


INTER PLANT STANDARD – STEEL INDUSTRY		
	<p align="center"><b>GUIDELINES FOR SELECTION, USAGE, INSPECTION AND REJECTION OF RIGGING EQUIPMENT (SLINGS &amp; ROPES)</b></p>	<p align="center"><b>IPSS: 1-11-027-16</b></p>
	<p align="center">Corresponding IS does not exist</p>	

## 1. FOREWORD

This Inter Plant standard, prepared by the Standards Committee on Safety Appliances and Procedures IPSS 1:11, with the active participation of the representatives of all member steel plants, experts in the field from member organizations and associated organizations, adopted in October, 2016.

- 1.1. This standard has been prepared to provide guidelines for selection, usage, inspection and rejection of rigging equipment (Slings & Ropes)

## 2. SCOPE

To provide a guideline regarding selection, usage, inspection and rejection of rigging equipment (Slings & Ropes)

## 3. Procedure:

### General

- 3.1. All the rigging equipment should carry their unique identification number. No chain, rope or lifting gear shall be used unless –
  - it is of good construction, adequate strength, suitable quality and free from any defects.
  - it has been tested and examined once in a year for general use and once in six months for hot metal lifting use by a competent person and issued a certificate.
- 3.2. Rigging equipment for material handling shall be visually inspected prior to use on each shift. Defective rigging equipment shall be removed from service. Steel chains, slings and web slings shall be used for securing / supporting heavy loads ( $\geq 70$  kg) and use of Manila ropes, Fibre ropes in rigging activities shall be strictly prohibited for heavy loads.
- 3.3. Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging and lifting equipment should be clearly marked with its safe working load and identification number.

- 3.4. In case of multi-sling, the safe working loads at different angles of the leg shall not be exceeded. The upper ends of sling legs shall be connected by means of a shackle ring or link of adequate strength.
- 3.5. Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to employees.
- 3.6. Slings shall not be shortened with knots or bolts or other makeshift devices.
- 3.7. Every sling used for raising or lowering on lifting appliance shall be secured attached to the appliance and the method of attachment shall not be a method likely to result in damage to any part of the sling or to any lifting gear supporting it.
- 3.8. Precautions shall be taken through the use of suitable packing or otherwise to prevent the edges of the load from coming into contact with the sling, rope or chain where this would cause danger.
- 3.9. Hands and fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- 3.10. Shock loading is prohibited.
- 3.11. A sling shall not be pulled from under a load when the load is resting on the sling. Table given below provides approximate safe working load for various sizes of ropes links. Load limitations due to included angle of two slings must be observed strictly.

**Wire Ropes Slings - Maximum SWL (in KG.) (Double Leg Wire Rope Sling)**

Nominal Dia. of Rope		INCLUDED ANGLE			
		0 Deg.	30 Deg.	60 Deg.	90 Deg.
3/8"	10 mm	1200	1150	1100	850
1/2"	13 mm	2000	1900	1750	1400
3/4"	19 mm	4450	4300	3850	3150
1"	25 mm	7700	7450	6650	5950
1 1/4"	32 mm	12500	11900	10850	8850
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1 2/4"	38 mm	17800	17200	15900	12600
1 3/4"	44 mm	28000	26600	24200	19700
2"	50 mm	36000	34600	32100	25900
2 1/4"	56 mm	46000	44600	39800	32500
2 1/2"	62 mm	56000	54000	48400	39500
2 3/4"	68 mm	68000	65400	58200	48000
3"	75 mm	82000	79200	71000	57900

*Note: Increasing the vertical/included angle between slings decreases the loading capacity of the sling.*

**4. ALLOY STEEL CHAINS**

- 4.1. A chain in use shall be thoroughly examined once at least every month by a responsible person.
- 4.2. Alloy Steel Chains shall never be welded or exposed to excessive temperatures
- 4.3. Alloy Steel Chains shall have permanently affixed identification, size, grade and rated capacity
- 4.4. Hooks, rings, welded or mechanical coupling links and other attachments when used with alloy steel chains shall have a rated capacity at least equal to that of chain.
- 4.5. Shop made hooks and links or make-shift fasteners, formed from bolts, rods. etc. or other such attachments, shall not be used.
- 4.6. Rings, Hooks, Swivels and end links attached to a chain shall be of the same material as that of the chain.
- 4.7. Rated capacity (working load limit) for alloy steel chain slings (single/multi-leg) shall not exceed the values given by the manufacturer.
- 4.8. Chains should not be hammered (especially with load) either to strengthen the links or to force the link into position.
- 4.9. The chain shall be free from bent, twisted, damaged or cracked links.
- 4.10. The safe working load shall be reduced as follows when the diameter of the link is reduced due to wear and tear.

