 whole load.

5.1.2 Assess the weight of the load to be lifted. If the gross weight is not marked, the information may be obtainable from the consignment notes, manuals, plans, etc. If there is no information, the weight should be assessed by a person competent to do so.

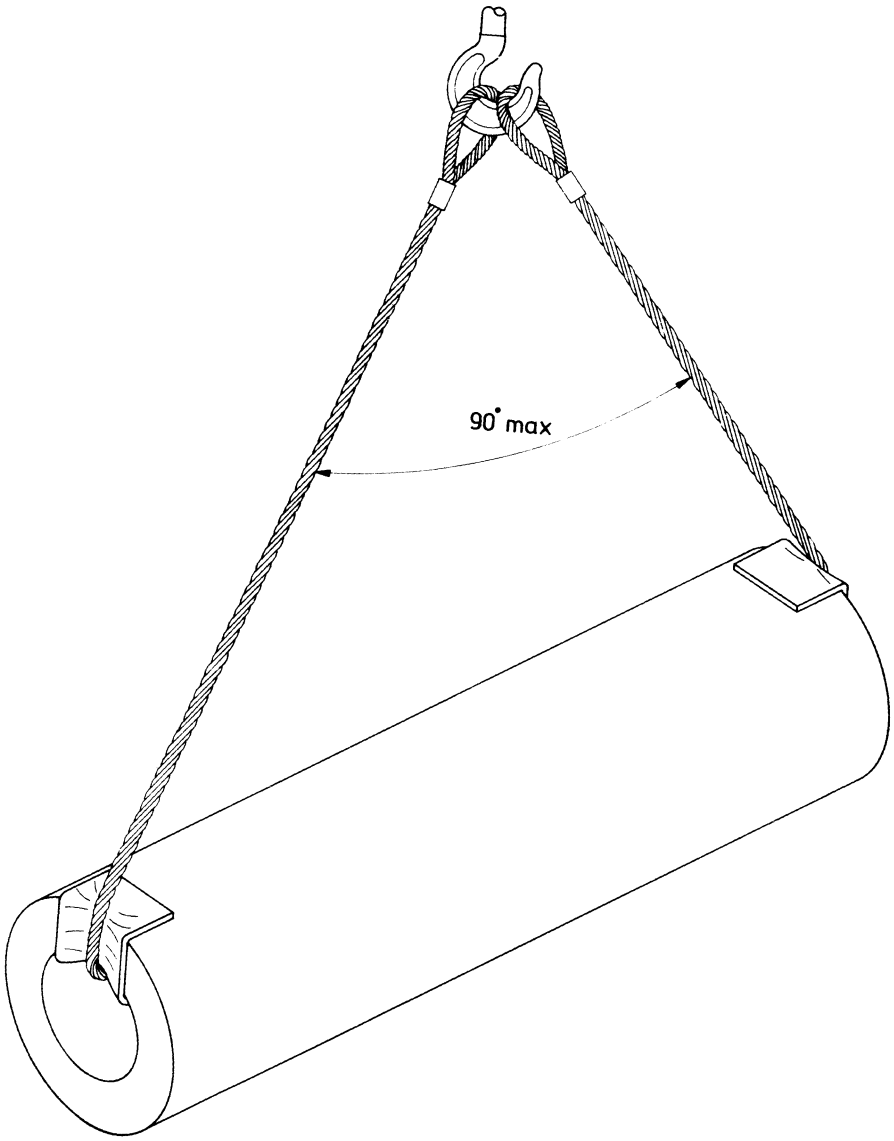
5.1.3 Ensure that the sling is strong enough. Having regard to the method of slinging, make sure that SWL of the sling is adequate for the load to be lifted.

As far as is reasonably practicable the effective diameters of pins, hooks or other components over which soft eyes are used should not be less than twice the rope diameter for single part legs, and four times the rope diameter for double part legs (spliced endless or grommet).



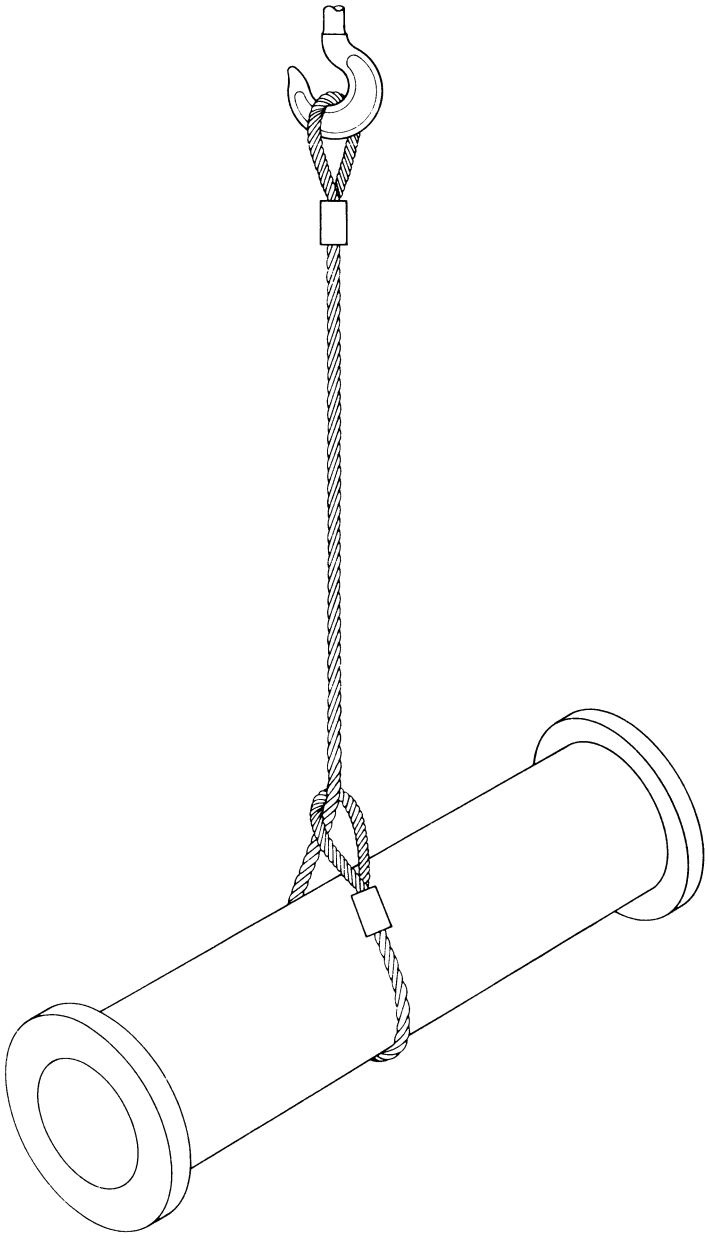
NOTE 1 Total load that may be lifted is that marked on the sling.
NOTE 2 A vertical or straight lift is only suitable for lifting a load which will be stable when suspended from a single lifting point.

