INTEGRAL SKILLS

DOGGING SUPPLEMENT for CRANES

LEARNER GUIDE

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MODIFICATION HISTORY

Version	Date	Nature of Amendment
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INTRODUCTION

This supplement has been developed to bridge the gap in the release of the new crane High Risk Work Licence (HRWL) units of competency (UOC) where the learner does not hold a HRWL for Dogging (DG).

This supplement only covers the additional information required for competency and is to be integrated with the delivery of the Primary Course / UOC, taking on all other aspects as outlined in the Primary Course.

LICENSING/REGULATORY INFORMATION

All legislative and regulatory requirements are outlined in the Primary Course.

PERFORMANCE EVIDENCE

HRWL Classes C6, C1 and CO
Performance evidence for this supplement is:

- planning for and managing load stability, including:
    - confirming and inspecting appropriate lifting gear and applying slinging techniques appropriate to the type of load, its mass and centre of gravity
    - confirming (identifying – C1, CO) the Working Load Limit (WLL) tags of the lifting equipment and gear and calculating the deration of the WLL resulting from the slinging techniques applied

HRWL Classes CV and CB
Performance evidence for this supplement is:

- Identifying hazards and using appropriate risk controls and safety measures and equipment relevant to slinging loads.
- Selecting and inspecting appropriate lifting gear and applying slinging techniques appropriate to the type of load, its mass and centre of gravity.
- Identifying the Working Load Limit (WLL) tags of the lifting equipment and gear and calculating the deration of the WLL resulting from the slinging techniques applied.
- Using lifting gear, including flexible steel wire rope (FSWR) sling, synthetic sling, chain sling (including shortener), spreader bar or lifting beam, tag line, shackles and eyebolts, and using bends and hitches when slinging, including:
    - Single sheet bend
    - Clove hitch
    - Bowline

KNOWLEDGE EVIDENCE

HRWL Classes CV, CB, C6, C1 and CO
Knowledge evidence for this supplement is:

- hazards commonly encountered while slinging:
  - instability of landing surfaces
  - overhead and underground hazards
  - insufficient lighting
  - traffic
  - weather
  - pedestrian traffic
  - work at heights
- selection, inspection, care, handling, application, limitations and storage of lifting equipment and gear:
  - Flexible Steel Wire Rope (FSWR) sling
  - synthetic sling
  - chain sling (including shortener)
  - spreader bar or lifting beam
  - tag line
  - shackles
  - eyebolts
  - plate clamps (CB, C6, C1, CO only)
  - load moving attachments, including magnetic, vacuum and grab (CB only)
- methods of making temporary connections to loads using fibre and/or synthetic ropes:
  - single sheet bend
  - clove hitch
  - rolling hitch (only required for C6, C1 and CO)
  - bowline

ASSESSMENT CONDITIONS

Adopt those of the Primary Course

HIGH RISK WORK LICENCE REQUIREMENTS

Adopt those of the Primary Course

WHEN IS A DOGGER REQUIRED

Safe Work Australia's information sheet on dogging states, a dogger is required to carry out dogging work. Slinging loads where judgement is not required and where the load is always in view of the plant operator is not dogging work, therefore a dogger is not required.

High Risk Work Licensing for Dogging - Information Sheet

https://www.safeworkaustralia.gov.au/system/files/documents/1703/dogging-hrwl-information-sheet.pdf

Refer to Appendix 1 and 2 for more detailed information.

HAZARDS COMMONLY ENCOUNTERED WHILE SLINGING

If you can remove or at least control a hazard you can reduce the risk involved. Each worksite has its own specific risks and hazards. Always check to see what systems and procedures are in place before conducting a risk assessment at a worksite, as they may affect the outcomes of the risk assessment.

Consult with other workers about hazards

Make sure you talk to the right people. This can include:

- Safety officers.
- Site engineers (where applicable).
- Supervisors.
- Colleagues.
- Managers who are authorised to take responsibility for the workplace or operations.

Common hazards include:

- Instability of landing surfaces
    - Surface condition
    - Underground Services
    - Weight bearing ability
- Overhead and underground hazards
    - Electricity/Powerlines
    - Overhead service lines
    - Obstructions
    - Trees
    - Plumbing
- Insufficient lighting

- Traffic
    - Vehicles
    - Other plant
- Weather:
    - Wind
    - Lightning
    - Rain / Storms
- Pedestrian traffic
- Work at heights

ASSESS THE LOAD AND CRANE

Before you try to shift a load you will need to make sure of the following:

- The weight of the load:
    - Confirm with Dogger/Rigger
    - Calculate
    - Obtain content or weighbridge notes or other information.
    - Weigh the load.
    - Estimate the load through calculations.
    - Check whether the weight appears on the load itself or the packaging that it is delivered in.
- Suitable Lifting points
- The centre of gravity of the load (so that you can have the crane positioned correctly to pick up the load).
- WLL of the crane
    - The crane/plant operator is responsible for identifying and communicating the capacity of the crane.

DETERMINE SPECIAL REQUIREMENTS AND LIFTING POINTS OF LOADS

You need to check and see if the load has any specific lifting points. This will give you a better idea of the types of lifting gear you should use and how you should sling the load.

The manufacturer may have specifications or information relating to the load and how it should be handled, especially in the case of hazardous, fragile or unstable loads.

You should access the manufacturers' specifications or engineers' reports and specifications for details on special or unique loads including:

- Load centre of gravity.
- Stress points.

- Lifting points.
- Spread of load.
- Travel path of load.
- Special slinging requirements.
- Lifting and/or landing requirements.

LIFTING LUGS

Lifting lugs are components that are found in some lifting gear and loads to assist with lifting.

Lugs are built with an opening in the centre so that cables can be attached, through these openings, for lifting purposes.

Lifting lugs may be:

- A permanent attachment – such as in a box with built in lugs or a spreader beam.
- A temporary attachment – such as the addition of eyebolts to a load.

If a load or piece of lifting equipment is fitted with lifting lugs, ensure that you:

- Visually inspect the lugs, making sure that there is no evidence of:
  - Welds splitting or cracking.
  - Damage, splitting, separation or stretching.
- Check that the rated capacity is suitable for the job.
- Check the lugs for positioning in relation to the centre of gravity of the load being lifted.

LIFTING GEAR

The load and working environment will determine the type of lifting gear that you need to use.

Mark in your plan the lifting gear that you intend to use along with the details of how you intend to sling and control the load during the lift. Lifting gear includes all equipment associated with the lifting and moving of the load from the hook down.

Lifting gear can include:

- Ropes.
- Chains.
- Slings.
- Attachment hardware (Shackles, Eye bolts, Hooks etc).
- Beams.
- Clamps.
- Other attachments that can be used to lift or secure a load.

When assessing the lifting gear needs you will also need to consider whether the load requires packing and dunnage.
The use of packing, padding, lagging, edge protection, dunnage and corner pads can protect the lifting gear from sharp corners on a load and increase the safety of the lift.

Packing protects the load and lifting gear from damage during the lift, and also allows for safer attachment and detachment of the lifting gear.

It is important that you select the correct lifting gear for each load that you are lifting. Here are some examples:

Load Type	Suggested Lifting Gear
A pallet of bricks	A brick or block cage.
Steel plates	Plate or lifting clamps.
A single gas bottle	A suitable stillage or lifting box that ensures the load is stable and secure.
A load of loose pipes	Suitable stillage, pallets or slings.
Pre-cast panels	Lifting clutches.
A timber truss	Lifting beam and/or long sling or wire.
A load that is easily damaged	Synthetic webbing slings.
A bulky load or a load with uneven weight disbursement	Lifting beam.

Table 1 – Load vs Lifting Gear

It is extremely important that you carefully inspect all lifting gear before you use it to ensure that all items are safe to use and are appropriate for the task.

FLEXIBLE STEEL WIRE ROPE

Flexible Steel Wire Rope (FSWR) sizes are shown by nominal diameter in millimetres (mm). The tensile strengths are given in MegaPascals (MPa).

There are two principle grades of flexible steel wire rope (FSWR):

- **Grade 1570** – This rope is galvanised in appearance and usually has a fibre core (1570MPa).
- **Grade 1770** – This rope is blackish in appearance and usually has an independent wire core (1770MPa).

The smallest diameter of FSWR that can be used for lifting purposes is 6mm.

The maximum temperature exposure for fibre core FSWR is not to exceed 95°C.

Rope Construction

FSWR is made up of a number of wires laid into a strand, then a number of strands laid around a core.

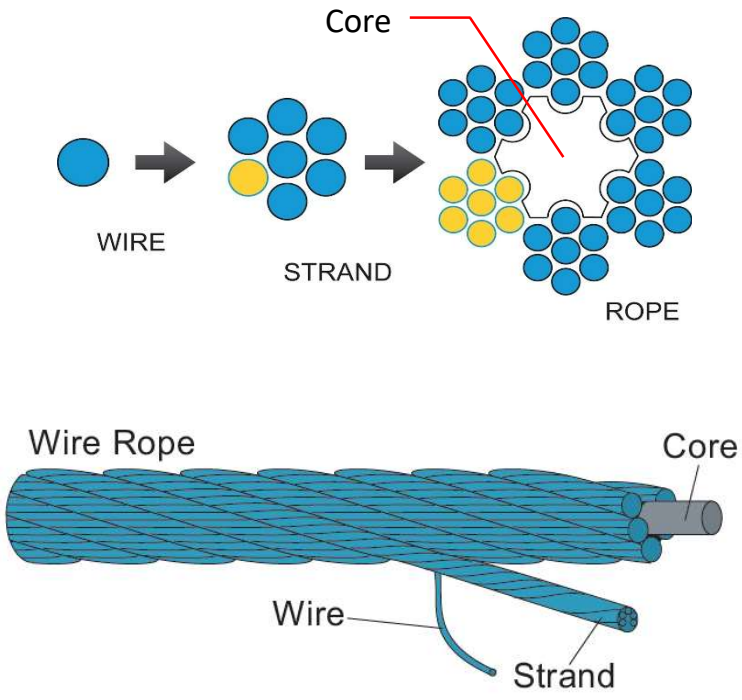


Figure 1 – Main Components of FSWR

The specification FSWR is documented using a coding system consisting of a number of abbreviations. Pre-formed ropes have a spiral shape bent into each wire before the wires are fitted into position in the finished rope. Post-formed ropes are compressed or twisted into shape after the rope has been made.

Abbreviation	Description	Abbreviation	Description
6	Number of strands	IWR	Independent Wire Rope
19	Number of wires per strand	IWRC	Independent Wire Rope Core
FC	Fibre Core	FW	Filler Wire
J	Jute	TS	Triangular Strand
RH	Right Hand Lay	S	Seale
LH	Left Hand Lay	SF	Seale Filler Wire
OL	Ordinary Lay	SW	Seal Warrington
LL	Lang's Lay	W	Warrington
FSWR	Flexible Steel Wire Rope	WF	Warriflex
GSWR	Galvanised Steel Wire Rope	WS	Warrington Seale

Table 2 – Wire Rope Abbreviations

Using the above abbreviations, a 6 strand, 19 wires per strand, fibre core, left hand ordinary lay, galvanised steel wire rope would be identified as, 6x19 (or6/19) FC LHOL GSWR. The most common types of rope are developed from basic 6/19, 6/24 and 6/37 constructions.

Lay of Wire Rope

Lay describes the manner in which either the wires in a strand, or the strands in the rope are laid in a helix. To determine the lay of a rope, you view the rope as it points away from you. If the strands appear to turn in a clockwise direction as they progress away from you, the rope has a right hand lay. If the strands appear to turn in an anti-clockwise direction then it has a left hand lay, the lay of the rope does not affect the WLL but does affect the spin of the wire rope.