<b>Normal chain link diameter (mm)</b>	<b>Reduction of rated Capacity by 5%, when the diameter at worn section is as follows (mm)</b>	<b>Reduction of rated Capacity by 10 %, when the diameter at worn section is as follows(mm)</b>	<b>Remove from service When diameter is(mm)</b>
5.75	5.75	5.70	5.40
8.78	8.78	8.55	8.10
12.68	12.68	12.35	11.70
15.60	15.60	15.20	14.40
18.53	18.53	18.05	17.10
21.45	21.45	20.45	19.80
24.38	24.38	23.38	22.50

#### 4.11. Removal from Service

- Whenever wear at any point of any chain link exceeds 10 per cent reduction in diameter, the chain shall not be used and to be removed from site.
- The stretch in the chains shall not be more than 5% of its original length.

### 5. **WIRE ROPES**

- 5.1. Every wire rope of lifting appliance and lifting gear shall be inspected by a responsible person for such use once in at least three months.
- 5.2. The safe working load recommended by the manufacturer for various sizes and classification of wire ropes shall be followed.
- 5.3. Wire ropes shall not be secured by knots.
- 5.4. Wire ropes used for construction activities shall have a factor of safety 6 : 1. Only tested wire ropes shall be used.
- 5.5. The wire rope should be properly lubricated.
- 5.6. Each wire rope used in hoisting or lowering or in pulling loads shall consist of one continuous piece without knot or splice.
- 5.7. Wire rope shall not be used if in any length of six diameters, the total number of visible broken wire exceeds 5% percent of total number of wires or if the rope shows other signs of excessive wear, corrosion or defect.
- 5.8. In pendants or standing ropes, there should not be more than 3 broken wires in one rope lay. (A rope lay is the length along the rope in which one strand makes a complete revolution around the rope).
- 5.9. Near attached fittings there should not be any broken wires.
- 5.10. Reduction in diameter of the rope due to core failure, abrasion, etc. should not be more than 10% .
- 5.11. Rope stretch should not be more than 150 mm per 30 m length in the six strand wire ropes.
- 5.12. No bird caging, kinks or core protrusion shall exist in the wire rope.
- 5.13. A sling which has been exposed to excessive temperature for an excessive length of time may have significantly reduced strength.

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

5.15. All precautions to be taken to prevent corrosion.

## 6. **STORAGE OF SLINGS**

6.1. Slings should be stored in a fabricated stand category wise after use.

## 7. **NATURAL ROPE AND SYNTHETIC FIBRE**

7.1. All splices in rope slings shall be made in accordance with manufacturer's recommendation.

7.2. Spliced fiber rope slings shall not be used unless they have been spliced as per the manufacturer's recommendation.

7.3. Knots shall not be used in lieu of splices.

7.4. Natural and synthetic fiber rope slings shall be immediately removed from service, if any, of the following conditions are present.

- Abnormal wear.
- Powdered fiber between strands.
- Broken or cut fibers.
- Variations in the size or roundness of strands.
- Discoloration or rotting.
- Distortion of hardware in the sling.

7.5. Synthetic Webbing (Nylon, Polyester and Poly Propylene)

7.5.1. Synthetic webbing shall be of uniform thickness and width and edges shall not be split from the webbing width.

7.5.2. Fittings shall be –

- of a minimum breaking strength equal to that of the sling; and
- free of all sharp edges that could in any way damage the webbing. Attachment of end fittings to webbing and formation of eyes.

7.5.3. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an eyes pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

7.6. Environmental Conditions

When synthetic web slings are used the following precautions shall be taken.

- Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquid of acids or phenol are present.
- Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

7.7. Removal from Service

Synthetic web slings shall be immediately removed from service if any of the following conditions are present.

- Acid -or caustic burns;
- Melting or charring of any part of the sling surface;
- Snags, punctures. tears or cuts;
- Broken or worn stitches; or Distortion of fittings.

**8. CHAIN BLOCKS / HOOKS / PULL LIFTS**

8.1. The Chain Blocks should have safety Latch both in the Top & the Bottom hook

8.2. Chain blocks of proper lifting capacity supported by Test Certificate should be used for lifting known loads.

8.3. Chain block must be checked, and tested yearly It should be lubricated before every use.

8.4. No cannibalizing should be done on chain block.

8.5. Chain blocks should be tested for slip by suspending safe load.

8.6. It should operate freely and the chain should not come out of pulleys. The anchorage should be strong and rigid.

8.7. They should be checked for cracks, excessive wearing, elongation, etc. Hooks opened out should not be used.

8.8. No chain block / puller which has been tampered, be used unless it is thoroughly checked and tested by competent person.

8.9.Chain block / puller must be checked if stored for longer time, by subjecting to shock load, to observe slipping of load, jamming of links etc.

8.10. Use wire rope / sling for tying in (do not use Manila or Fibre Rope for tying purposes)

## 9. **CHOCKERS**

9.1.Chocker sling made of nylon or polyester shall not be used in construction site for lifting of materials.

9.2.Chocker sling shall be rugged, abrasion resistant and crush resistant.

9.3.Every chocker used for lifting or anchorage shall be inspected once in a month by a responsible person for such use.

9.4.The safe working load recommended by the manufacturer for the chocker shall be followed.

9.5.Chocker shall not be secured by knots.

9.6.Any defective chocker shall be removed from its use, if damage such as the following is visible:

1. Cuts, holes, tears, snags or crushed.
2. Excessive abrasive wear.
3. Excessive pitting or corrosion, cracked, distorted or broken fittings.
4. Broken or worn threads in the stitch patterns.
5. Melting or charring of any part of the chocker.
6. Other visible damage which raises doubt as to the strength of the chocker.

9.7.All damaged chocker shall be cut into pieces and scraped.

## 10. **SHACKLES**

10.1.Pins should not be bent; pins shall not be replaced with bolts.

10.2.Removals from service

- Discard the shackle if there is any deformation on the body of the shackle.
- Discard the shackle if the shackle pin is bent, cracked or twisted.

- Discard the shackle if the threads in the body or on the pin are damaged.
- Discard the shackle if the shackle pin is not fitting properly in the body.
- Shackles worn in the crown or the pin more than 10% of the original diameter should be replaced.

**11. Method of slinging and the sling angle:**

The safe working load of the sling decreases

significantly while using bridle hitch, basket hitch or chocker hitch as described below :

I - Bridle hitch (Refer Figure 3)

SWL = SWL of single vertical sling x H/L x 2 Where H = head room between the hook & load , L = Length of the sling

II - Bridle hitch (Refer Figure 4)

- \* For single basket hitch, vertical loading SWL = SWL of single vertical hitch x 2
- \* For single basket hitch, inclined legs SWL = SWL of single vertical hitch x H / L x 2
- \* For double basket hitch, vertical legs, SWL = SWL of single vertical hitch x 4
- \* For double basket hitch, inclined legs, SWL = SWL of single vertical hitch x H / L x 4

III - Chocker hitch (Refer Figure 5)

- \* For single chocker hitch, when the angle is less than 45<sup>o</sup> SWL = SWL of single vertical hitch x A / B
- \* For single chocker hitch, when the angle is 45<sup>o</sup> or more, SWL = SWL of single vertical hitch x 3 / 4
- \* For double chocker hitch, when the angle is less than 45<sup>o</sup> SWL = SWL of single vertical hitch x A / B x H / L x 2
- \* For double chocker hitch, when the angle is less than 45<sup>o</sup> or more, SWL = SWL of single vertical hitch x 3 / 4 x H / L x 2

<b>Monitoring &amp; Reviewing</b>				
	<b>Frequency</b>	<b>Mechanism</b>	<b>Record</b>	<b>Responsibility</b>
	Weekly / Monthly	Inspection	Inspection Record	User Department.