Figure 1 — Vertical or straight lift



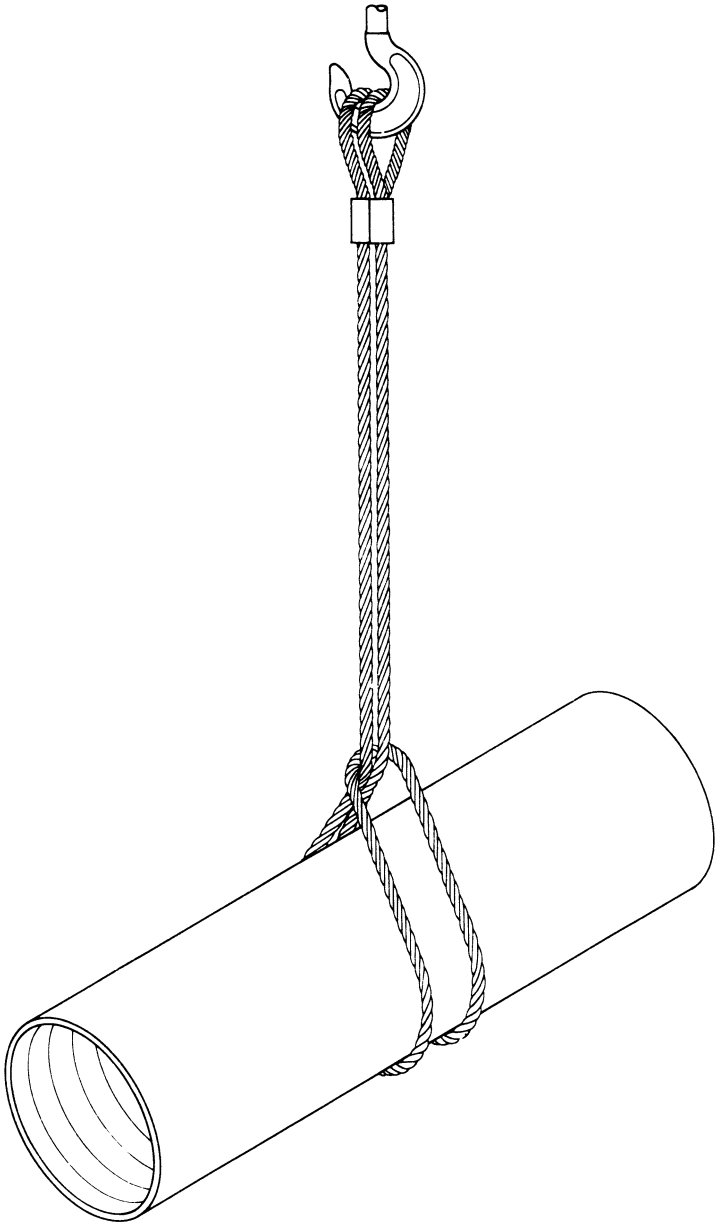
NOTE 1 The total load that may be lifted when the included angle does not exceed 90° is 1.4 × that marked on the sling.
NOTE 2 A basket hitch should only be used when the sling is passed through part of the load and the load is balanced on the sling.

Figure 2 — Basket hitch



NOTE The total load that may be lifted is that marked on the sling.

Figure 3 — Simple choke hitch



NOTE The total load that may be lifted is 2 × that marked on the sling.