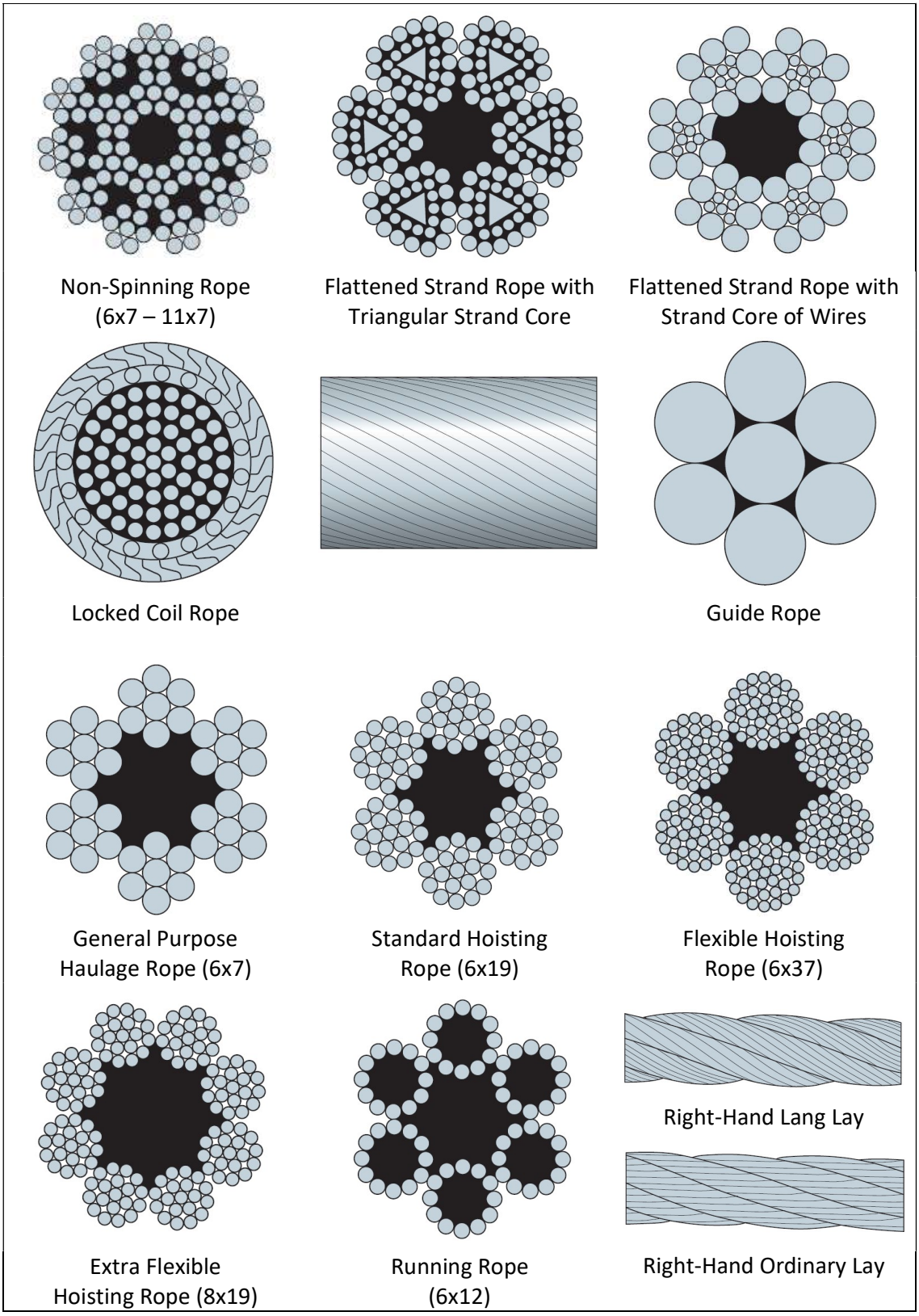


Figure 2 – Wire Rope Types

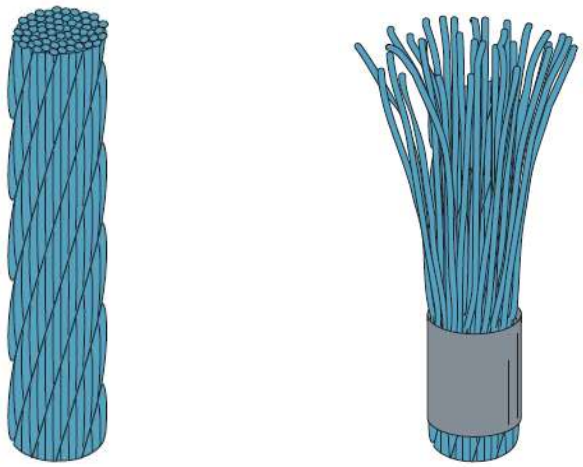
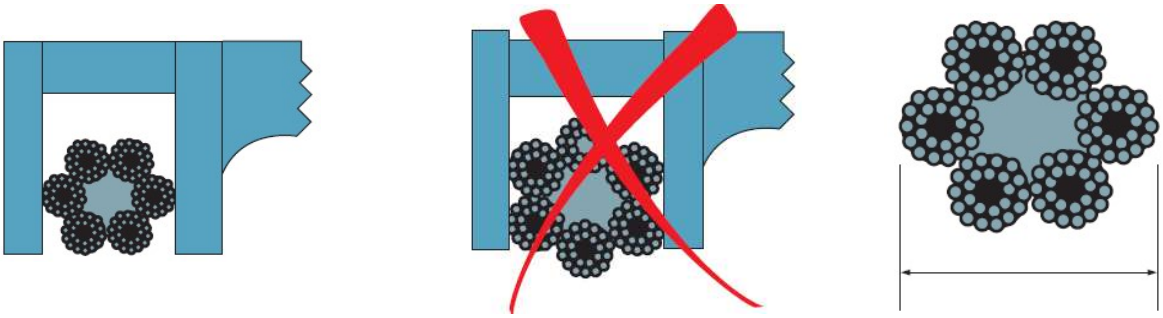


Figure 3 - Pre-formed Rope & Non Pre-formed Rope

Measuring FSWR

The diameter of a wire rope is the diameter of the circle that encloses all of the wires. It is important to take the greatest distance of the outer limits of the crowns of the two opposite strands.



Correct Incorrect Rope Diameter

Figure 4 – Measuring Wire Rope

Lay length is the distance along the rope in which one strand makes a complete revolution of the rope.

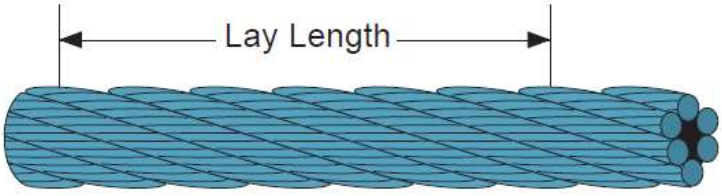


Figure 5 – Wire Rope Lay Length

Cross Laid and Equal Laid Ropes

Where strands are made up of two or more layers of wires around a centre wire, the wires in these layers may be crossed-laid. That is, the pitch or length of lay will be longer for the outer layer. This construction is limited to small ropes and cords, to some ship ropes and to standing ropes in larger sizes.

For all other purposes, ropes of equal-laid construction are preferable. By this method, all layers of wires have the same pitch or length of the lay. Therefore, each wire in the layer lies either in a bed formed by the interstices or valleys between the wires of an under layer, or alternatively along the crown of an underlying wire. Because no layer of wires ever crosses over another, an equal-laid rope maintains its diameter in service, has a more solid cross section and improved fatigue life compared to ropes of the cross-laid type. When wires are laid up in a strand in equal-laid construction, the arrangements of wire are referred to as Warrington, Seale or Filler, depending on the way in which the wires are arranged.

Warrington (also known as Warriflex)	A number of large wires are laid over the king wire. Then pairs of wires, one large and one small are laid around these. Each large outer wire lays in the valleys formed by the two inner wires, and each small outer wire rests on the crown or top of an inner wire. This prevents crossing of wires in the rope. The alternate small and large outer wires combine to give great flexibility with resistance to abrasion.
Seale	A number of small sized wires are laid over a central king wire. A similar number of larger wires are laid over these inner wires. Each outer wire lays in the valley formed by two of the inner wires. The small wires give flexibility to the rope while larger outer wires provide resistance to abrasion. Seale rope 6x19 construction requires larger sheave and drum diameters than other 6x19 construction ropes. Only use this type of rope for jobs where recommended by a crane or rope manufacturer.
Filler	A number of wires laid over a king wire. In the valleys formed by these, are laid very small ‘filler’ wires. These filler wires, with the first layer, then make double the number of valleys. The outer wires (usually the same size as the first layer) are laid in the valleys, and the length of lay of all the wires is equal, with no crossing of the wires.

Table 3 – Laid Rope Descriptions

Selection and Use of FSWR

- A rope made of a small number of heavy wires in the strands better withstands abrasion, but more quickly fails from bending.
- A rope made of many small wires better resists bending, but is more susceptible to abrasion.
- Longest rope service life results from the correct compromise of resistance characteristics to meet the forces in the particular rope use.

As a general rule, FSWR are used as below:

- Ordinary lay Independent Wire Rope Core (IWRC) is used mainly for hoist ropes with multiple fall reeving and multiple layering on the drum, IWRC is sometimes recommended for boom hoist ropes by manufactures.
- Ordinary lay fibre core is used mainly for slings and sometimes as a hoist rope when crushing is not a factor (i.e. single layer hoist drums.
- Lang's lay has a tendency to twist in operation and must be anchored for boom suspension ropes and is not suitable for hoist ropes.
- No-rotating rope is normally used for reeving where rope spin is a factor.
- IWRC rope is stronger and resistant to crushing.
- Fibre core rope is more flexible, but is prone to crushing and deformation.
- All crane ropes should be pre-formed.

Rotation Characteristics of FSWR

FSWR will try to rotate under load, or when the load is released. The likelihood of twisting increases in proportion with the diameter of the rope because:

- Different loads apply varying forces on the strands as the rope bends around a sheave.
- The groove on the sheaves force the rope to twist due to friction against the side of sheave.

To prevent load rotation, swivels are used at the load end. The swivel is usually built into the hook.

The structure and dynamic characteristics of FSWR means that under load, the different types of FSWR behave very differently when used with swivels.

- Non-rotating FSWR – use swivels with non-rotating FSWR to avoid overstraining the rope. Twisting forces may force the rope to unlay if the rope is prevented from rotating.
- Other FSWR – Never use swivels with other FSWR. Using swivels on other FSWR will cause the rope to unlay, decrease the rope's effective WLL, and significantly accelerate material fatigue.

Slings

FSWR slings are available in a number of different configurations including:

- Soft eye.
- Thimble eye.
- 2-leg sling.
- 4-leg sling.
- Open swage socket.
- Closed swage socket.
- Hook captive.
- Master link captive.

RATED CAPACITY OF FSWR

The rated capacity of a sling is the maximum load limit that may be lifted by that sling during a straight lift.

To calculate the rated capacity in kilograms of FSWR, square the rope diameter (D) in millimetres (mm) and multiply by 8.
The number **8** is used because FSWR is eight times stronger than Dry Natural Fibre Rope

Example:	Rope diameter = 12mm **Rated Capacity (kg) = D^2 (mm) x 8** = D (mm) x D (mm) x 8 = 12 x 12 x 8 = **1,152 kg** Therefore: Rated Capacity (t) = 1.15 tonnes

The above equation can be reversed to calculate the diameter (D) in millimetres of FSWR needed to lift a given load. To do this, divide the load (L) in kilograms by 8 and find the square root of the result.

Example:	Load = 1,152 kg **Diameter of FSWR (mm) = √(1,152 / 8)** = √144 = 12 (mm) Therefore: A FSWR sling of at least 12 mm in diameter is needed to lift a 1,152 kg load for a straight lift.

CARE OF FSWR

FSWR should be stored on racks or reels and should be coiled and uncoiled in the correct way. Keep FSWR stored under cover in a cool dry location in accordance with manufacturer guidelines. Do not expose to temperatures over 95°C.

Inspection

A wire rope is not to be used for lifting if it displays signs of:

- Kinks.
- Core slippage.
- Crushing.
- Knots.
- Corrosion.
- Stretching.
- Heat exposure.
- High stranding.
- Damaged splice.
- One broken wire near a fitting or socket.
- Bird caging.
- Wear.
- Distortion.
- Reduction in rope diameter.
- 10% of wires are broken over a length of 8 x diameter of the rope.

Example: (Broken Wires)	10mm diameter. 6/19 FSWR – 6 x 19 = **114 wires** **10% of 114** 114/10 = 11.4 = **11 wires** **11 Broken wires over a distance of 8 x 10mm = 80mm**

Statutory regulations govern the inspection and discarding or wire ropes. All ropes should be inspected before use and ropes left idle should be inspected monthly.

You must comply with the relevant standards for the use of steel rope. Keep sufficient records of inspections and rope condition to provide a reliable history of the rope.

Look for evidence of wire breaks in the valley between the strands on running ropes. Breaks occurring on the crowns of the outside wires indicate normal deterioration. Breaks in the valleys between strands indicate an abnormal condition, possibly fatigue or breakage of other wires not readily visible. You should discard any rope with more than one break in one lay.

ANCHORING AND SECURING FSWR

Anchorages are used for attaching the wire rope to the head of the boom, the crane hook or the drum. The eye on the anchorage for a rope must have a thimble. Approved methods of fixing a hoist wire to the boom head of a crane are:

- A hambone wedge socket.
- A machined swaged eye with thimble.
- A button socket.

If the hook of a crane spins rapidly, it indicates that the rope:

- May be incorrectly fixed at the head of the boom.
- May be the wrong type.
- Has been twisted when running onto the drum.
- May be incorrectly fitted to the winch drum.

Take severe twists out of hoist lines by discharging the weight off the hoist rope, releasing the anchorage from the boom head and untwisting the hoist rope.

Wedge Socket

It is essential to use a wedge and socket that is the correct size for the rope. Under no circumstances should the wedge protrude at the narrow end of the socket. An incorrectly sized wedge and socket may result in the rope pulling through the fitting when a load is applied. Ensure that the wedge and rope are properly seated in the socket before the lifting device is put into service. The tail on the dead end of the rope should project at least 200 mm. A bulldog grip must be applied to the tail of the rope below the socket to indicate slippage.

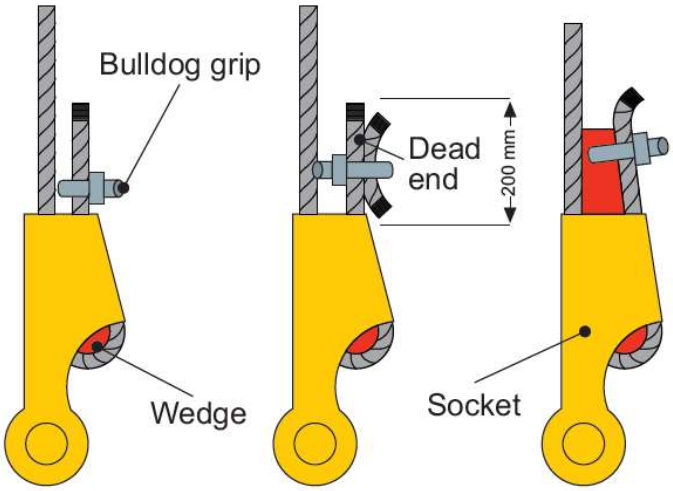


Figure 6 – Correct Clamping

Bulldog Grips

Bulldog grips are only suitable for permanent fixed stays or guys and must never be used for hoisting loads. At least three grips should be used for each fitting and they should be spaced at least six rope diameters apart. Grips should be fitted with a saddle on the load side of the rope and be the correct size for the rope being used. Grips should not be used to directly connect two straight lengths of rope as the rope could be crushed or pulled through the grip. Correctly applied, grips can form an eye capable of developing 80% of the rope's original strength.

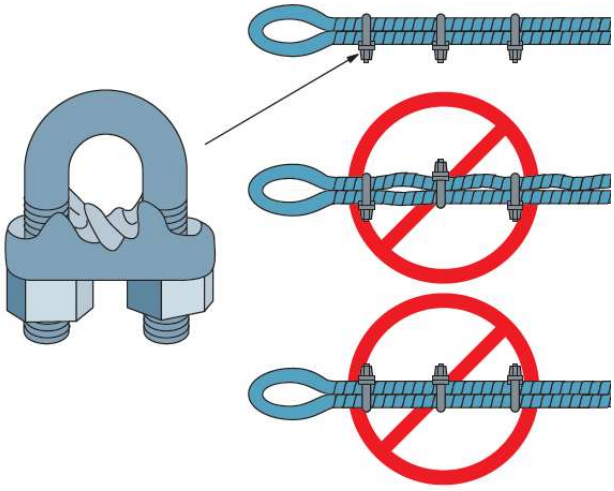


Figure 7 – Wire Rope Grips

Saddle Grips

Saddle grips are considered safer than bulldog grips, but should not be used for hoisting or direct loading. They can be used for guying, lifelines and span ropes. Single base clamps comprise two saddles and two bolts, which provide protection from crushing. As with bulldog grips, saddle grips are used on a rope to form eyes that develop 80% of the rope's strength. Double base clamps extend at least six rope diameters in length and provide greater clamping ability without causing rope damage. Double clamps form an eye that can develop up to 95% of a rope's original strength.

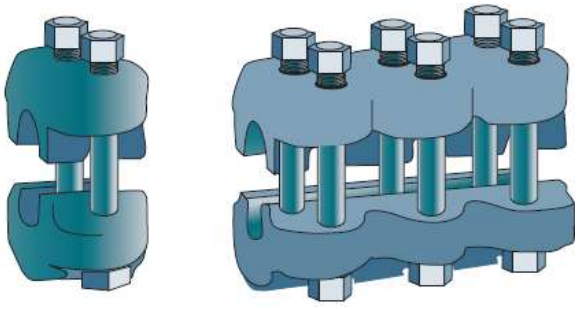


Figure 8 – Saddle Grip Single Saddle Grip Double

Thimbles

Thimbles are designed to protect the load bearing area inside the crown of the eye from chafing and distortion and to form a hard eye in a rope. Do not use thimbles or swages with the following defects:

- The tail of FWSR has slipped inside the swage fitting.
- The thimble is loose on the rope.
- The swage fitting is loose.
- There is a broken wire at either end of the swaged fitting.