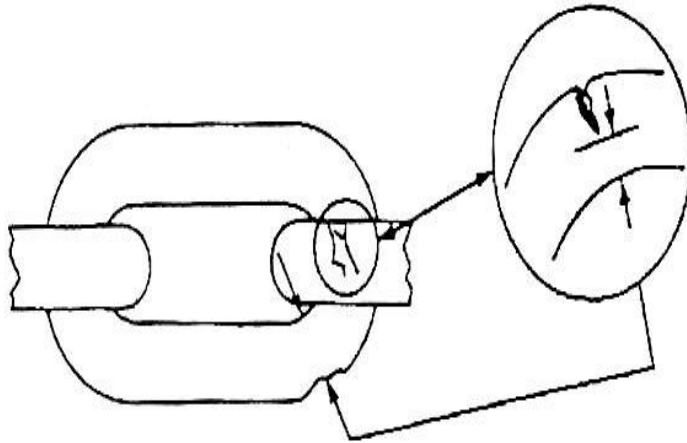


**Table 2**

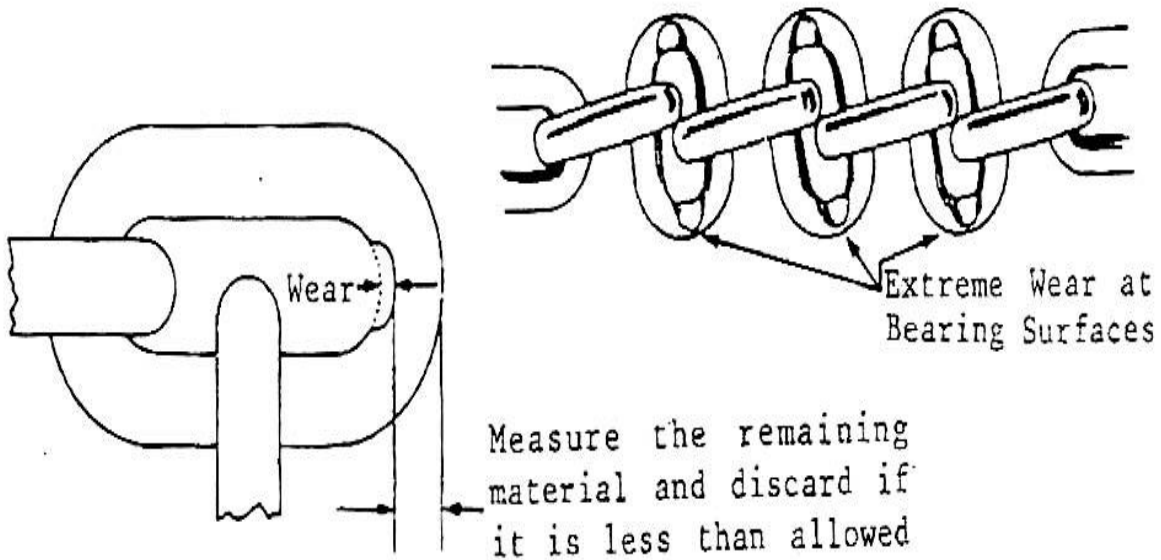
**Replacement Criteria for Wire Rope Replacement Overhead  
Lifting : Cranes, Hoists and Monorails**

<b>SIGNS OF DETERIORATION</b>	<b>CRITERIA FOR REPLACEMENT</b>	
Reduction of rope diameter because of: Loss of core support corrosion worn outside wires	For Rope Diameters	Reduction more than
	Upto 5/16" (8.0 mm)	1/64" (0.4 mm)
	3/8" (9.5 mm) to 1/2" (13.0 mm)	1/32" (0.8 mm)
	9/16" (14.5 mm) to 3.4" (19.0 mm)	3/64" (1.2 mm)
Broken outside wires	Twelve randomly distributed broken wires in one rope lay. Four broken wires in one strand in one rope lay	
Worn outside wires	Wear of one-third of the original diameter of outside individual wires.	
Corroded or broken wires at end connections. Corroded, cracked, bent or worn end connections	Any of these conditions indicates need for replacement.	
Severe kinking, crushing, cutting or unstranding.	When such kinking, etc. results in distortion of rope structures.	