Figure 4 — Doubled and choked

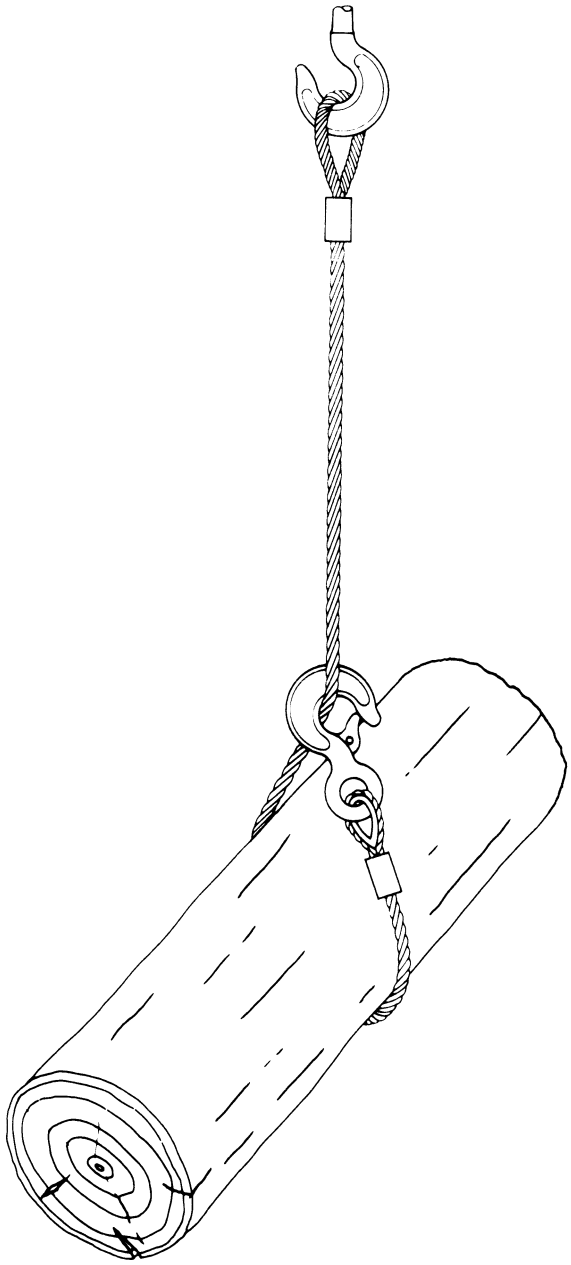
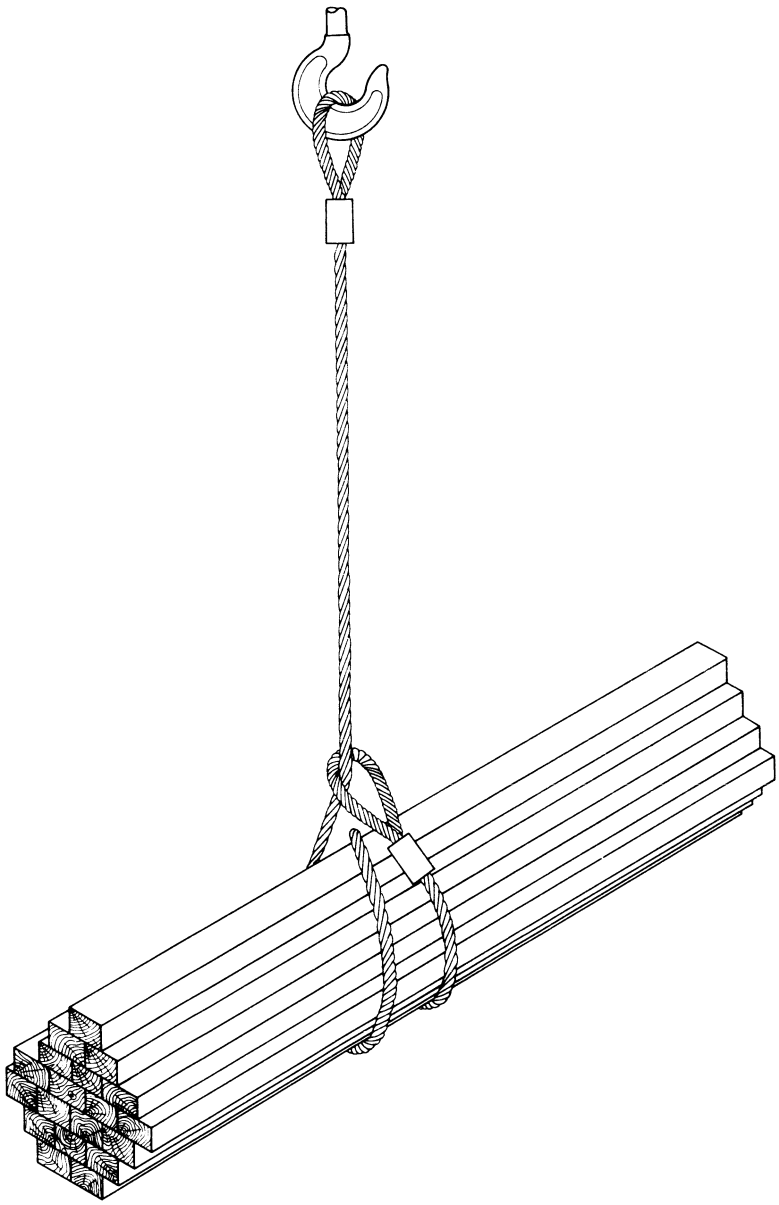
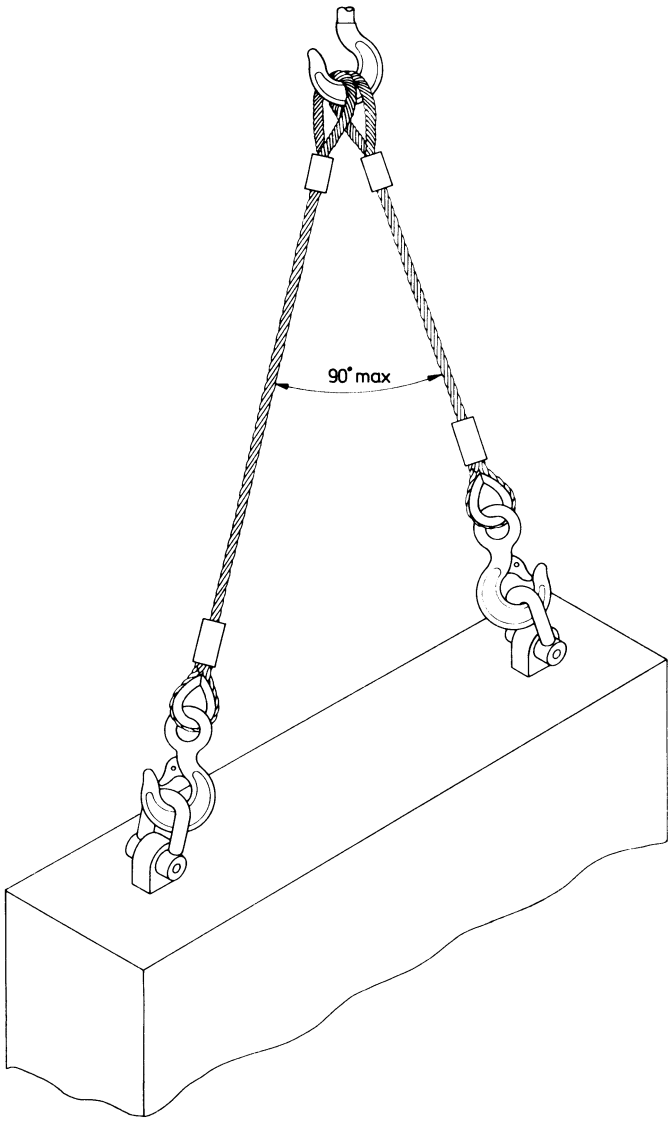