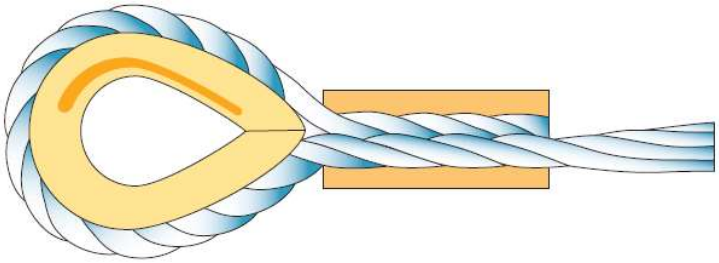


Figure 9 – Longitudinal section of a splice showing how the metal of the ferrule 'flows' round the strands of the rope.

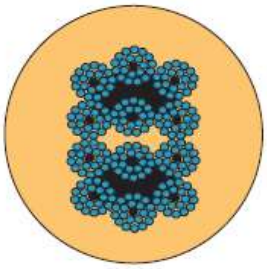


Figure 10 – Cross section of a splice showing how rope and ferrule form one strong, homogenous mass.

Reduced or Flemish Eyes

Reduced or Flemish eyes are used for securing falls or whips to drum anchorages and must be capable of withstanding 90% of the guaranteed breaking strength of the rope to which they are attached. They are not to be used for hoisting loads with cranes. They are laid from a single strand and finished in the same manner as a long splice. Making endless grommet strop slings, while essential in shipping work, is not essential elsewhere, but like splicing, expert knowledge can be gained with experience.

UNCOILING FSWR

Wire rope is usually delivered from the manufacturer in coils or wound around wooden reels, in which the length supplied depends on the size and weight of the rope. There is always a danger of kinking a wire rope if it is improperly unreeled or uncoiled. Careful handling will prevent kinks, which are impossible to remove and may result in permanent damage to a rope. If a loop forms in slack rope, the loop should be thrown out at once, because a kink will develop if this loop is drawn tight. When a kink develops, the strands of a rope are distorted and become permanently set at this position. Excess wear occurs and wires will fracture at this point.

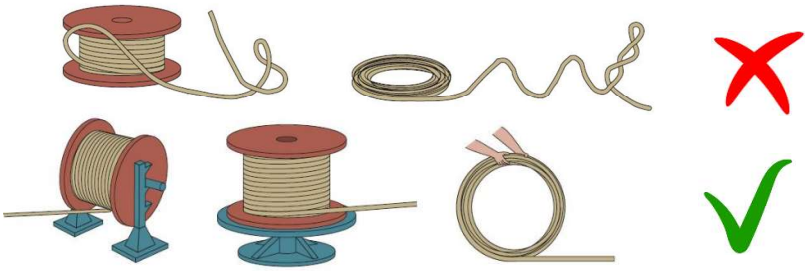


Figure 11 – Uncoiling FSWR (incorrect & Correct)

Precautions for Uncoiling

- Mount wooden reels on a spindle or shaft set upon jacks or stands, so that the reel will revolve as the rope is pulled off. Where there is danger of the reel running too freely and permitting the rope to run off uncontrolled, fit the reel with a brake.
- Alternatively, secure the end of the rope, stand the reel on its edge, and roll the reel along the ground in a straight line away from the free outside end. Ensure that the rope does not strike rocks or other sharp objects. The latter method should be used when a rope is delivered in a coil.
- Coils and reels can be laid flat on a turntable. A coil, however, should be laid on a turntable so that for a right hand lay rope, the turntable revolves clockwise as the outside end of the coil is pulled off. Use the opposite direction for a left-hand lay.
- When transferring a rope directly from a reel to a rope drum of a crane, hoist or haulage winch, or from one reel to another, it is important that the rope is taken from the top of the full reel and wound over the top of an empty drum or reel. Or alternatively, from the bottom of a full reel to the underside of an empty drum or reel. By using these methods, reverse bends, which would cause twisting, looping and kinking of the rope, are avoided and the rope will be easier to handle.
- Always take care to prevent wire rope from running over sand, ash, grit, clinker, earth or mud. Never take a rope off one side of a reel laid flat on the ground, as a loop and a possible kink will be produced for each wrap of rope taken off.

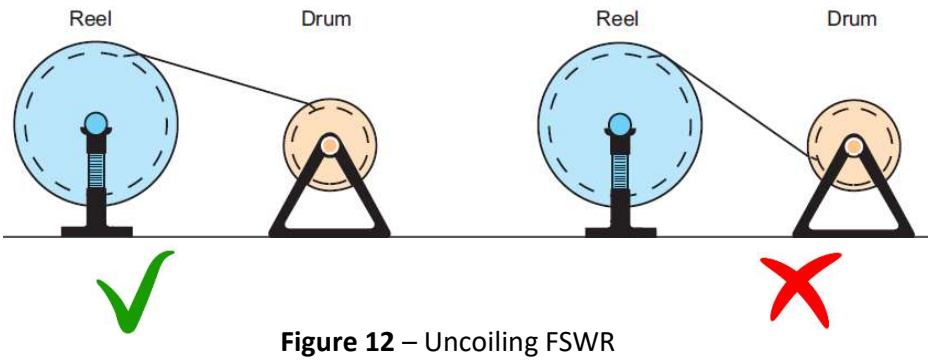


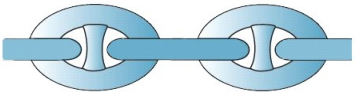
Figure 12 – Uncoiling FSWR

CHAINS

Chain gives no warning of failure, but it is better suited than wire rope for some jobs. Chains can be used to lift hot loads or heavy objects with sharp edges that could cut wire. When chain is used as a sling, it has little flexibility, but grips the load well. Load chain is heavier than wire rope used for the same application; however it can handle rougher treatment. Chain can be stored without serious deterioration and has a longer effective life than wire rope. Subject to good maintenance, the greater endurance and convenience of chain in many cases compensates for its greater weight and higher cost. Some of the advantages of chain over wire rope are:

- Withstands rough handling.
- Not likely to tangle or knot.
- Very flexible when not under load.
- More resistant to abrasion and corrosion.
- Wear in the links is easily seen.
- High working load limit.

Types of Chains

Type	Description
Short Link chain 	The size of the chain is determined by the diameter of the material in the actual link. Short link chain is made in short links to provide greater strength. The link length does not exceed five times the diameter of the link or 3.5 times the diameter in width. Short link chain is the only chain to be used for lifting when the chain is not required to be calibrated.
Stud Link Chain 	Stud link chain has a stud across the centre of each link. It is not suitable for lifting purposes and is used mostly in the marine industry.

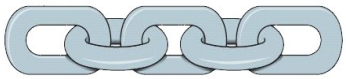
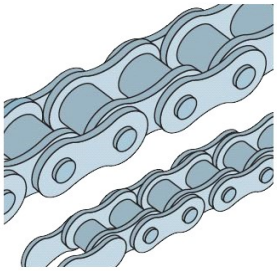
Type	Description
Calibrated Chain 	Calibrated chain has the link sides parallel to prevent stretch under load and is pitched so that the links are a constant and accurate length. Calibrated chain rides smoothly in the groove of a sheave or drum, or in the pockets of a load sheave (gypsy). This chain is principally used on chain blocks. Chain length will not exceed six times the diameter of the material used, and width does not exceed 3.5 times the diameter of the material used. Welds must be smoothly finished, free from fins or flashes. Weld diameter must not exceed the diameter of the material from which the chain is made.
Brush and Roller Chain 	Bush and roller chains are parallel or flat chains, commonly seen on the drive sprockets of cycles or forklifts. Because of their inability to bend sideways, they cannot be used as load chains to suspend loads except where the loads run in guides.

Table 4 – Chain Type Examples

Lifting Chain Grades

Chains are made in various grades and marked on a link at regular intervals. The word 'grade' means tensile strength of chain. Grade 80 chain is the only chain suitable for overhead lifting. Chain slings must have permanently affixed durable identification tag stating size, grade, rated capacity and reach. If there is no WLL tag attached to the chain, look for the grade markings as shown in the table below and arrange to have the identification tag replaced. If the grade markings are unclear or if there are no marks or stamping, the chain should not be used for lifting.

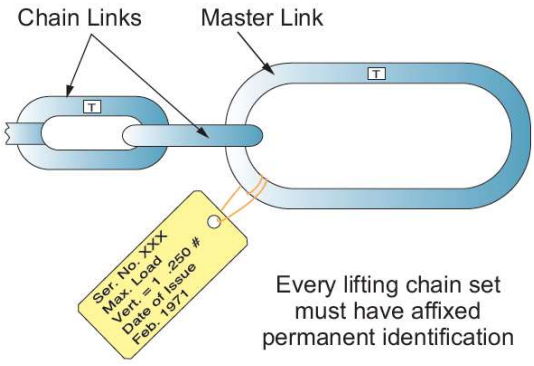


Figure 13 – Lifting Chain Identification

Lifting chains and chain slings are marked with different letters. These letters tell you what grade the chain is:

Grade	Description
30(L)	30(L) or 30 or 3. This is the minimum grade chain used for safe lifting of loads. Industrial and agricultural applications including guard rail chain, logging and load securement. Not recommended for overhead lifting.
40	M or 40 or 4 or 04 (High tensile chain). Approximately 50% stronger than grade 30. Typical uses are load binding, tie downs and towing.
50	P or 50 or 5 or 05.
60	S or 60 or 6 or 06. May be used in rigging and lifting applications.
70	Links are heat treated. Ideal for transport, load binding, logging and towing. 20% stronger than grade 40 chain and about 60% stronger than grade 30. Not recommended for overhead lifting.
80	T (Higher tensile/High grade Herc-Alloy chain used extensively for all load lifting uses). Most common chain for lifting. Widely used for slings, magnets, heavy duty dragging and pulling.
100	V (Very high tensile chain – Usually pink in colour). Approximately 25% stronger than grade 80.

Table 5 – Chain Grades

The following types of chains **MUST NOT** be used for lifting a load:

- Wrought iron chain.
- Grade 75 (transport lashing chain).
- Proof coil chain.
- Approved grade chains under allowable diameter.
- Mild steel chain.

Lifting chain is proof-tested short link chain. The barrel of short link chain requires a greater force to bend, provides greater strength, reduces the tendency to twist and provides better reeving performance.

Grade markings or letters denoting the grade are stamped or embossed on the chain at least every metre or every 20 links, whichever is less.

Grade 80 (T) chain is the minimum grade of chain that can be used for general load lifting uses, such as wrapping and reeving.

Safe use of Chains

When using chains always check that the chain is suitable for the task. Grade 80 chain is the only chain that should be used for overhead lifting. The smallest diameter high tensile Grade 80 chain that should be used for safe load handling is 5.5 mm. For Grade 30 chain the smallest diameter chain that can be used is 8 mm; however Grade 30 chain is not to be used for overhead lifting.

Chains can be exposed to higher operating temperatures than wire or synthetic rope. Chains do still have limits and must be discarded when exposed to temperatures exceeding those limits. The maximum temperature for mild steel (Grade 30) chain to be exposed to is 260°C, and then it must be discarded. For high tensile Grade 80 chain the maximum temperature for exposure is 400°C. Discard any chain that has been exposed to temperatures above these limits. Any lifting chain exposed to temperatures above 200°C must have the WLL reduced.

Temperature Range	WLL Reduction Factor
260°C to 350°C	0.85
350°C to 425°C	0.66

Table 6 – Grade 80 Temperature Reduction Factors

Precautions When Using Chains

- Make sure the chain is of the correct size and grade for the load.
- Make sure all attachments and fittings are of a type, grade and size suitable for service with the chain used.
- Inspect each link regularly for wear, nicks, gouges, stretch, localised bending and shearing.
- Take damaged chains out of service and send to the manufacturer to be repaired.

- Arrange for any non-repairable defective chain to be destroyed so that others cannot use it.
- Never exceed the rated working load limit.
- Know the weight of all loads to avoid accidental overload.
- Avoid impact (sudden) loading.
- Store chains where they will not be damaged or corroded.
- Never shorten a chain by twisting or knotting it or with nuts and bolts.
- Never wrap chain around sharp corners without padding, packing or corner pads.
- Never hammer a chain to straighten the links or to force the links into position.
- Avoid crossing, twisting, kinking or knotting a chain.
- Never use the tip of a chain hook to carry a load.
- Never re-weld alloy steel chain links. Return it to the manufacturer for repair.
- Do not drag a chain from under a load.
- Do not drop a chain from a height.
- Do not roll loads over a chain.
- Do not place a ring, shackle or eyebolt on a crane hook unless it hangs freely over the bow of the hook.

Special precautions should be taken and a larger size chain or sling should be used:

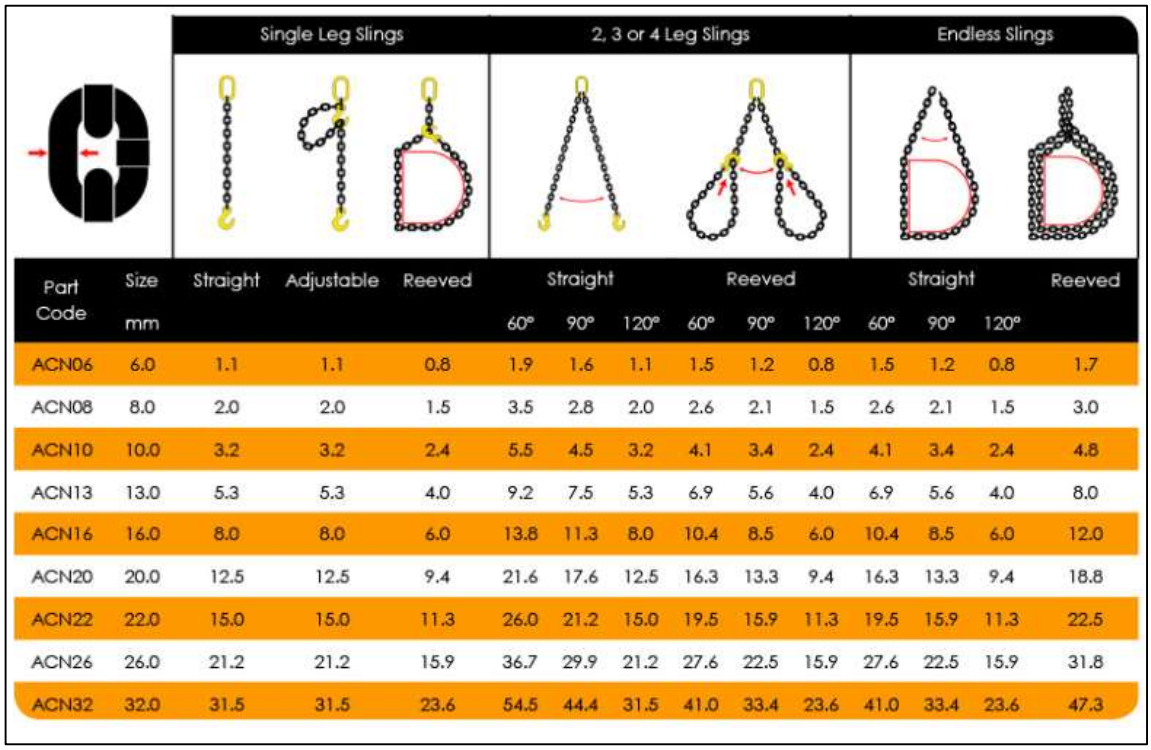
- Where the exact load is in doubt.
- When there is liability of shock loads.
- When the conditions are abnormal or severe.
- When there is exceptional risk to personnel or equipment.