**Figure 1 : Rejection Criteria for Chains**  
**Examine all chain links for gouges, chips and cuts**

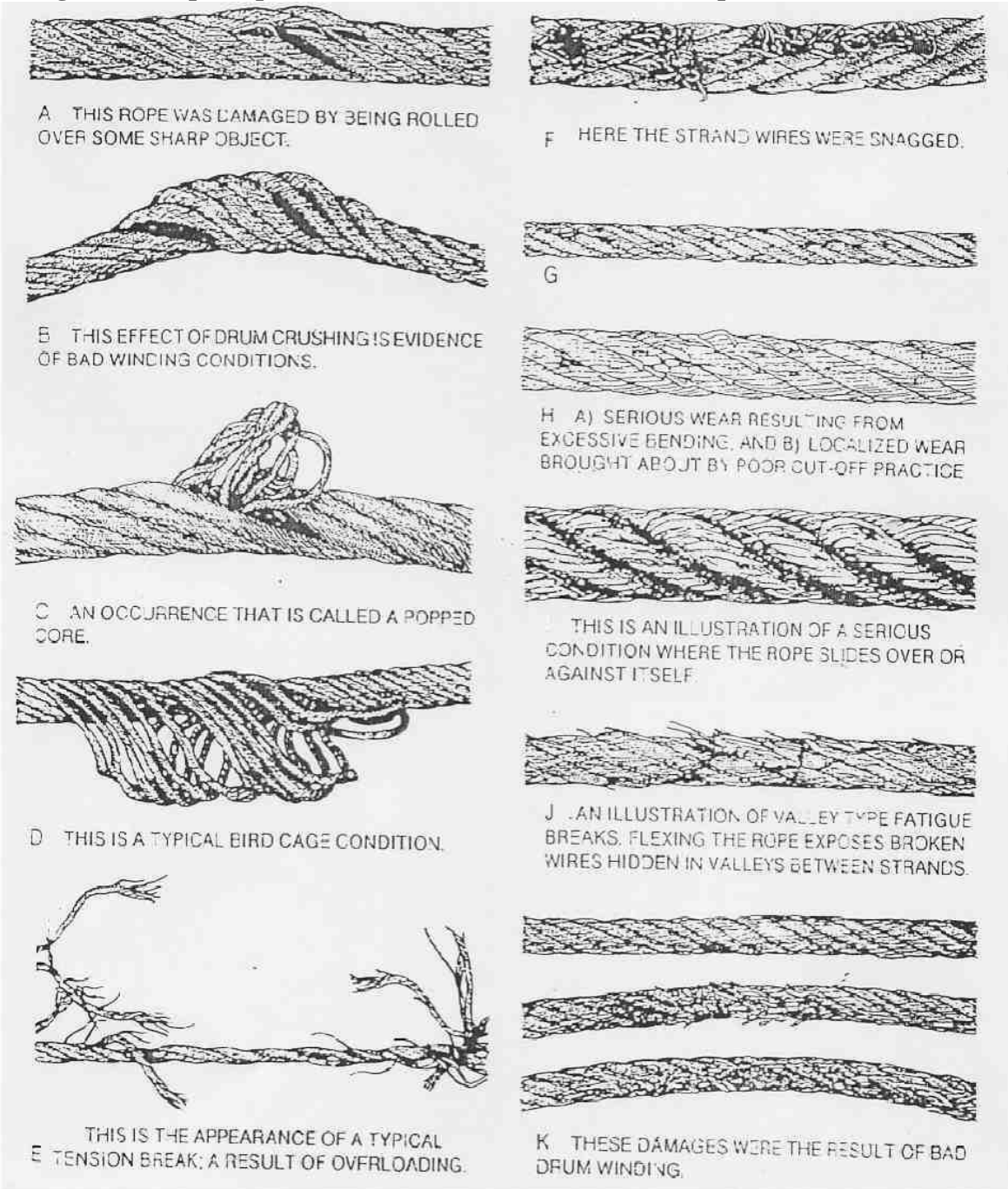


Examine all links for gouges, chips and cuts

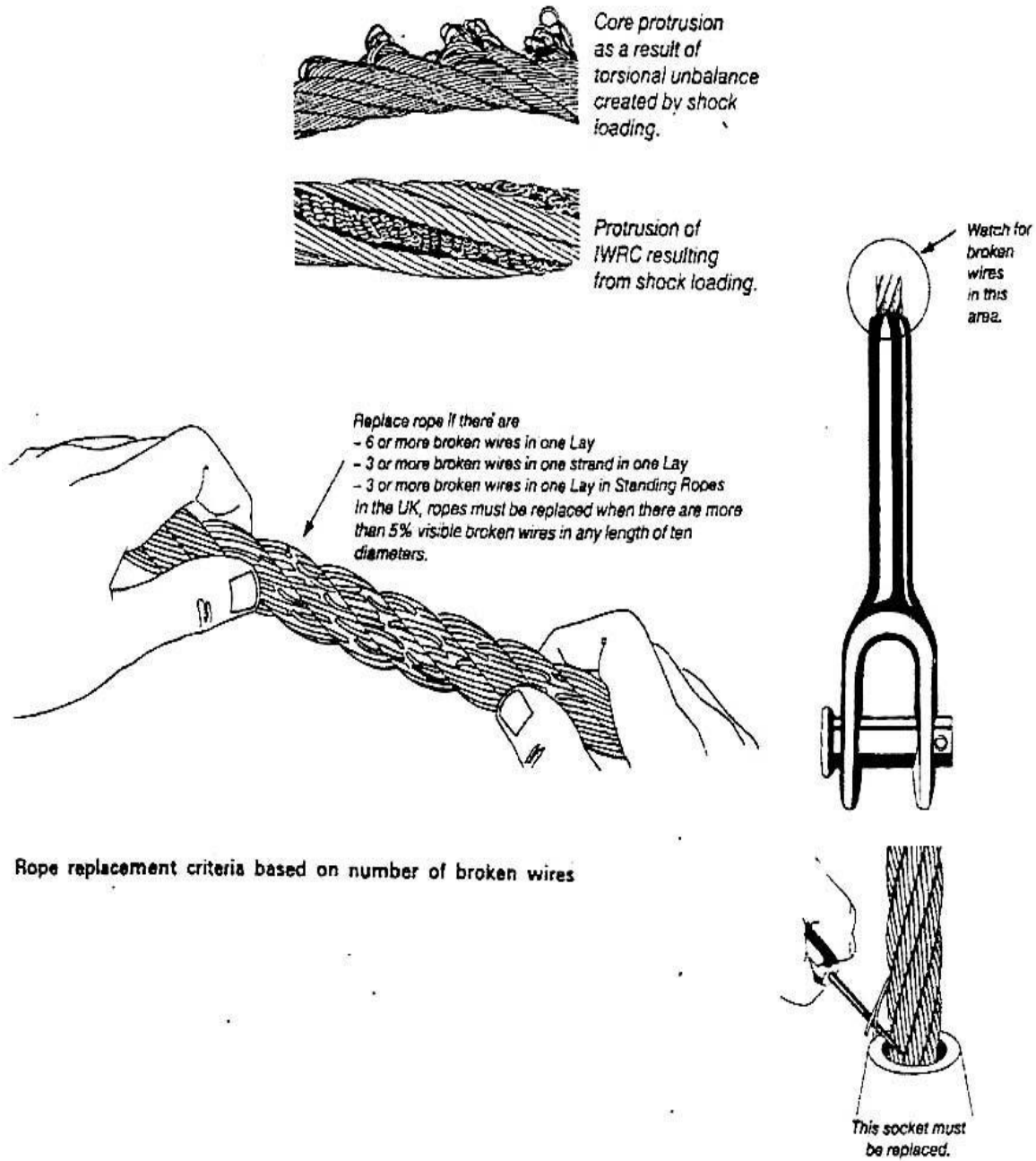


Examine all links for wear at bearing surfaces

Figure 2 : Rope Replacement Criteria based on Visual Inspection