Figure 5 — Example of offsetting load to provide a tilt



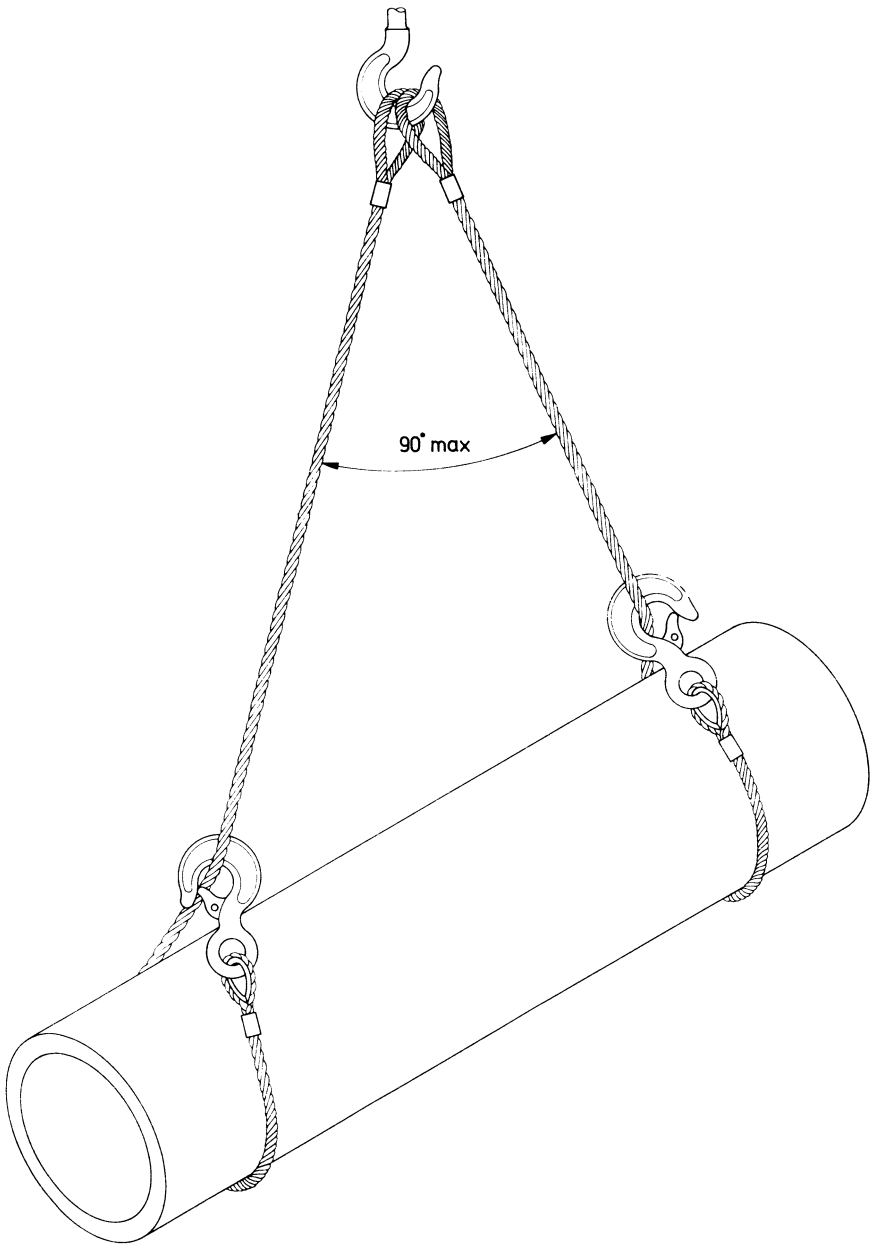
NOTE The total load that may be lifted is that marked on the sling.

Figure 6 — Choke hitch double wrapped



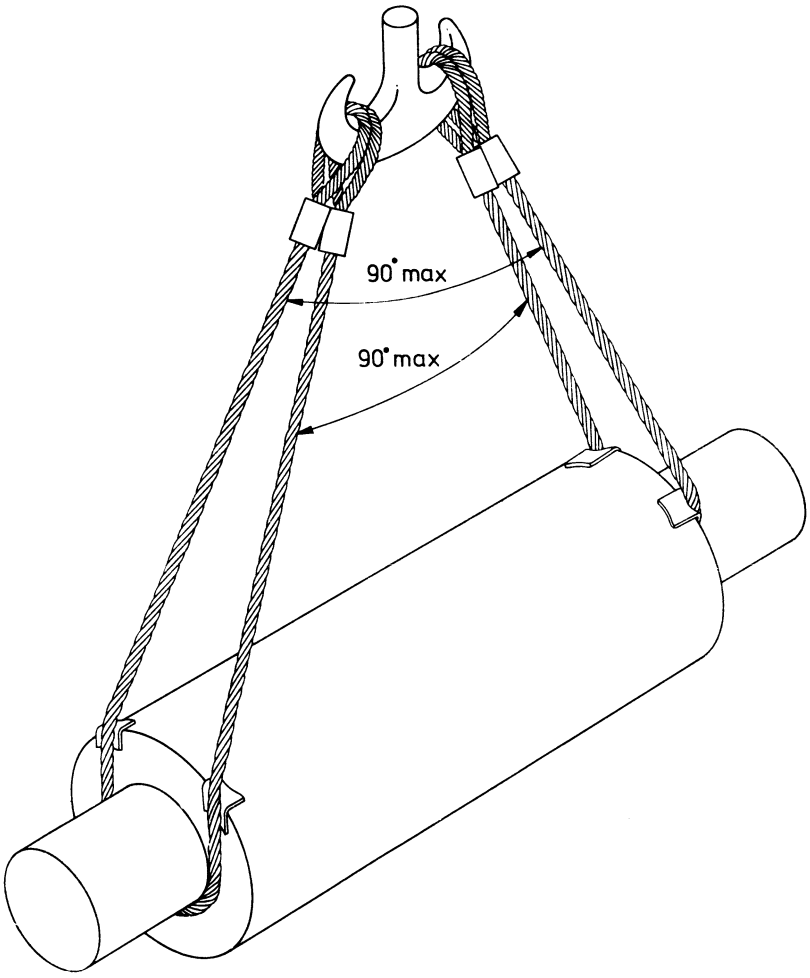
NOTE The total load that may be lifted when the included angle does not exceed 90° is 1.4 × that marked on the single sling.