Note: Never use a chain when it is possible to use wire rope. Chain does not give any warning that it is about to fail. Wire rope on the other hand fails a strand at a time, giving you warning before failure actually occurs.

Working Load Limit

Where a chain is reeved around an object, the bending action greatly weakens the nipped link or links, therefore a chain must be selected that is strong enough to lift twice the weight of the object. This allowance is made in addition to all other allowances made, for example, in addition to that for angles between legs and other reeving points. Use packing or corner pads if the chain is bent around tight bends or if there are sharp corners on the load. This will protect and reduce stress on the chain.

Always calculate the WLL of the chain and all lifting equipment. The WLL of lifting equipment may be reduced depending on the slinging configuration. Ensure that all situations and reductions are accounted for when calculating the WLL.



Part Code	Size mm	Single Leg Slings: Straight	Adjustable	Reeved	2, 3 or 4 Leg Slings: Straight 60°	90°	120°	Reeved 60°	90°	120°	Endless Slings: Straight 60°	90°	120°	Reeved
ACN06	6.0	1.1	1.1	0.8	1.9	1.6	1.1	1.5	1.2	0.8	1.5	1.2	0.8	1.7
ACN08	8.0	2.0	2.0	1.5	3.5	2.8	2.0	2.6	2.1	1.5	2.6	2.1	1.5	3.0
ACN10	10.0	3.2	3.2	2.4	5.5	4.5	3.2	4.1	3.4	2.4	4.1	3.4	2.4	4.8
ACN13	13.0	5.3	5.3	4.0	9.2	7.5	5.3	6.9	5.6	4.0	6.9	5.6	4.0	8.0
ACN16	16.0	8.0	8.0	6.0	13.8	11.3	8.0	10.4	8.5	6.0	10.4	8.5	6.0	12.0
ACN20	20.0	12.5	12.5	9.4	21.6	17.6	12.5	16.3	13.3	9.4	16.3	13.3	9.4	18.8
ACN22	22.0	15.0	15.0	11.3	26.0	21.2	15.0	19.5	15.9	11.3	19.5	15.9	11.3	22.5
ACN26	26.0	21.2	21.2	15.9	36.7	29.9	21.2	27.6	22.5	15.9	27.6	22.5	15.9	31.8
ACN32	32.0	31.5	31.5	23.6	54.5	44.4	31.5	41.0	33.4	23.6	41.0	33.4	23.6	47.3

Table 7 – Chain WLL Chart example

Inspection Criteria for Chains

You must check any chains carefully before using them. The below outlines what you are looking for. If a chain shows any of these then it is unsuitable for dogging.

- Missing rated capacity tag.
- Cracks in link welds, spot-welding.
- Exposure to excessive heat.
- Pitting.
- Twists and/or kinks and/or knots.
- Stretching, locked, movement restricted.
- Gouged/cut more than 10% of original link diameter.
- Severe/excessive rust or corrosion.
- Squashed/crushed more than 10% of original link diameter.
- Excessive wear on chain (over 10% wear in link diameter).

If you are using sling shorteners you must ensure they do not have more than 10% wear. More than 10% wear condemns them for use and they must not be used.

If any of these are present then the chain **MUST NOT BE USED!**

Chain slings should be made up to AS 3775 *Chain slings–Grade T* or the manufacturer's recommendations. When ordering parts for chain slings, ensure that they comply with the appropriate Standard.

The manufacturer's tag must be fixed on all chain slings. The tag must detail the rated capacity of the sling under all conditions and configurations of use.
If you cannot find a legible manufacturer's tag the chain sling should be taken out of service, in line with safe work procedures.

Rated Capacity of Chain
The rated capacity of chain is determined by the grade (G).

Do not use a chain to lift if it does not have a manufacturer's tag that gives details of the rated capacity. Return it to the manufacturer for rated capacity assessment and retagging.

To calculate the rated capacity of 80 grade lifting chain in kilograms, square the diameter (D) in millimetres (mm) and multiply by G (grade of chain) by safety factor (0.4 for Grade 80 chain). The below is an example for a Chain diameter of 10mm and Grade 80(T).

Example:	**Rated Capacity (kg) = D^2 (mm) x 80 x 0.4** = D^2 (mm) x 32 = D (mm) x D (mm) x 32 = 10 x 10 x 32 **= 3200kg** Therefore: Rated Capacity (t) = 3.2 tonnes or 3200kg

The previous equation can be reversed to calculate the diameter (D) in millimetres of chain needed to lift a given load. To do this, divide the load (L) in kilograms by G multiplied by safety factor and find the square root of the result. The below example is for a chain load of 3,200kg using a chain grade of 80(T).

Example:	**Diameter of Chain (mm) = √(Load (kg) / (80 x 0.4))** = √(3200 kg / 32) = √100 **= 10 mm** Therefore: A Grade 80 (T) chain, 10 mm in diameter, is needed to lift a 3200 kg load for a straight lift.

Shorteners

Shorteners are short chains with a hook at each end. They are used to shorten the length of a chain to a suitable length. The hooks on the shortener are hooked into the longer chain at a greater distance apart, effectively shortening that distance to the length of the shortener.

- When shorteners are used for shortening a multi-leg or single leg chain at the chain head, impose a 25% reduction on the WLL of that leg.
- If a pinlock is used, no reduction is needed.
- If a chain is reeved at the load, you still include the reduction at the multi-leg chain head.

Clevis Shortener Shortening clutches are similar to shorteners as they are used to shorten the effective length of a lifting chain. Care must be taken when using shortening clutches. The chain carrying the load must always lead out of the bottom of the clutch. If the direction is reversed so that the load carrying chain leads out of the top of the clutch, the front portion of the clutch may be pulled off and the load released.	 

Table 8 – Types of Hooks Example

SYNTHETIC WEBBING SLINGS

Synthetic webbing slings should only be used where an ordinary chain or rope sling is likely to damage the item being lifted. Synthetic webbing slings should never be used for general lifting applications.

They are made from nylon, polyester, polypropylene or aramid polyamide. Each sling must be labelled with their rated capacity.

Webbing slings may be sleeved to protect against the ingress of dust, or they may be close woven or treated in some manner to give the same protection. Webbing slings wrap around loads with smooth contacting surfaces. As the area of contact is greater than with round slings, it reduces the pressure applied to the load by the sling. They may be used in conjunction with wire rope or other slings.

There are three types of synthetic-webbing flat slings:

- Endless.
- Single or double-part with an eye at each end.
- Single or double-part with a terminal attachment at each end.

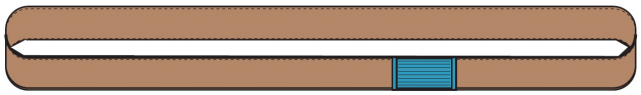
Endless	
With Flat Eyes	
With Reversed Eyes	
With Formed Eyes	
Single-Part or Double-Part with terminal attachment at each end	

Table 9 – Synthetic Webbing Sling Types

Specified webbing materials are high-tenacity, continuous multifilament polyamide (nylon), polyester (terylene, Dacron) or polypropylene yarns. Each type of webbing has different properties based on the material from which it is made. Always use the appropriate sling for the conditions of the lift. The properties of the most common slings are shown below.

- Polyamide, or nylon, is alkaline resistant but is damaged by acids.
- Polyester, or terylene/Dacron, is resistant to acid but is damaged by alkaline.
- Polypropylene is resistant to acid and alkaline but is damaged by organic solvents.

The use of these materials ensures high wet and dry strengths, abrasion resistance and resistance to attacks by microbes and many chemicals.

Flat sling lifting capacity is expressed in terms of maximum mass in tonnes that may be lifted in a straight pull. The breaking strength of webbing is measured in kiloNewtons per decimetre width.

Note: The elastic nature of the sling material allows high energy absorption, but slings which are stretched may take some time to recover. For this reason they should not be measured soon after use.

Ensure that synthetic web slings are not twisted when being used to support or lift loads, as this will decrease the rated capacity of the sling.

Webbing Sling Selection

Round synthetic slings are one of the most **DANGEROUS** types of lifting sling available to doggers and riggers. This is mainly because the fibres inside the sling do the lifting instead of the outside webbing sleeve.

This is dangerous because you cannot see the condition of the internal fibres. Therefore it is extremely important that you check these types of slings thoroughly for cuts, burn marks and tears on the outer sleeve. You should only ever use round synthetic slings for round loads or loads with edges that have been packed with soft packing materials, e.g. car inner tube or carpet.

Consider:

- Type of sling required — endless, single-part or double-part with an eye at each end, or single-part or double-part, with a terminal attachment at each end.
- Width and effective length.
- Material suitable for conditions (chemicals, heat, moisture).
- Maximum load and manner of use i.e. direct loading, basket hitch or choke hitch.
- Size of hook or details of other lifting devices with which the sling is to be used.
- The nature of loads to be handled.

Webbing Sling Markings

Synthetic-webbing slings have permanent markings with the Working Load Limit, the type of material from which the sling is made and any cautionary warnings. This information may be colour coded into the sling. The lifting capacity of a synthetic-webbing sling can be determined by the colour coding or by the SWL/WLL tag on the sling. Any flat webbing synthetic sling that does not have an information tag/label attached must be tagged as unserviceable, removed from service and returned to the manufacturer for testing and re-tagging.

Colour	WLL (Tonnes)
Violet	1 Tonne
Green	2 Tonne
Yellow	3 Tonne
Grey	4 Tonne
Red	5 Tonne
Brown	6 Tonne
Blue	8 Tonne
Orange	10 Tonne

Table 10 – Webbing Sling Colour Chart Example

Synthetic-webbing slings may be marked using:

- A printed label of woven fabric attached to a sewn joint.
- In some types of webbing, a single black line around the entire length indicates each tonne of WLL; this is a mandatory requirement of endless round slings.
- Stamping on the terminal attachment when fitted.
- A durable and corrosion-resisting plate permanently fixed to a terminal attachment when fitted.

The marking shows the following information:

- Manufacturer's name or trademark.
- Lifting capacity - WLL direct (straight) loaded.
- Type of webbing material - i.e. polyamide or polyester.
- Limitation of application - e.g. 'keep away from acids'.
- Month and year of manufacture.
- Identification marking correlating the sling with a warranty certificate.

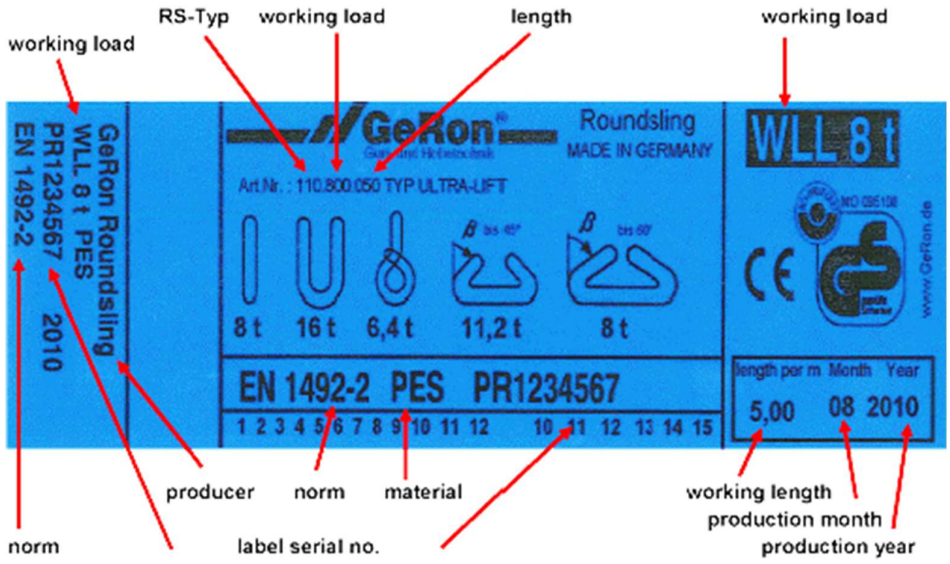


Figure 14 – Identification Label Example

Safety Checks When Using Webbing Slings

When using webbing slings always ensure that:

- The sling material will resist chemicals, heat and exposure to sunlight to the degree necessary in the circumstances of its use.
- The lifting capacity (WLL) consistent with the method of lift and reeving is not exceeded.
- Allowance is made for shock loading, unusual or severe working conditions and particular dangers.
- Slings are placed around the load so that it is balanced.
- The sling must be straight, untwisted and not crossed as this will decrease the WLL.
- The splice of endless slings must not be bent around the hook or load.
- When used in pairs, the slings are as close to vertical as possible. Use a spreader beam if necessary.
- The sling is protected where necessary from abrasion or cutting by the load which may cause serious loss of strength.
- Slings are fitted with a non-destructive tag.
- Slings are not dropped from a height.
- Slings are not pulled from under a load when the load is resting on the sling.
- Lagging, edge chaffers or other adequate protection are used on sharp corners or edges.
- Choke hitched slings are located so that the nip of the choke is not on the load bearing seam.
- The angle between the legs of choke hitches, basket hitches or multi-leg slings does not exceed 120°.

Note: Nylon slings can suffer a loss of strength of up to 18% when wet, but regain that loss of strength after drying. This is allowed for in its WLL.