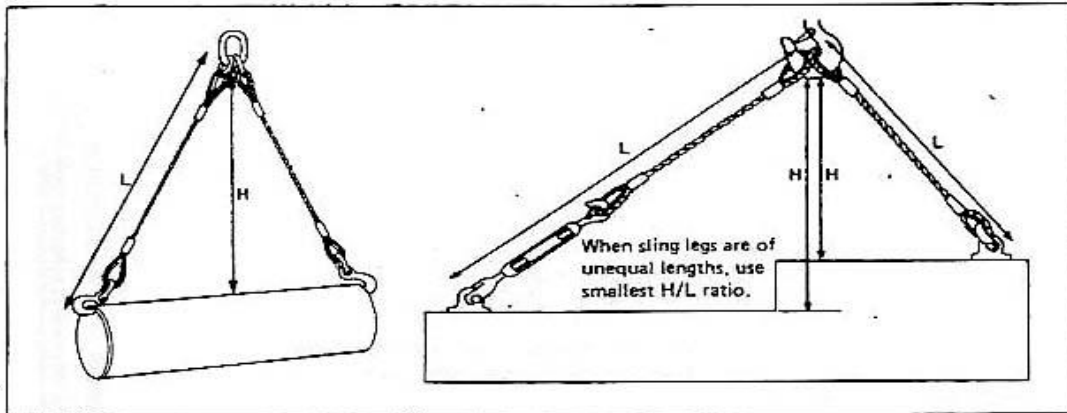


**Figure 2 (contd.): Rope replacement criteria based on number of broken wires**

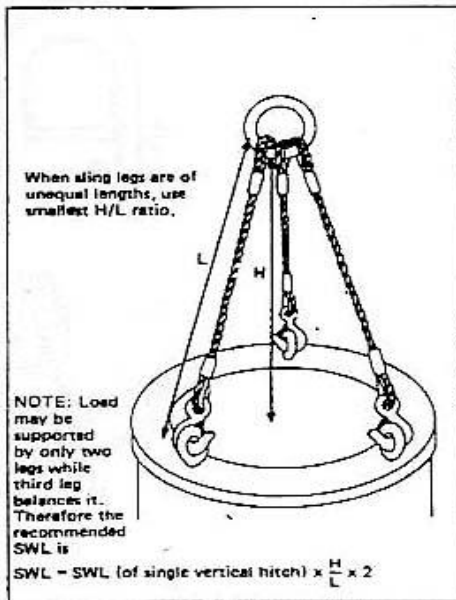


**Figure 3 : Determining capacity 2 leg / 3 leg / 4 leg bridle hitch**

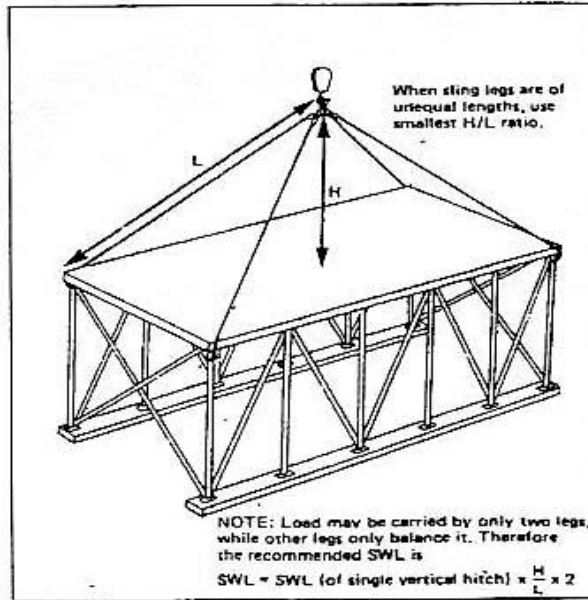
- \* For single basket hitch, inclined legs,  
 $SWL = SWL \text{ of single vertical hitch} \times \frac{H}{L} \times 2$
- \* For double basket hitch, vertical legs,  
 $SWL = SWL \text{ of single vertical hitch} \times 4$
- \* For double basket hitch, inclined legs,  
 $SWL = SWL \text{ of single vertical hitch} \times \frac{H}{L} \times 4$