Figure 7 — Two single-leg slings used with direct attachment



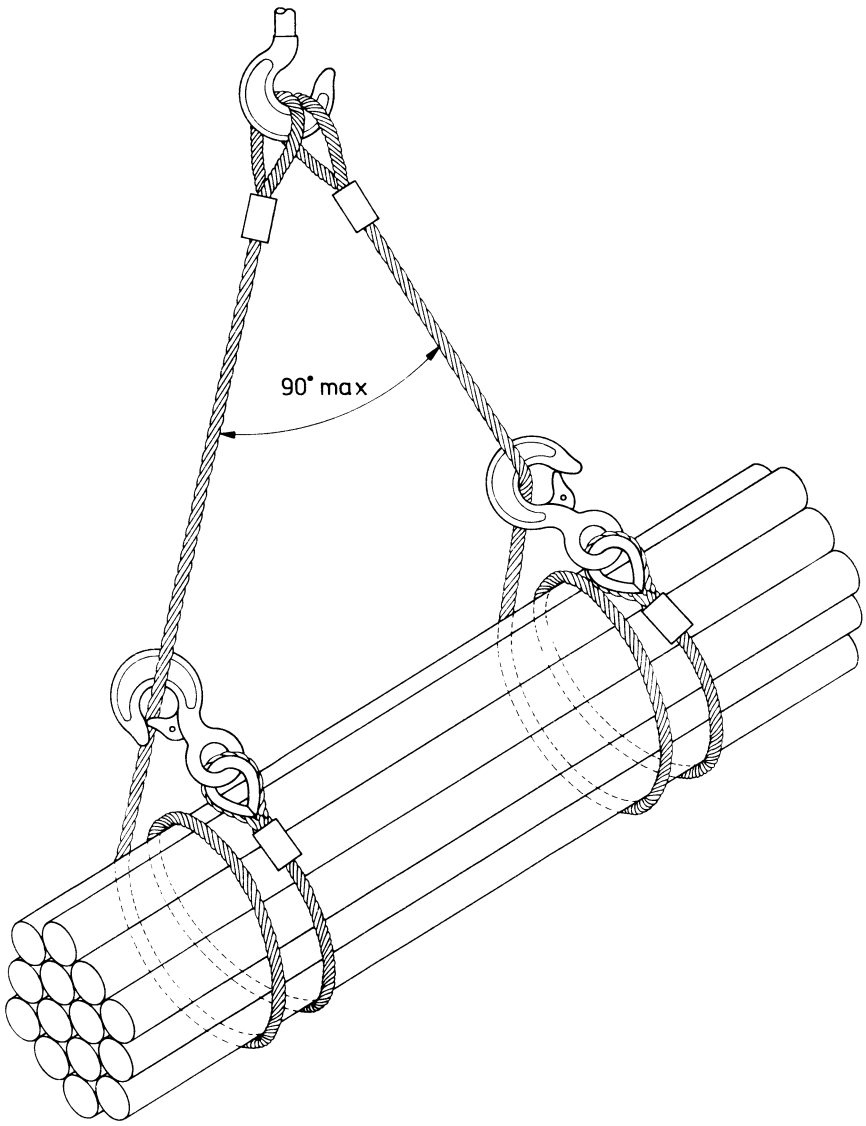
NOTE The total load that may be lifted when the included angle does not exceed 90° is 1.4 × that marked on the single sling.

Figure 8 — Two single-leg slings used in choke hitch



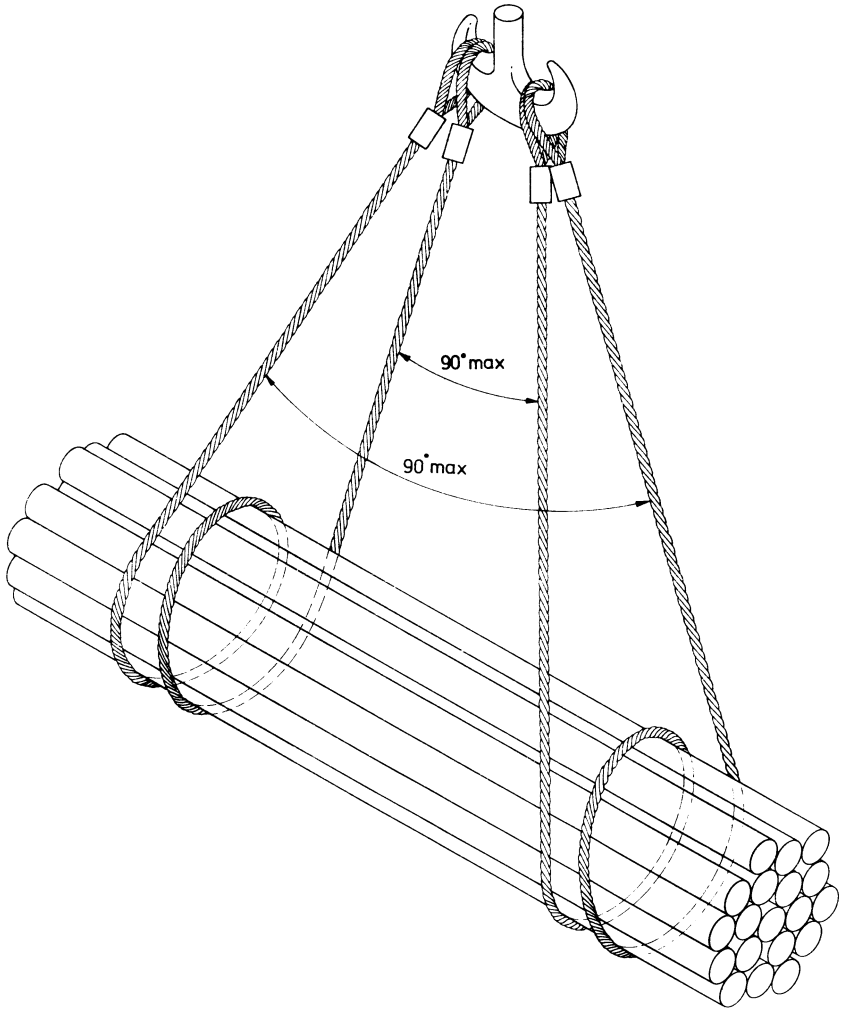
NOTE The total load that may be lifted provided that no included angle exceeds 90° is 2.1 × that marked on the single sling.

Figure 9 — Two single-leg slings used in basket hitch



NOTE The total load that may be lifted when the included angle does note exceed 90° is 1.4 × that marked on the single sling.

Figure 10 — Two single-leg slings used in double wrap choke hitch



NOTE The total load that may be lifted provided that no included angle does note exceeds 90° is 2.1 × that marked on the single sling.

Figure 11 — Two single-leg slings used in double wrap basket hitch

5.1.4 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, should be withdrawn from service immediately (see clause **6**).

5.1.5 Ensure that the load will be in balance when lifted. Attach the slings to designed lifting points where provided. If lifting points are not marked on the load, the position of the centre of gravity should be assessed. The type of sling and the slinging methods used should ensure that the load will not topple or slip (see clause **4**). The supporting hook should be positioned directly above the centre of gravity. Where this is not practicable, particular care should be taken when lifting the load (see **5.3** and Appendix A).