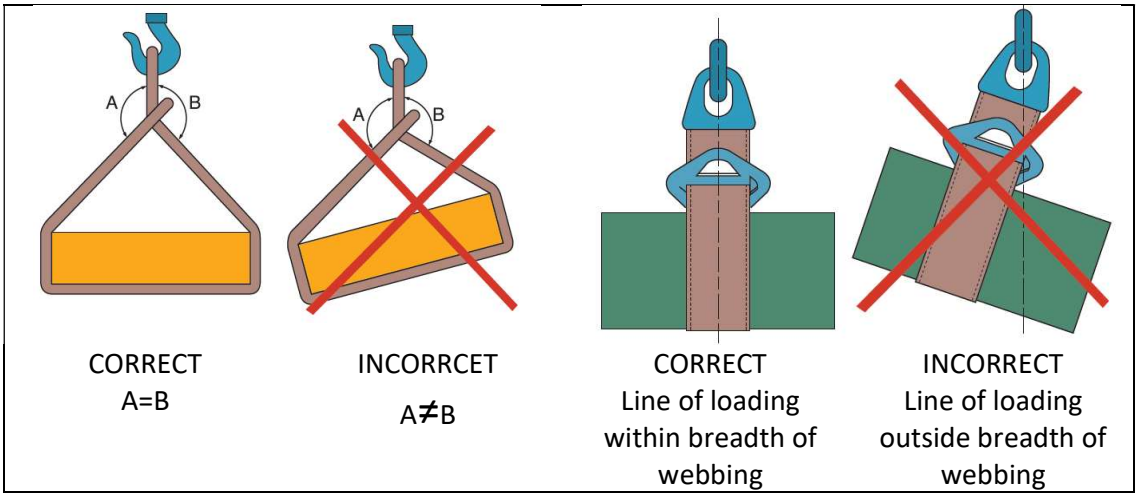


Figure 15 – Balancing the load

Working Load Limit

The WLL of webbing and round slings depends on application and capacity, which are coded and shown adjacent. The maximum working load applied to a synthetic webbing flat sling when reeved is determined by multiplying the sling's lifting capacity (WLL) for direct loading by the appropriate factor.

	M = 1.0	M = 0.8	M = 2.0	M = 1.9	M = 1.7	M = 1.4	M = 1.0
SLING TYPES	VERTICAL WLL	CHOKE WLL	BASKET WLL	30° WLL	60° WLL	90° WLL	120° WLL
	KG	KG	KG	KG	KG	KG	KG
Violet	1000	800	2000	1900	1700	1400	1000
Green	2000	1600	4000	3800	3400	2800	2000
Yellow	3000	2400	6000	5700	5100	4200	3000
Grey	4000	3200	8000	7600	6800	5600	4000
Red	5000	4000	10000	9500	8500	7000	5000
Brown	6000	4800	12000	11400	10200	8400	6000
Blue	8000	6400	16000	15200	13600	11200	8000
Orange	10000	8000	20000	19000	17000	14000	10000

Table 11 – Webbing Sling WLL Example

Inspection Criteria for Synthetic Slings

You must check any synthetic slings carefully before using them. The checklist below outlines what you are looking for. If a synthetic sling shows any of these then it is unsuitable for dogging and should be tagged, separated from usable equipment and reported to the appropriate person.

- Missing or illegible Rated Capacity tag.
- Stretched or damaged sleeve.
- Cuts, tears or contusions in outer sleeve.
- Damage to stitching.
- Burn marks on outer sleeve.
- Damage from temperature or sunlight exposure.
- Excessive internal or external wear, burns or abrasions.
- Damage to eyes, terminal attachments or end fittings.
- Broken fibres/strand (internal wear). You can usually feel a soft lump on the inside of the sleeve.
- Damage from chemical exposure (including alkaline or acidic substances or solvents).

Storage of Synthetic Slings

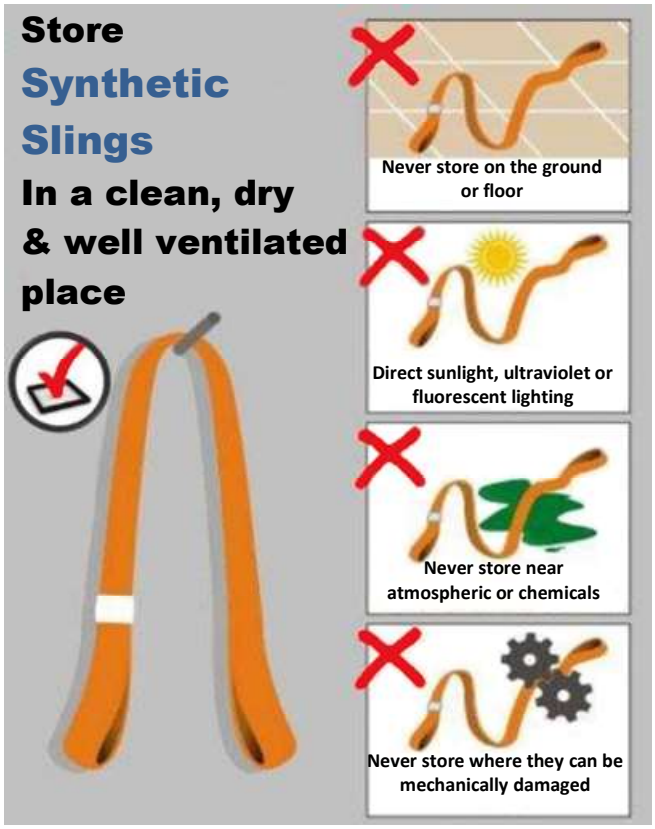


Figure 16 – Sling Storage

SHACKLES

A shackle is a portable link, used for joining various pieces of lifting equipment. The two main shapes for load lifting are the 'dee' and 'bow' shackles.

Figure 17 – Bow Shackle

Figure 18 – Dee Shackle

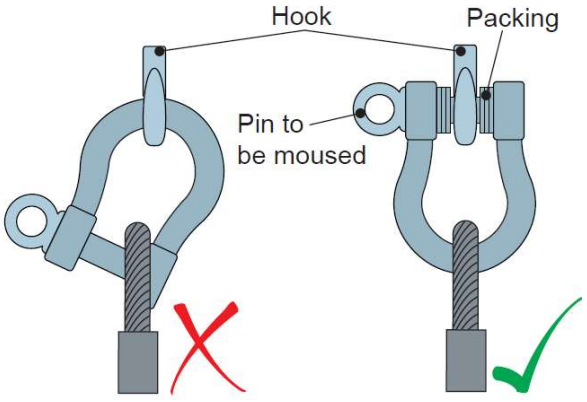
Almost all shackles are made of round bar and have circular eyes. The pin of the common shackle screws directly into one eye and should preferably have a collar.

In some shackles, the pins pass clear through both eyes and are secured by a split pin forelock (i.e. split flat cotter pin) or nut and split pin.

If you are using a shackle to support multiple slings ensure that you use a bow shackle. Always use the correct size of shackle pin. Do not use a nut and bolt in place of the proper shackle pin. A bolt that does not fit tightly is likely to bend and break.

Shackles must have their rated capacity stamped on the shackle (not on the pin).

The WLL of a shackle is marked on the shackle. Do not use a shackle if the WLL is missing or is not legible. Never allow a shackle to be pulled at an angle, as this will open the legs up and severely reduce the WLL. When fixing a shackle to a crane hook the shackle should be positioned so that the pin rests on the crane hook. Pack the shackle pin with washers so that the hook is centred and the load is carried evenly.



Always inspect shackles for defects before carrying out any lift. Never use a shackle or pin that is bent or damaged in any way.

A shackle is to be removed from service and discarded if it is:

- Bent.
- Cracked.
- Damaged.
- Deformed.
- Missing the WLL or the WLL is illegible.
- Nicked, cut or gouged deeper than 10% of the diameter.
- Missing its pin or has a pin that fits incorrectly.
- Wear of the pins or shackles equal to, or more than, 10% of the diameter.

EYEBOLTS

Eyebolts are used extensively as lifting lugs on set pieces of equipment. The safest eyebolt is a collared eyebolt. Un-collared eyebolts should only be used where the pull on the eyebolt is vertical.

Figure 19 – Un-Collared Eyebolt

Figure 20 – Collared eyebolt

Collared eyebolts can be used where the pull is at an angle or a vertical lift. The underside of the eyebolt should be machined and the seating upon which the eyebolt is tightened should also be machined.

The eyebolt should be tightened so that both faces meet in a neat tight fit. If both faces are apart the collar is of no use.

Where two eyebolts are used to lift a load, a pair of slings should be shackled into them. Do not reeve a single sling through two eyebolts and then put both eyes on the hook.

USING SHACKLES AND EYEBOLTS

A shackle is used to couple an eyebolt to a hook or chain. The safest eyebolts have collars that prevent bending when the eyebolt is pulled at an angle. The tension in any leg of a sling attached to an eyebolt will always be applied with the eye, so that it does not tend to bend the eye sideways.

Never insert the point of a hook into an eyebolt, always use a shackle. Do not use a sling reeved through an eyebolt or reeved through a pair of eyebolts. One single sling leg should be attached to each eyebolt. Eyebolts must be kept in line with each other. Where eyebolts cannot be kept in line with each other and at the same time tightened, thin washers or shims may be inserted under the collars to allow the eyebolts to be tightened and turned in line with each other.

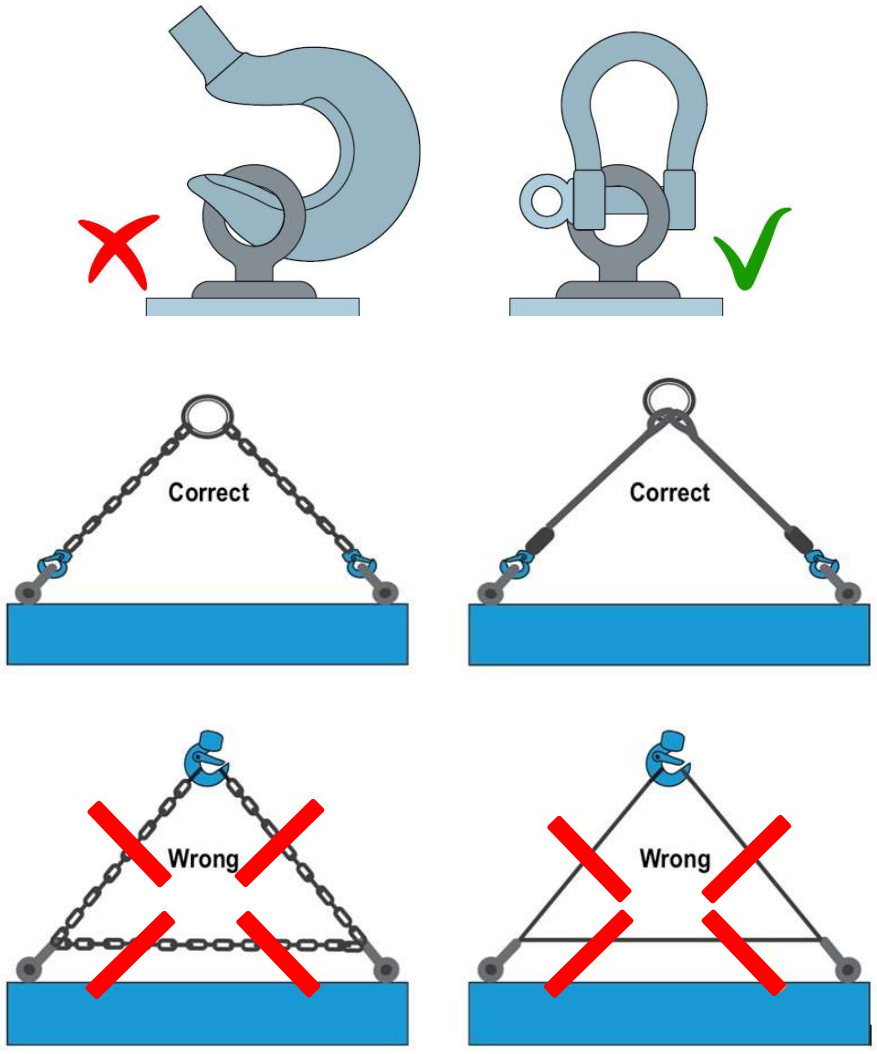


Figure 21 – Attaching to Eyebolts

Collarless eyebolts are only to be used for direct steady vertical lifts, and then only where the eyebolt is of sufficient size. Pulling a collarless eyebolt at an angle will bend or break the shaft of the eyebolt. Collared eyebolts can be used for slinging and lifting at an angle. Collared eyebolts are used when lifting with multiple leg slings where the pull on the slings is not directly vertical. Angular pull must only be applied in the plane of the eye and not at right angles to it.

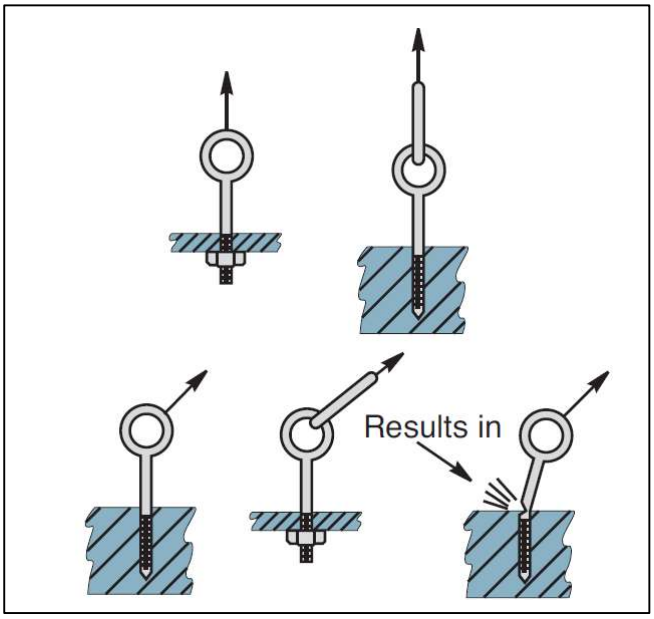


Figure 22 – Use of Un-Collared Eyebolts

Never heavily hammer an eyebolt on the crown to tighten it. A light hammer may be used after tightening to check the 'solid feeling', which indicates a properly fitted eyebolt.

SPREADER AND LIFTING BEAMS

Spreader and lifting beams are devices which spread the load evenly for a given lift. They are generally made to suit a particular job.

Most have a central lifting point for the crane or lifting medium, and have two or more lugs underneath to take the load slings. All spreader beams must be suitable to lift the particular load and must be branded with the rated capacity.

The rated capacity must include the weight of the load plus all lifting gear (slings, shackles etc.). The spreader beam must also display the weight of the beam and its serial number.

Lifting Beam

A lifting beam performs the same role as a spreader bar. The difference is the crane connection method. The lifting beam connects directly to the crane or with the use of a short sling (snotter), and the load may be connected at any point on the lower edge of the beam. The beam must be engineer designed and load stamped.

Because of its capacity to hold a load rather than divert sling angles, a lifting beam is heavier and far more robust.

A second use for a lifting beam is for equalising a load to be lifted by two cranes. This is achieved by inverting the beam, connecting each end to a crane and suspending the load from the centre of the beam.

Figure 23 – Lifting Beam Examples

Spreader Beam

A spreader beam literally "spreads" a two-legged top sling. A spreader beam has better stability than a lifting beam and a higher potential capacity for a given size of steel section used. Spreader beams require more headroom than lifting beams due to the two-legged sling arrangement at the top.

Figure 24 – Spreader Beam Examples

Note: A spreader bar must be engineer designed and have the WLL and self weight permanently marked on it.