**Determining capacity of two-leg bridle hitch**

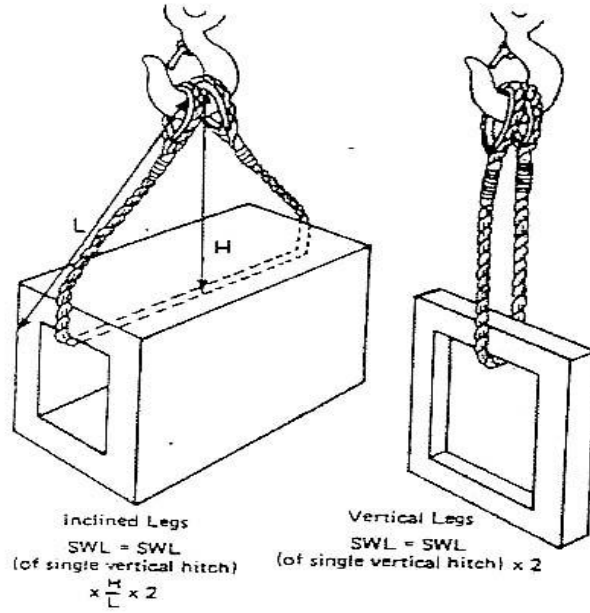


**Determining capacity of three-leg bridle hitch**

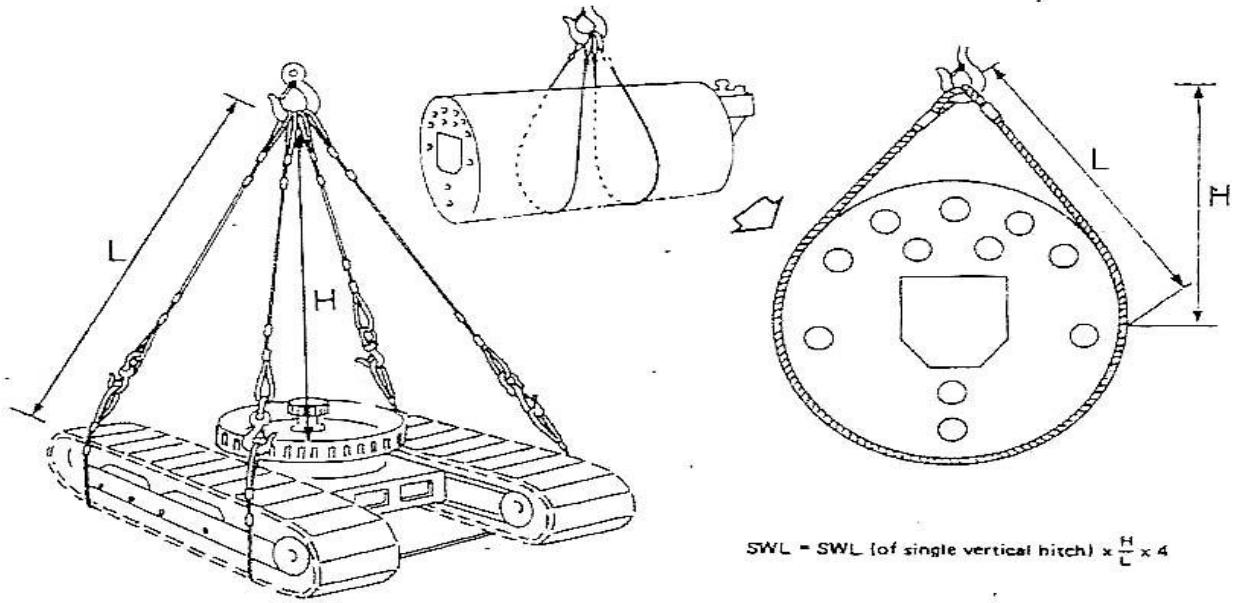


**Determining capacity of four-leg bridle hitch**

**Figure 4 Determining Capacity of Double Basket Hitch with inclined legs**



**Determining capacity of single basket hitch**



**Determining capacity of double basket hitch with inclined legs**

Figure .5 : Determining capacity of double choker hitch