5.1.6 Ensure the load contains no loose accessories. If the load comprises a number of pieces, for instance a bundle of pipes, choose a slinging method which will secure all the pieces (see **4.1**, **4.2** and Figure 4, Figure 6 and Figure 10).

Do not attach sling to banding or strapping unless they are designed for the purpose.

5.2 Fitting the sling. When fitting the sling ensure that:

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

b) only the eye termination or link is placed on the crane hook;

c) the terminations are properly seated without overcrowding;

d) the load is effectively secured by the sling;

e) the relevant leg angle does not exceed that for which the sling is rated and marked (see **4.3**);

f) the sling is not bent around any corners that might damage or reduce the effective strength of the sling. Where necessary suitable packing pieces should be used (see Figure 15);

g) when using choke hitch:

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;

h) 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;

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

5.3 Raising or lowering the load. When raising or lowering the load ensure that:

a) a recognizable code of signals is used which is fully understood by all concerned[3)];

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

f) the load is in balance (see Appendix 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 they might constitute a danger and should be subject to careful control.

5.4 Precautions. The following precautions should be taken.

a) Do not allow ANYONE to ride on the load.

b) Do not allow the load to be carried over ANYONE without exercising due care.

c) Do not leave a suspended load unattended.

d) Do not drag slings on the floor.

e) Do not expose the slings unnecessarily to corrosive liquids, solids, vapours or to excessive heat.

6 Inspection, thorough examination and discard criteria

6.1 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 should be inspected for damage or deterioration before being issued for use, and thereafter be checked for obvious defects, at suitable intervals during service.

Additionally, routine thorough examinations should be carried out by a competent person.

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

6.2 Inspection (for details see **6.4**). 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.

6.3 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.

It is an essential feature of this thorough examination that the results are documented.

A routine thorough examination should be carried out at intervals not exceeding 6 months and this interval should be less where deemed necessary in the light of service conditions or where required by statutory regulations.

6.4 Assessment of the condition of the sling and discard criteria

6.4.1 ***Broken wires***[4)]

6.4.1.1 *General.* Broken wires are detrimental because of:

a) the possibility of injury to users' hands;

b) the loss of strength in the rope.

[3)] See Figure 2 of BS 5744:1979.

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

The appearance of well distributed broken wires has no marked effect on the strength of the sling, but it might be indicative of mechanical or corrosive damage. Generally, 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 users' hands, protruding wires should be broken off in the gusset by reverse bending until fracture occurs.

6.4.1.2 *Randomly distributed breaks.* If the total number of visible broken wires in any length of 10 rope diameters exceeds 5 % of the total number of wires in the rope, the sling should be withdrawn from service and referred to a competent person for thorough examination.

6.4.1.3 *Localized breaks.* If there are three or more broken wires closely grouped (i.e. at a specific point in the rope) or in any one strand within a length of 6 rope diameters, the sling should be discarded.

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

6.4.3 *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. Whilst 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 should be withdrawn from service and referred to a competent person for thorough examination.

6.4.4 *Significant distortion of the rope.* The sling should be discarded when distortion due to kinking, crushing, core collapse, or knotting is identified (see Figure 16). 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 should be withdrawn from service and referred to a competent person for examination.

6.4.5 *Heat damage.* There should be no discoloration of the wires, nor evidence of overheating, such as loss of lubrication or pitting of the wires caused by electrical arcing, etc.

A sling which has been exposed to high temperatures, i.e. in excess of 100 °C, for any length of time may have a significantly reduced strength.

Where such heat damage is identified the sling should be withdrawn from service and referred to a competent person.

6.4.6 *Damaged or defective fittings, ferrules or splices.* Particular attention should be paid to signs of:

a) opening up 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;

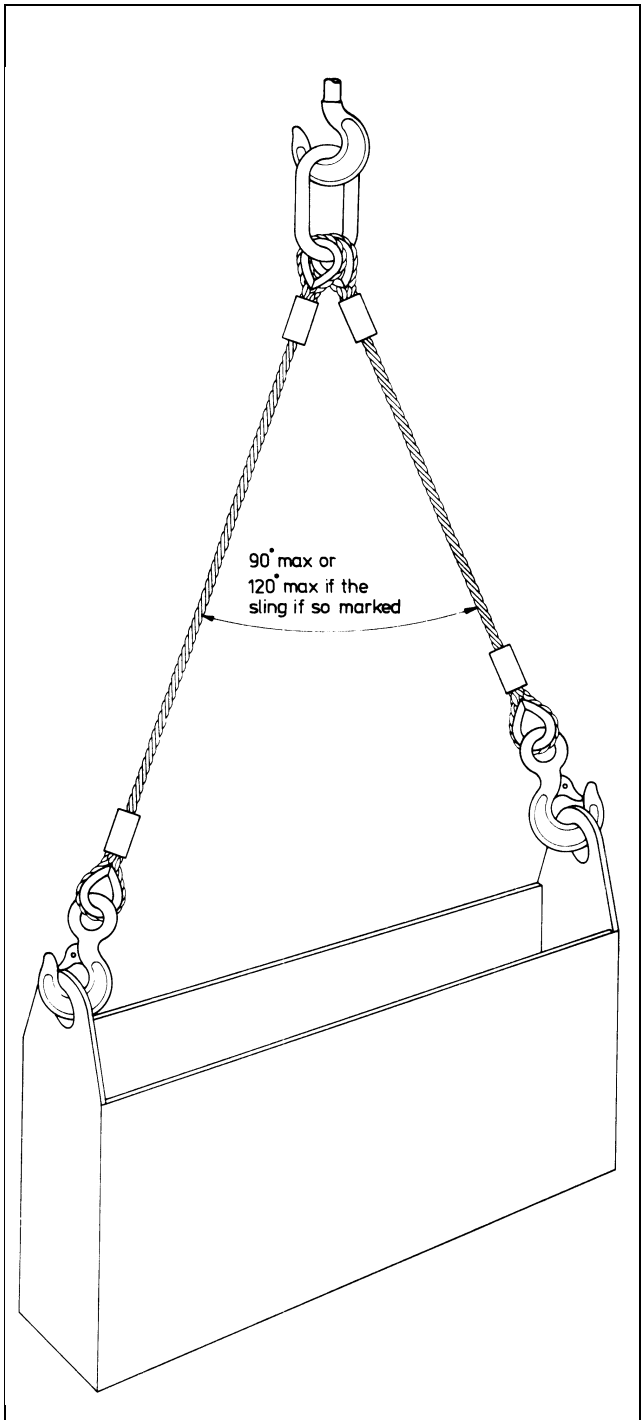
g) the effect of bursting stress at the throat of the eye due to the use of a pin of excessive diameter or certain types of thimble;