Lifting slings must be connected to the spreader at the same distance as the slings to the crane hook.

Where long loads are to be lifted, it is possible to use two identical spreaders to lift a load using four slings attached to the crane hook. Spreaders designed for this type of use have provision for a bar to be fitted to each end to keep them a set distance apart. This becomes what is referred to as a box spreader.

TAGLINE

A tagline is used to assist in the safe landing and control of the load. It is appropriate to use taglines when working near overhead power lines and at any time where the load may become easier to control in the landing process.

Taglines may also be necessary if the load is liquid with a moving centre of gravity, if it is windy, or if there are obstacles or obstructions that need to be avoided during the move (that could not be removed).

Natural fibre ropes are commonly used for taglines as they are strong and non-conductive.

The minimum diameter fibre rope you can use as a tagline is 16mm. DO NOT use a wet rope as a tagline – it could conduct electricity if coming into close range of power lines.

When using a tagline, do not wrap the rope around yourself as you may be dragged by a sudden movement of the load. Always wear gloves when using a tagline.

PLATE CLAMPS

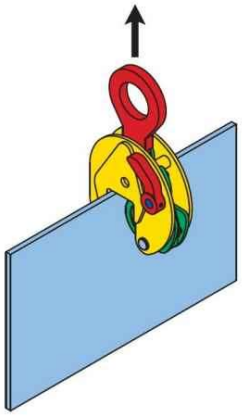


Plate clamps eliminate the need for drilling or creating a hitch. The most important parts of a plate clamp include the lifting shackle, spring, teeth within the jaw, and the various links and pins. To lift a plate, the teeth of the plate clamp need to be pushed into the plate. With help from the powerful spring, this turns the lifting point of the clamp into the lifting point of the plate and essentially causes the two objects to become one.

What's great about plate clamps is that their grip strength automatically increases as the load gets heavier. Essentially, the weight of the load determines how much link tension there will be, and the link tension determines jaw torque and ultimately grip strength. Learn more about what this means below.

Vertical plate lifting clamps can lift and turn over flat plates 180 degrees and can be used to transport plates in a vertical position.

Vertical lifting clamps should never be sideloaded and you should never try to lift more than one plate at a time. If you're lifting a long plate, you should consider using two clamps connected to a spreader bar to minimize swing and maximize lifting safety. Also, keep in mind that plates which are hot in temperature can damage the structural integrity of the plate clamp. Columbus McKinnon recommends that you do not lift plates that are 250 degrees or higher.

Note: Slips on harden surfaces

LOAD MOVING ATTACHMENTS

Magnetic

Electrically operated magnetic lifting devices, in the form of a single magnet or a group of magnets suspended from chains or wires or attached to lifting equipment in another way, can be used for lifting and transporting steels and most ferrous materials or components without the need for slingers. They are widely used in many industrial sectors including metal/component manufacture and storage, shipbuilding, and metal recycling facilities.

Figure 25 – Magnetic Attachment Examples

Magnets can be provided without power supply i.e. permanent magnets, or where power is supplied from an external source or through an in-built battery. Electro-permanent magnets are also available where permanent magnets are utilised to hold the load and power is used to release the load. Power is used to both energise and release the load. They use a combination of permanent magnets and magnets whose polarity is switched by an electrical pulse rather than mechanically. Some can be partially energised to facilitate load shredding. Different shapes and types of magnet are available, for example:

- flat pole plate magnets for handling sheet metals and bulk goods such as scrap iron, etc;
- specially-shaped pole plate magnets for lifting pipes, round steel bars or sectional steel;
- magnets with adjustable pole fingers for lifting items of irregular shape;

Vacuum

Vacuum lifters are types of lifting equipment that incorporate a vacuum as or as part of the lifting mechanism. They consist of a below-the-hook frame with a large vacuum pad or several smaller suction cups for grabbing large sheets, rolls, plates, or other smooth-surfaced products. They are driven by pneumatic, hydraulic, electric, or mechanical power.

There are many different types of vacuum lifters. Choices include heavy-duty lifters, vertical-horizontal lifters, coil lifters, battery-powered vacuum lifters, and products with mobile attachments.

- **Heavy-duty** vacuum lifters are made with oversized lifting frames, vacuum pads, and vacuum stations. They are designed to handle materials and products such as metal plates.
- **Vertical-horizontal** lifters can hold a load in place either vertically or horizontally, depending on the application requirements.
- **Coil** lifters are vacuum lifters for handling rolls and coils.
- **Battery-powered** lifters are similar to electrically-powered devices, but have a rechargeable battery.
- **Mobile attachment** vacuum lifters are suitable for use with forklifts, excavators, and other end-effector equipment.

Figure 26 – Vacuum Attachment Examples

Grab

A Crane Grab is a special tool used by cranes to grab dry bulk goods. Two or more bucket jaws can be opened and closed together to form a space for the material, when loading the jaws are closed in the material pile, the material is caught in the space, when unloading the jaws are opened in the material pile under suspension, the material is scattered on the pile, the opening and closing of the jaws are generally manipulated by the crane hoisting mechanism wire rope.

Figure 27 – Grab Attachment Examples

Grabs are the main tool for dry bulk cargo handling in ports, as they are free from heavy physical labour and can achieve high loading and unloading efficiency and safety. According to the type of cargo to be handled, they can be divided into ore grabs, coal grabs, grain grabs, timber grabs, etc.

The more common forms of crane grabs in daily use are shell and multi-petal. The shell grab relies on the opening and closing of two combined buckets to grab and load bulk materials and is mainly used in sand mills, coal mines, mines and infrastructure construction to complete the grabbing and lifting of bulk materials such as sand and gravel, coal dust, coal

blocks, earth stones and soil. Timber and straw grabs are also part of the shell grabs and can be used in timber mills to grab round logs and straw treatment plants to grab straw bales.

The multi-flap grab is controlled by the opening and closing of multiple jaws to grab the material, and is used for steel scrap grabbing and sorting in steel mills, bulk waste and waste sorting, loading and unloading and handling in waste disposal yards and construction sites, and car dismantling, sorting and recycling in car recycling yards, with replaceable teeth and high hardness wear-resistant steel to ensure a long service life; flap shells can be selected according to different working environments Fully closed flap shells, semi-closed flap shells, wide flap shells and narrow flap shells.

Figure 28 – Grab Attachment Examples

COMMUNICATION REQUIREMENTS

Before starting work you will need to determine the best communication methods for the situation.

Talk to the crane operator before you start and select the methods that you are going to use to communicate during the lift. This may include:

- **Hand signals** – should be used only when the crane operator is always in direct view of the person dogging the load.
- **Whistle signals** – may be used if the crane operator is in or out of view of the person dogging the load.
- **Fixed channel two-way radios** – should be used if:
    - Hand signals can't be seen.
    - Whistle signals cannot be heard or they may be confused with other whistle signals where multiple cranes are in use in the area.
    - It is more efficient than other methods.

Hand and whistle signals used in Australia.

ACTION	WHISTLE, BELL or BUZZER	HAND SIGNAL
Hoist Raising	2 Short ●●	
Hoist Lowering	1 Long ▬	
Luffing Boom up	3 Short ●●●	

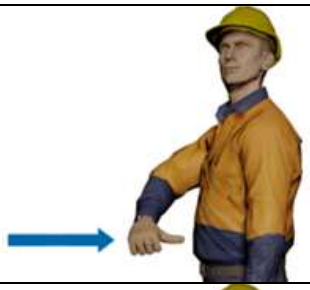
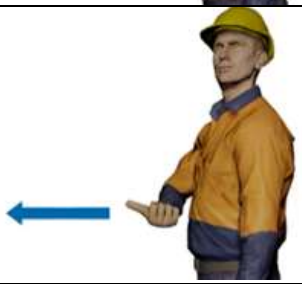
Luffing Boom Down	4 Short ● ● ● ●	
Slew Right	1 Long, 2 Short — ● ●	
Slew Left	1 Long, 1 Short — ●	
Jib/Trolley Out **Telescoping Boom Extended**	1 Long, 3 Short — ● ● ●	
Jib/Trolley In **Telescoping Boom Retract**	1 Long, 4 Short — ● ● ● ●	
Stop	1 Short ●	

Table 12 – Hand & Whistle Signals

Inspect Communication Equipment

If you are using any communication equipment (such as fixed channel two-way radios) make sure that it works before starting the job. This includes checking that radios are charged up and will not stop working half way through the task.

DEFECTS

If you identify any equipment that is defective, damaged or faulty you must not use it. The equipment needs to be isolated from use to stop anybody from accidentally using it and the defect needs to be reported to an authorised person.

Make sure you complete any isolation procedures as required.

This may include tagging or locking out equipment and completing fault reports or other documentation.

Faulty lifting equipment may need to be labelled and rejected, destroyed or returned to the manufacturer (depending on the type and severity of the fault).

- Do not use.
- Tag out.
- Report to supervisor.

Figure 29 – Danger and Out of Service Tags

SELECT SLINGING METHODS

The way you sling the load will depend on the size, shape and requirements of the load. Some slinging techniques reduce the rated capacity of the slings. Make sure you have allowed for the reduction when you are selecting the slings and lifting equipment for the job.