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

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

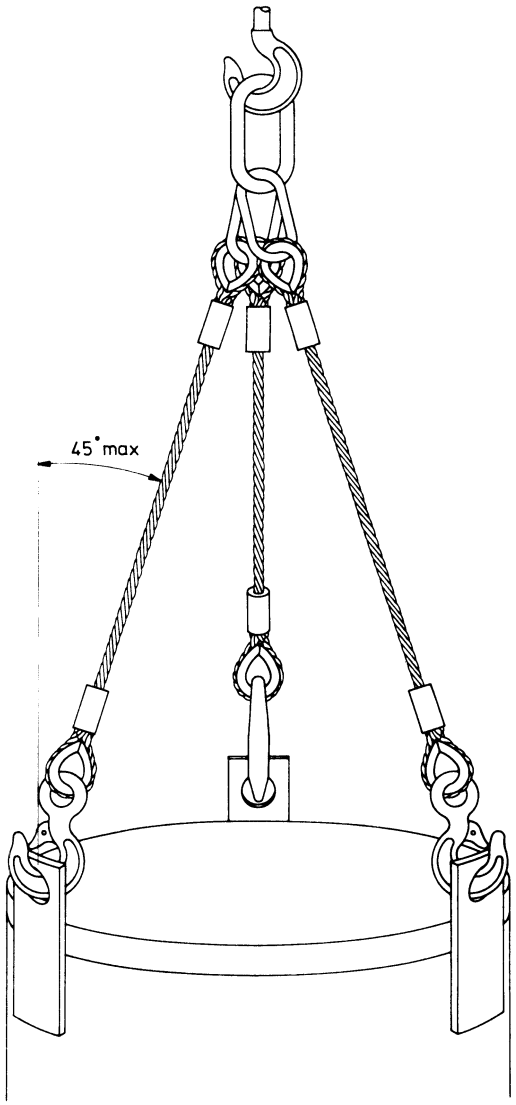
Items a) and b) may be an indication of overloading and will usually be justification for withdrawing the sling from service.

[4] The Docks Regulations (1934), The Shipbuilding and Ship Repairing Regulations (1960) and The Construction (Lifting Operations) Regulations (1961) contain specific requirements relating to the number of broken wires.



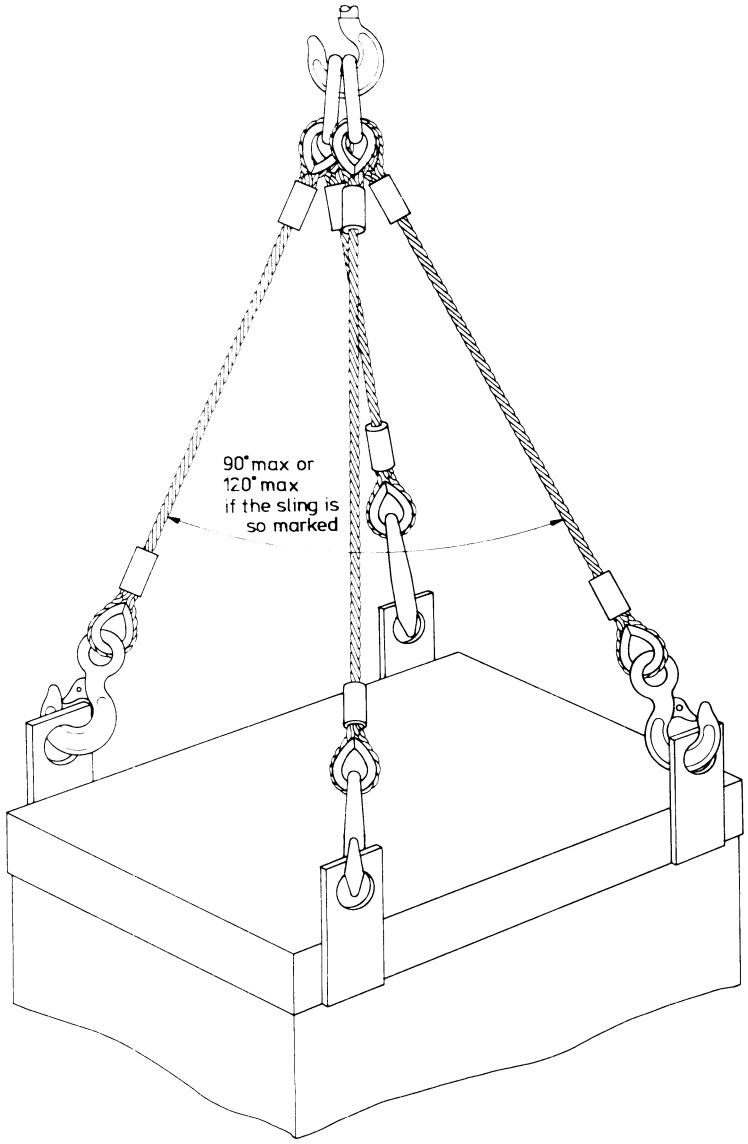
NOTE The total load that may be lifted is that marked on the sling assembly.

Figure 12 — Two-leg sling



NOTE The total load that may be lifted is that marked on the sling assembly.

Figure 13 — Three-leg sling



NOTE The total load that may be lifted is that marked on the sling assembly.