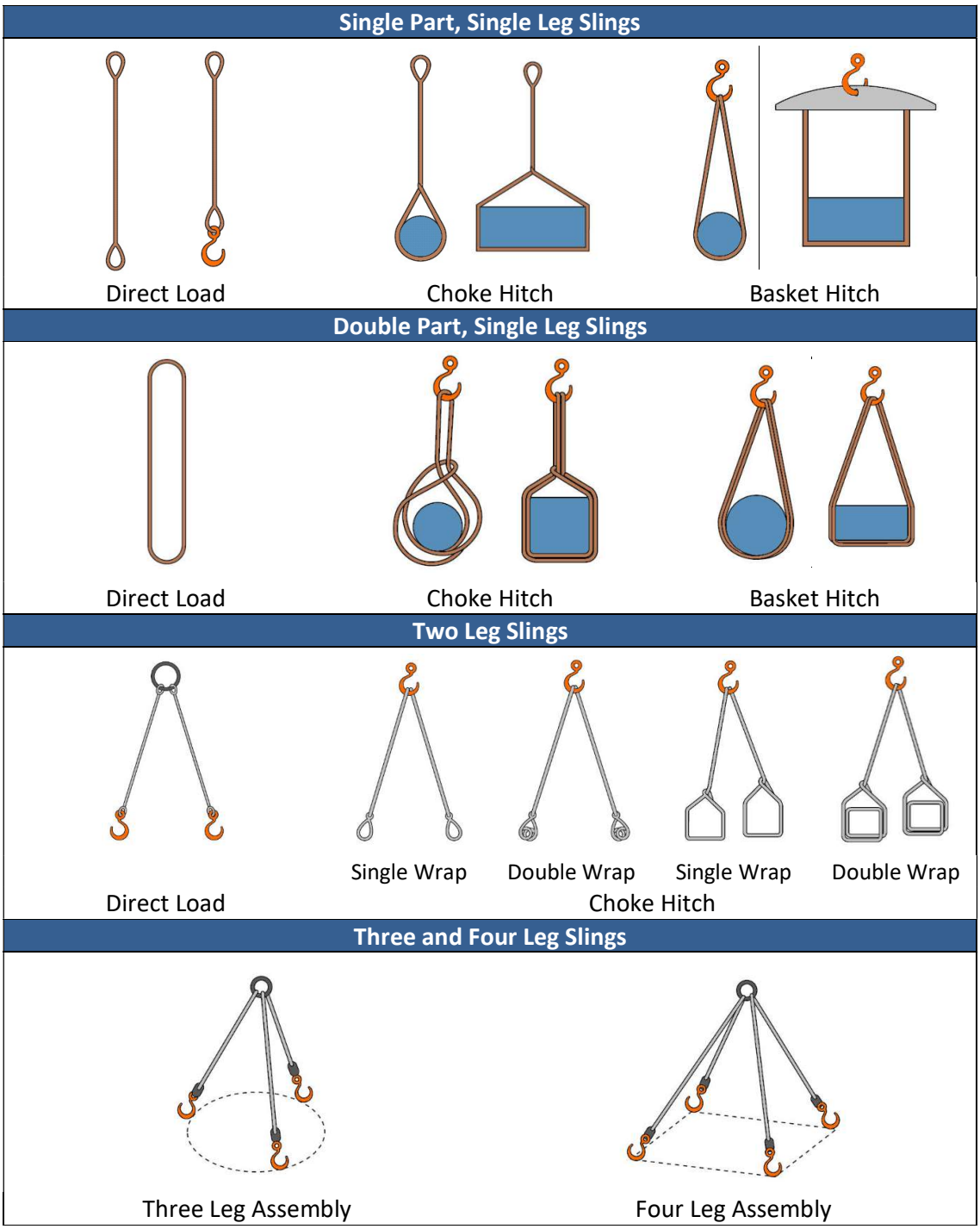


Table 13 – Sling Methods

LOAD FACTORS AND SLINGING

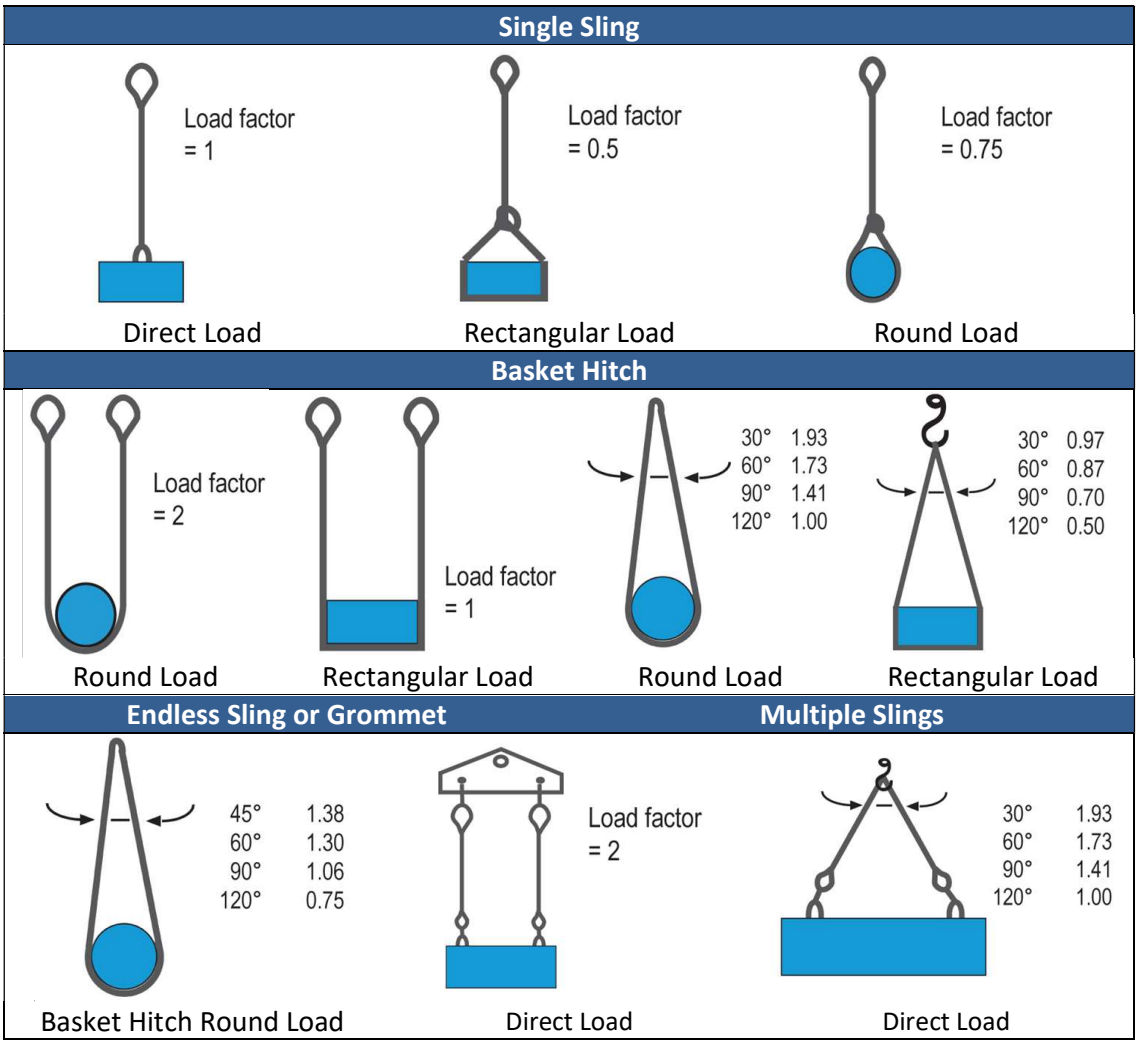
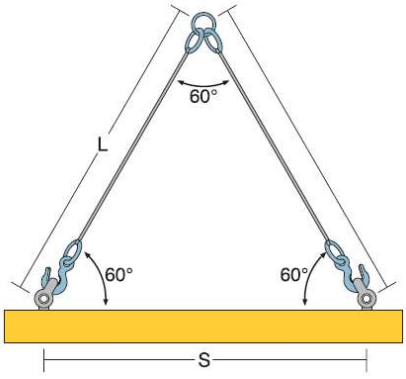


Table 14 – Load Factors

The lifting capacity decreases as the angle between the legs of the sling attachment increases. Different methods of slinging will also alter the lifting capacity.

A simple rule of thumb for a good safe working angle is to make sure that the horizontal distance between the points of attachment of the load does not exceed the length of the slings i.e. if 'L' is greater than 'S' the angle is OK.

This will ensure that the angle between the two legs of the sling does not exceed the recommended angle of 60°.



The recommended maximum angle between the two legs of a grade 80 or 100 chain sling is 120°.

When you are using two slings to lift a load and are determining the length and capacity of the slings required, ensure that you consider:

- The weight of the load.
- The reeve factors.
- The angle factors.
- The size of the load.
- The slinging method.
- The clearance required to make the lift.

When slinging a rigid object with a multi-legged sling it must be assumed that only two of the sling legs are taking the load.

Additional legs do not increase the rated capacity of the sling assembly, therefore each leg has to be capable of taking half of the weight of the load.

The maximum angle of a four-legged sling is the greatest angle between any two of the four slings. This is generally between the diagonally opposite legs. The rated capacity is assessed through the largest included angle in the multi-legged sling assembly.

The rated capacity of slings decreases as the angle between the slings increases or if the slings are nipped or reeved. All factors must be considered when determining which sling is the correct one to lift a given load.

Included Angle	Load Factor
60 degrees	1.73
90 degrees	1.41
120 degrees	1

Table 15 – Degrees and Load Factor

SAFE SLINGING TECHNIQUES

You can determine the safest slinging points on a load through calculation or by conducting a test lift.

Calculations such as measuring the distances from the centre of the load out to the slinging points and evenly distributing the weight will ensure that the lifting points are safe.

This is the best method, but may not always be possible.

When selecting suitable slinging points make sure that you consider:

- The centre of load distribution and load balance.
- Security of slings.
- Reeve and angle factors.
- Weight of load.
- Avoiding damage to the load.

DO'S AND DON'TS OF SLINGING AND LIFTING

Do's	Don'ts
✓ Place packing/dunnage under loads to allow for easy sling removal after setting down. Make sure loads and base is firm if loads are to be stacked. ✓ Use bow shackles where more than two slings are placed on a hook, particularly if the hook is large. ✓ When using more than one sling on a load which is heavy at one end, ensure that the sling at the heavy end is rated for the larger load. ✓ If possible, position the crane so that you can always see the load. ✓ Watch for hazards that the crane driver may not see. ✓ Wherever possible position yourself so that the crane driver can clearly see you and your signals. ✓ Ensure that the crane hook is directly over the load. If the hook is not directly over the load, the load will swing when lifted. Swinging overloads slings and can put excessive side loading on the boom, causing boom failure.	× Don't use worn or broken gear. × Don't leave unused sling legs or hooks dangling when the crane is travelling. × Don't trail slings along the ground, or pull slings from beneath loads with a crane. × Don't use bricks, concrete blocks, or other crushable objects when packing under loads or between stacks. × Don't leave the pins out of shackles when not in use. × Don't use bolts when the pins are lost. × Don't knot wire rope and chains, or join chains with nuts and bolts. × Don't cross, twist, or kink any chain. × Don't drop a chain from a height. × Don't roll loads over a chain. × Don't place a sling, shackle or eyebolt on a crane hook unless it hangs freely over the bow of the hook. × Don't place several slings on the same hook without a safety latch or mousing. × Don't leave wire rope slings attached to the load and crane during welding.

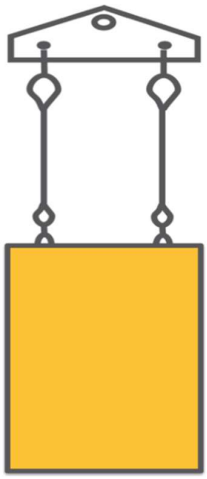
Do's	Don'ts
✓ Always close latchhooks after attaching or releasing them. ✓ Keep hands and fingers clear when a crane is first taking the strain on a load. ✓ Conduct a test lift. ✓ Check that support personnel are clear of the load prior to taking up the strain. ✓ Ensure no personnel are standing close to the chassis or outriggers of a slewing mobile crane. They can become jammed or crushed by the rotating counterweight. ✓ Check slings, and balance the load before lifting load further. Continue to check the slings and balance as the load is being lifted. ✓ Carry loads as close to the ground as possible, just high enough to clear any obstacles. ✓ Constantly monitor the load and lifting area as the lifting operation proceeds. ✓ All personnel must stand clear of loads, particularly when they are being moved. Heavy loads should be tied, as a person attempting to hold them steady may easily be crushed against the crane or other object. ✓ Use sling protection, for example a conveyor belt, car tyre rubber, timber or purpose built protector. Do not use material, cloth bags or similar materials.	Earthing through a shop crane may damage both the wire rope slings and the crane. × Don't guess at the weight of loads or the capacities of cranes, or of any lifting gear. Refer to manufacturer documentation. × Don't overload hooks or lift loads on the point of hooks. × Don't reeve slings on wide heavy loads. × Don't impose angular pull on the ferrule of a mechanical splice. × Don't reeve a sling around an open top load, without using a spreader to prevent crushing. × Back hooking is not recommended (passing a leg of a sling around a load back onto the crane ring). × Do not ride on a lifting hook, sling attachment or suspended load, with the exception of riding in a suspended workbox that meets all statutory and necessary requirements.

Table 16 – Slinging Do's & Don'ts

SLINGING TECHNIQUE 1

A drum filled with water is to be lifted with two vertical flexible steel wire rope (FSWR) slings fixed to a spreader:

What is the minimum diameter FSWR required to safely lift the drum?



- The weight of the load is 1500kg.
- The lifting beam weighs 400kgwith a WLL of 4 tonne.

Drum Filled With Water

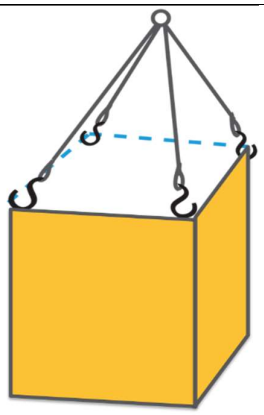
Calculations:	Rated Capacity = Weight of load divided by angle factor. = 1500 ÷ 2 = **750kg** Diameter of FSWR sling (mm) = Square root of (Rated Capacity (kg) ÷ safety factor 8) = √ (750 ÷ 8) = √93.75 = 9.682 Therefore: **FSWR diameter = 10mm** (rounded up from 9.682)

SLINGING TECHNIQUE 2

A box with built-in lifting lugs is to be lifted.

The included angle between the diagonally opposite sling legs is 90 degrees.

What is the maximum load that can be lifted (rounded down to the nearest 10th of a tonne)?



- The chain slings are Grade (80) T.
- The chain diameter is 12mm.

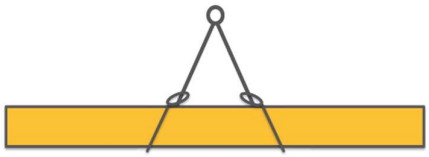
Box with Built in Lifting Lugs

Calculations:	Firstly calculate the rated capacity for the chain using the formula: Rated Capacity (kg) = D squared (mm) x (grade x 0.4) Rated Capacity (kg) = D^2 (mm) x (grade x 0.4) = 12 x 12 x (80 x 0.4) = **4608kg** For multi-legged slings, it must be assumed that only two slings are taking the load. Therefore, the permissible load is calculated for one pair of diagonally opposite slings. Multiply the rated capacity by the angle factor (1.41 for a pair of slings with an included angle of 90 degrees) to calculate the maximum load of the box. Maximum Load = Rated Capacity x angle factor = 4608kg x 1.41 = **6497.28kg** Therefore: This is then converted to tonnes and rounded down to the nearest 0.1t. **Maximum load = 6.4t** (rounded down from 6497.28kg)

SLINGING TECHNIQUE 3

A pair of FSWR reeved slings is to be used to lift a steel beam.

Calculate the weight of the load and the minimum diameter of FSWR required to lift it.



- The angle between the sling legs is 90 degrees.
- The steel beam weighs 173kg/m.
- The steel beam is 5m long.

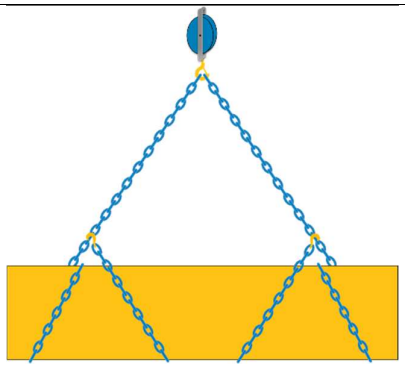
Steel Beam

Calculations:	Weight of the Load = 5 x 173 = **865kg** Diameter of Sling = √(Load ÷ safety factor ÷ reeve factor ÷ angle factor) = √(865 ÷ 8 ÷0.5 ÷ 1.41) = √153.369 = **12.384** Therefore: **Minimum Diameter of Sling = 13mm** (rounded up from 12.384mm)

SLINGING TECHNIQUE 4

A square load is to be lifted using a set of Grade 80 (T) chains. The chains are slung in a two-legged sling and reeved around the load.

Using the angle of the sling and the weight of the load calculate the chain diameter that will need to be used.



- The included angle for the slings is 60 degrees.
- The weight of the load is 2000kg.

Square Load

Calculations:	The formula to calculate the necessary grade 80 (T) chain diameter is: Chain Diameter = √(weight of the load ÷ reeve factor ÷ load factor ÷ 32) The reeve factor around rectangular loads = 0.5 The load factor for slings at 60 degrees = 1.73 Chain Diameter = √(2000 ÷ 0.5 ÷ 1.73 ÷ 32) = √72 = **8.49** Therefore: The minimum Grade 80 (T) chain diameter that can be used in this configuration to lift this load is **9mm.**

LOAD HANDLING

Before the load can be shifted, you need to make sure it is correctly connected to the crane hook and secured to prevent unwanted movement during the lift.

The lifting equipment needs to be attached and secured to the crane hook (or lifting hook).

The hook should be fitted with a safety latch to prevent the slings from dislodging. If the lifting gear does not fit over the bill of the hook, use a shackle or lifting rings to attach the gear to the hook.

Make sure the shackle or lifting ring is large enough to comfortably hang from the hook with enough space for slings or other equipment.

Loose Bundles

The correct method of lifting loose bundles is with two slings, double wrapped with a basket hitch. Double wrapping compresses the load and prevents it from slipping out of the slings. When wrapping a load do not force the eye of a sling down at the nip point. This practice will decrease the WLL and damage the sling. Avoid using a choke hitch as it does not provide full support for loads and material can slip out. Always chock, or block, round loads before releasing them to prevent them from rolling away.

The safe methods for slinging and lifting loose pipes or a loose bundle of steel are:

- Use two slings.
- Double wrap the slings.
- Reeve the eye.
- Ensure that bites are in same direction.
- Maximum 60° angle.
- No pressure on safety latches.
- Appropriate sling angle (for a loose bundle of steel).
- Adequate packing to protect the slings (for a loose bundle of steel).

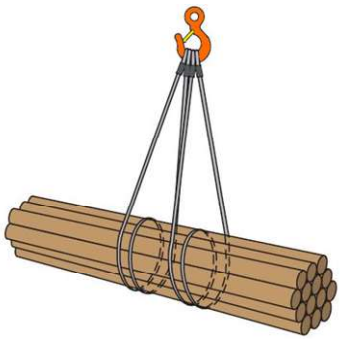


Figure 30 – Pair of double wrap basket hitches

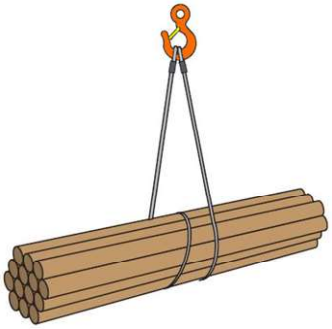


Figure 31 – Single double wrap basket hitch

Loose Items

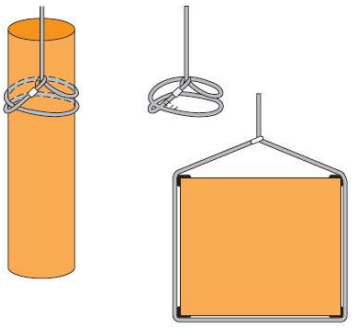
Loose items such as scaffold clips must be raised in properly constructed boxes branded with the WLL. Do not stack items higher than the side of the material box unless they are properly secured. Ensure that the lifting box is stable and is not top heavy.

Do not lift loose items in 200 litre drums or makeshift containers because:

- There is no rated lifting capacity.
- You cannot reliably know the condition of the base of the drum (drums are usually discarded because they are unfit to hold liquid).
- Holes cut into the sides for the sling or hooks are likely to pull through under the load weight.
- Sharp edges on the holes are likely to cut through a sling.

Vertical Loads

When lifting round vertical loads always use a round turn and reeve the sling, with two full turns and nip. Use pads to protect slings from sharp edges on square or irregular shaped objects. Padding will also prevent the slings damaging the load.



Structural Steel

Structural steel can be very dangerous. When a load arrives on site, walk around the truck and check that the load has not shifted. Serious injury or death can occur if steel beams fall when the restraining chains are removed. Trucks must have restraining spikes, or a frame, fitted when carrying steel beams to prevent them from falling off the truck.

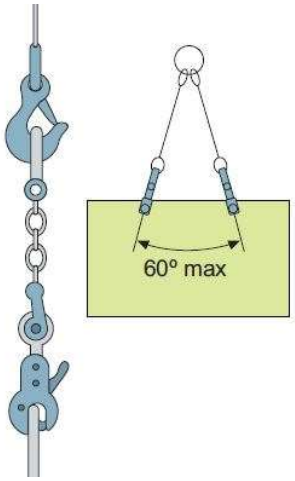
NOTE: Do not removing the securing chains or straps if there are no restraining spikes in place.

Deep beams are unstable and can topple because they are narrower in width than height. Keep bundles of steel straight and level when lifting. Do not lift the bundles vertically or at an angle as slings do not give sufficient hold to prevent them falling. Steel sections are likely to move as the load is lifted and the sling bites into the nip. Keep your hands well clear when a load of steel is lifted.

Steel Plate

Steel plates are usually thin and many are long and wide. The plates tend to sag and buckle during a lift, so methods have been developed to prevent this from happening. Some of the correct lifting methods and equipment for handling steel sheet plate include using:

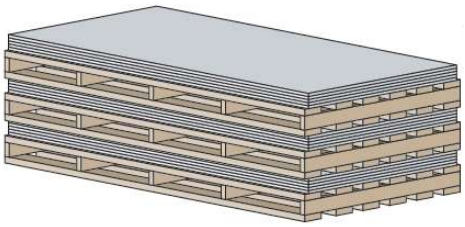
- Two leg slings.
- Maximum sling angle of 60%.
- Plate clamps.
- Shackles.
- Spreader beams.
- Lifting lugs, welded to the plate by a competent person.



Take care when setting plate down that has been lifted vertically. When the vertical plate touches the ground and tension is released from the slings, the hook can slip out of the hole in the plate. To prevent this, use a plate clamp attached to a shackle and hook with a safety latch. Keep the tension in the slings until the plate is in place and secure.

Plasterboard

Sheets of plasterboard are usually delivered on site in plasterboard packs. Plasterboard packs should be lifted in a specifically designed lifting cage. If a suitable lifting cage is not available, wrap the load in metal strapping and lift with the slings in a choke hitch configuration. Use additional padding or packing to prevent the strapping and slings from damaging the load. Another method of lifting plasterboard packs is to wrap the pack in plastic and place metal strapping around the load. If wrapped this way, the packs can be lifted using two slings in a basket hitch configuration.

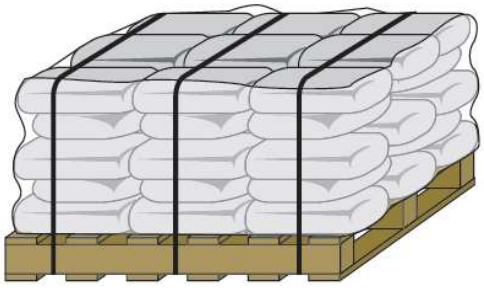


Pallets

Pallets are used to deliver a wide variety of loads. Before lifting a loaded pallet check that the:

- Pallet is in good condition.
- Load is secured so that nothing can fall off.
- Load is properly slung.

The WLL of a standard hardwood pallet is 2000 kg. This WLL is greatly reduced when there are any missing boards or other defects.



NOTE: Some pallets are designed for packaging not lifting.

To lift a load on a damaged pallet, raise the load and pallet only enough to reposition it onto an undamaged pallet, then lower the load and sling properly before further lifting or moving. If no spare undamaged pallets are available, do not lift the load; send it back to the supplier to be re-palleted.

Brick Cage

Lifting bricks can be extremely dangerous if they are not properly secured. To prevent loose bricks falling from height, always lift a pallet of bricks or blocks inside a brick cage. Brick, or block, cages are designed to safely hold pallets of bricks, or other loose objects, as they are lifted. The brick cage fits over the load and is attached securely to the pallet. Always check the WLL of the brick cage and the pallet before lifting loaded pallets with a brick cage.

Personnel Cages

Often there is a need to lift or lower personnel using a crane. Personnel are not to be lifted by a crane unless they are within a suitably rated personnel cage or lift box. Never lift personnel on a sling or hook. When hoisting a worker in a lift box, the person dogging the load rides in the box with the worker. Cages are normally rated to hold a number of personnel and extra for tools and equipment. Always check that the personnel cage and all lifting equipment are rated for the combined weight of the cage, lifting gear, tools and materials as well as the personnel within the cage. The cage is not to be lifted unless the door of the cage is closed and secured.

NOTE: Safety harnesses must be worn at all times within the cage.

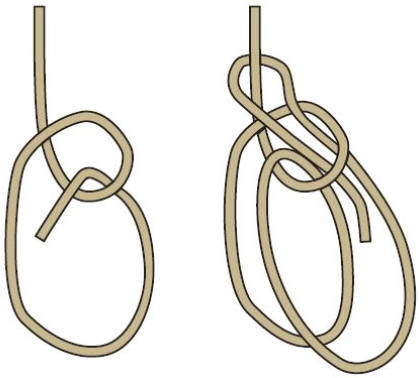
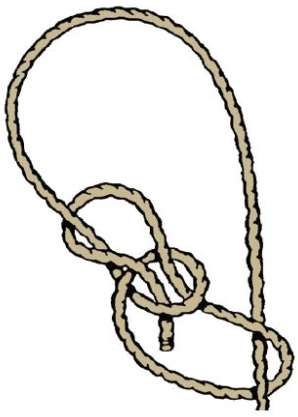
Rubbish Bins

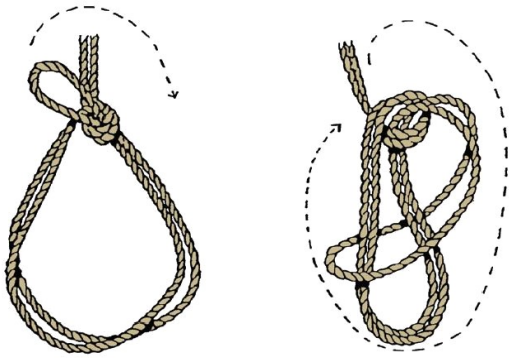
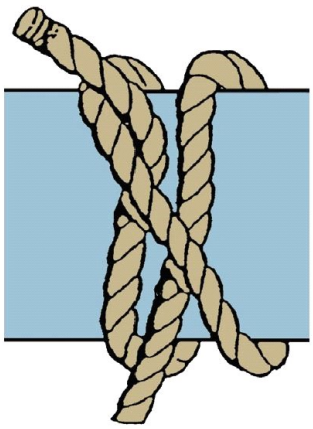
Rubbish bins must have proper lifting lugs and be branded with the WLL. Overloaded rubbish bins must not be lifted. Secure the load before lifting when rubbish can spill or be blown from a bin, especially in windy conditions. Use a four-legged sling for slinging rubbish bins. Release the two front slings and raise the bin with the two back slings to tip the bin. Do not stand behind a bin when emptying rubbish because it may suddenly whip back when it clears the ground.

TEMPORARY ROPE CONNECTIONS

Knots, bends and hitches are used for securing ropes. Bends are used to tie one rope to another. Hitches tie a rope to another object. The most common forms of bends and hitches used for various applications are in the following table.

Note: Bends and hitches underload will reduce the WLL of the rope.

Bowline Single The Bowline provides a reasonably secure loop in the end of a rope. Under load it does not slip or bind.	
Bowline Double The Double Bowline provides a more secure attachment than a single bowline.	
Bowline Running Used for making a temporary eye to run along another part of rope.	

Bowline on the Bight The Bowline on the Bight is formed by making the first part of a bowline with the bight of the rope and passing the whole hitch through its bight.	
Rolling Hitch A Rolling hitch is used for lifting tubular objects, It grips tightly when under load and slackens when the load is released. This hitch is very useful and is preferable to the clove hitch or blackwall hitch, providing rolling turns are put on in the proper direction of pull.	
Clove Hitch Use the Clove Hitch to start rope lashings. Secure the ends with additional half hitches.	

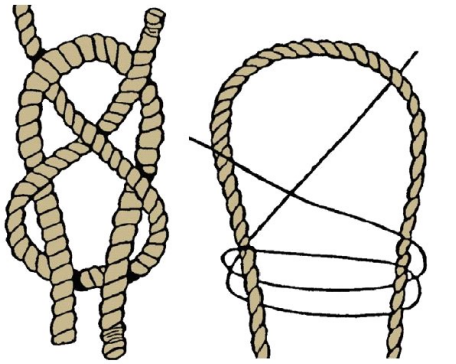
Sheet Bend A Sheet Bend joins two ropes of different sizes. It is safer when a double sheet bend is used. The smaller rope must bend around the larger rope.	 Bend Double Sheet Bend

Table 17 – Temporary Connections (Knots)

PREPARE LOAD DESTINATION

You should ensure that the destination for the load is also prepared and ready for the load to be landed.
The load destination could be:

- The ground.
- Loading platforms.
- Suspended floors.
- Vehicles.

Make sure that the load destination is tidy and ready to receive the load. Check that the load will be supported by the load destination. For example, if placing the load onto a concrete floor, you should use site information gained from engineers or authorised site personnel.

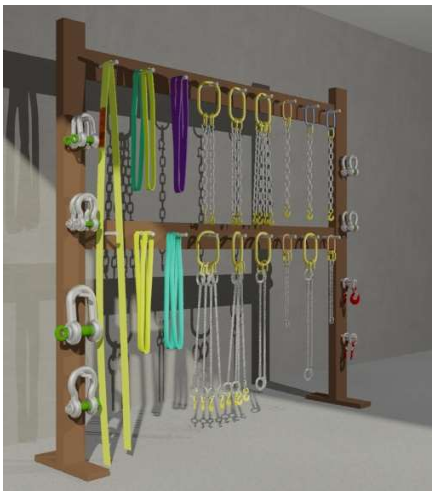
You may need to set up blocks or chocks to keep the load stable once it is lowered and to allow you to safely remove the lifting gear without it being damaged or crushed by the weight of the load.

If the load is to be placed on a Cantilevered Crane Loading Platform (CCLP) it is important that you ensure the CCLP is capable of supporting the load. This can be done through checking the load limit or rated capacity (normally marked on the platform). If the CCLP is not marked you should seek advice from the manufacturer.

STORING EQUIPMENT

When storing lifting equipment you should consider if the location is:

- Clean and dry.
- Out of direct sunlight, ultraviolet light or fluorescent lighting.
- Well ventilated.
- Under cover.
- Away from chemicals, oils, sand/grit, and machinery.
- In a vermin free environment.
- In accordance with manufacturers' specifications.



Store all slings in a clean dry storage cabinet or area and hang them or coil them neatly according to site procedures.

APPENDIX 1 – CONDITIONS WHEN A DOGGER IS OR IS NOT REQUIRED

Activity		A Dogger is Required	Dogger is not required if ALL the conditions below are met.
Slinging a load	**Selecting** the slinging method	Judgement is required.	No judgement required because the: • selection of the slinging method is pre-determined by a competent person (2), and • lifting points are pre-determined by a competent person and marked on the load where appropriate
	Selecting the lifting gear	Judgement is required.	No judgement required because the: • weight of the load—or load within a weight range—is pre-determined by a competent person e.g. may be marked on the load, and • selection of the lifting gear is pre-determined by a competent person.
	Inspecting the lifting gear	Judgement is required.	No judgement required because the condition of the lifting gear is regularly inspected by a competent person.
Safe work lifting procedures incorporating: • electing the slinging method and lifting gear, and • inspecting the lifting gear		Judgement is required because there are no safe work lifting procedures.	No judgement required because the: • safe work lifting procedures (3) have been documented and signed off by a competent person, and • all workers involved have been trained and demonstrated competency in the safe work lifting procedures.
Directing the plant operator - load is in or out of view of the plant operator.		Directing required because the load is out of the plant operator's view during the lift.	No directing required because the load is in view of the plant operator at all times during the lift.
Training - as part of the Dogging Unit of Competency for a HRW licence.		A dogger is required to supervise training.	

(2) A competent person includes a dogger, rigger or an engineer experienced in designing safe work lifting procedures.

(3) Further information on documenting safe work lifting procedures is in the General guide for cranes.

APPENDIX 2 – EXAMPLES OF WHEN A DOGGER IS REQUIRED

Example	Is a Dogger required	
	Yes/No	Why
An excavator configured to lift loads is used to place pipes in a deep trench. The lifting gear has been specifically chosen by an engineer to lift pipes which are all of a similar size and weight, therefore no judgement is required by the person slinging the pipes. The pipes cannot be seen by the excavator operator when they are being placed in the trench.	**Yes**	A dogger is required because the plant operator cannot see the load throughout the lift and a dogger must be used to direct them.
A mobile crane is used to lift beams to the second storey of a building under construction. The beams are dissimilar and various slinging techniques are required. The mobile crane operator cannot see the landing area for the steel beams. No safe work lifting procedures have been documented.	**Yes**	A dogger is required because: • The plant operator cannot see the load throughout the lift and a dogger must be used to direct them, and • Judgement on slinging techniques is required as safe work lifting procedures have not been documented.
A multi-purpose tool carrier—telescopic handler— with a jib attachment is used to lift pallets of bricks to the first storey of a building under construction. The pallets are all of the same size and weight. No safe work lifting procedures have been documented.	**Yes**	A dogger is required because judgement on slinging techniques is needed as safe work lifting procedures have not been documented.
A factory making aluminium panels uses a bridge and gantry crane to move the panels around the workplace. The panels are always in view of the plant operator. Safe work lifting procedures have been documented and signed off by a competent person. All workers involved in the lift have been trained in the safe work lifting procedures.	**No**	A dogger is not required because: • The load is always in view of the plant operator. • Safe work lifting procedures have been documented and signed off by a competent person, and „ all workers involved in the lift have been trained in the safe work lifting procedures.
A hospital patient lifting sling and trolley is used to move a patient from one bed to another.	**No**	A dogger is not required because: • No judgement is required on slinging techniques, and • Specific slinging and moving techniques for handling patients (safe work lifting procedures) are standardised, well documented and taught to workers undertaking patient handling tasks.