Figure 14 — Four-leg sling

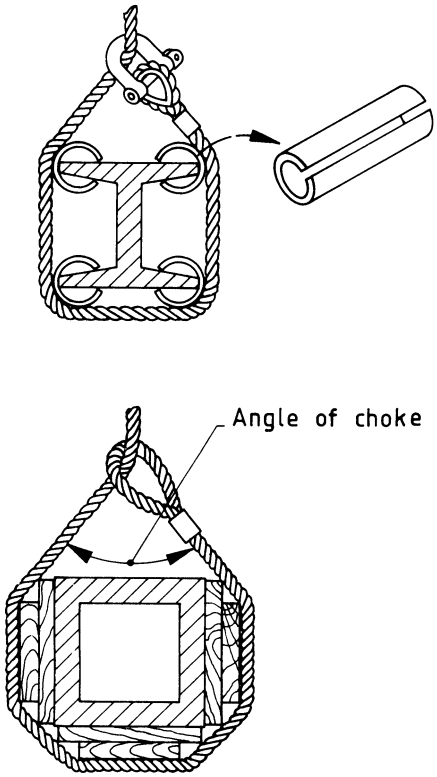


Figure 15 — Examples of protective packing also showing angle of choke

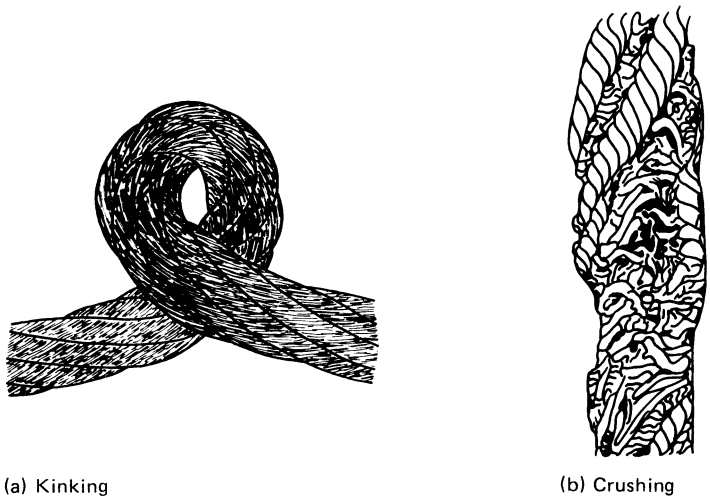


Figure 16 — Examples of rope distortion and damage

Appendix A Load stability

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 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 17). (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 a hazardous situation:

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.

When 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 should be lifted only sufficiently for the degree and direction of any tilt and swing to be determined. The tendency to tilt and swing should 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 18).

A.3 Effect of a high centre of gravity. To minimize the risk of toppling, the points of attachment of the sling legs should, where practicable, be above the centre of gravity of the load (see Figure 19).

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 the centre of gravity (see Figure 20).

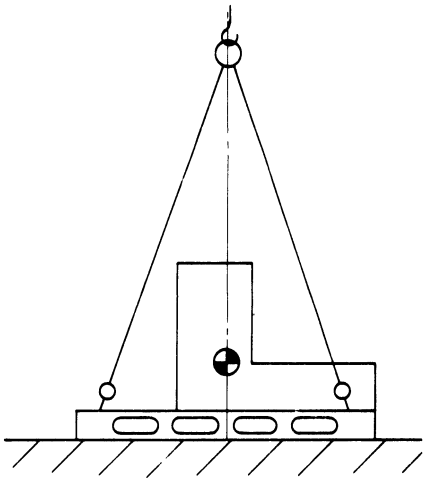


Figure 17 — Alignment of centre of gravity

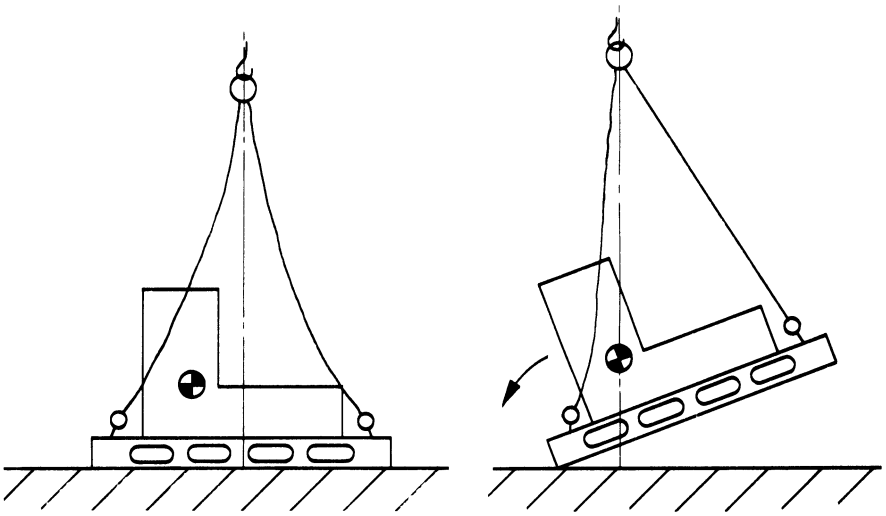


Figure 18 — Example showing effect of centre of gravity misalignment

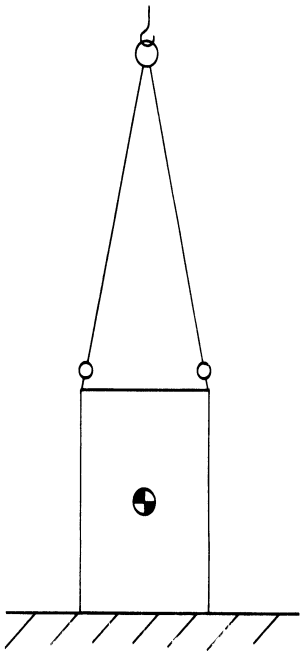


Figure 19 — Example of stable load

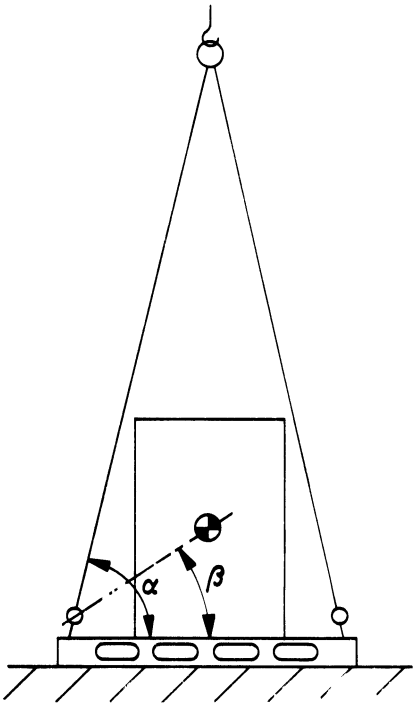


Figure 20 — Example of high centre of gravity relative to attachment points

Publications referred to

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

BS 5744, *Code of practice for the 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).*

BS 6166, *Recommendations for rating of lifting gear for general purposes.*

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