



NCMT



RIGGING & SLINGING

COURSE MATERIAL

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المركز الوطني للإدارة والتدريب
National Centre for Management & Training

BASIC RIGGING & SLINGING TRAINING



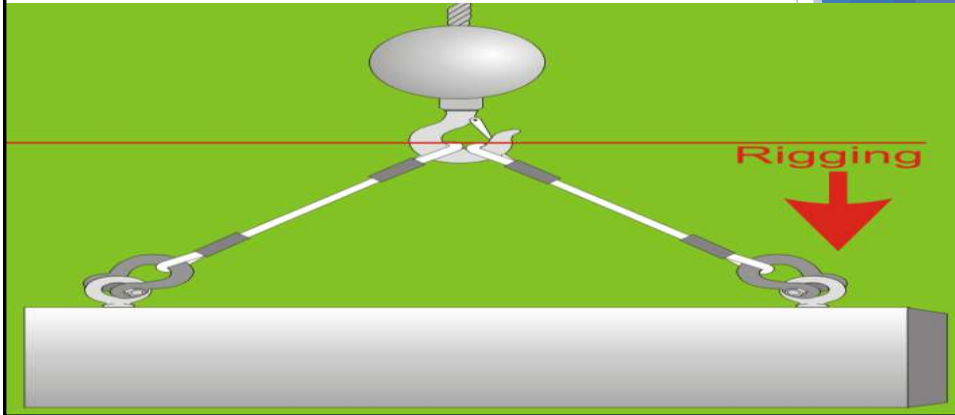
COURSE RULES

- Cell Phone usage
- Breaks
- Participation
- No Smoking



Definition of rigging

Rigging is part of the lifting operation which forms the link between the Lifting device and the load.



LIFTING DEVICES

Any Mechanical device capable of raising or lowering the load

- ▶ Cranes
- ▶ Forklift
- ▶ Lifts
- ▶ Suspended Cradles
- ▶ Powered Hoists
- ▶ Manual Hoists
- ▶ Beam trolleys etc..



TYPES OF CRANE



LIFTING GEARS & ACCESSORIES

Lifting gears / Accessories:

Any device which is used or designed to connect a load to a lifting appliances which does not form part of the load. There are different types of lifting gears are available, You should select the right type of gear depending on your load characteristics

Example: Wire rope slings, chain slings, hooks and fittings Swivels, shackles, eye bolt etc..



TYPES OF SLINGS

A looped rope, strap or chain for supporting, cradling, or hoisting something

Synthetic web sling



Synthetic round sling



Chain sling



Wire rope sling



Mesh Sling



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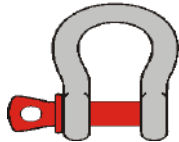
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ATTACHEMENTS

It is used to attach slings to load or load to sling for connecting each other.



Hooks



Shackles



Eye Bolts



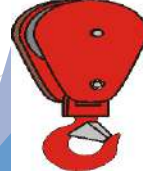
Hoist Rings



Turnbuckles



Master Links




Blocks




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TERMINOLOGIES



**LOAD
LIMITS**



DANGER
DO NOT
EXCEED WORK
LOAD LIMIT
(WLL)




TANDEMLOC
WLL 17.5T
10 TON

WLL - Working load limit

SWL - Safe working load

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Identification and Capacity

The manufacturer must issue a Test Certificate for every crane he produces, identifying it and specifying the Safe Working Load (SWL) which must be clearly marked on the Crane structure.

Safe Working Load




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Basic Rigging Hitches

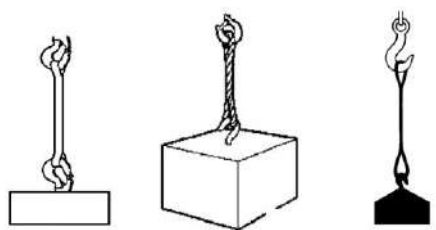
The diagram shows three types of rigging hitches. 1. **Straight**: A vertical chain sling with a hook at the top and an eye at the bottom, resting on a flat surface. 2. **Choker**: A chain sling with a hook at the top and an eye that loops around a cylindrical load. 3. **Basket**: A chain sling with a hook at the top and two eyes at the bottom that form a basket shape around a spherical load.

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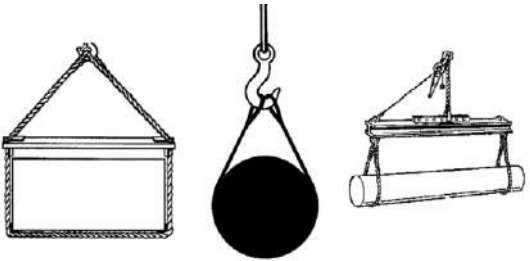
Vertical Hitch

A **vertical hitch**, or **straight hitch**, is the most basic hitch used to directly connect a load to a lifting device. On a **vertical hitch**, the eye of a single chain sling, wire rope sling, or synthetic sling is connected to the crane or hoist hook, while the other eye is connected to an attachment point on the load.



Basket Hitch

The **Basket Hitch** employs a closed loop made of rope, or webbing as shown in the animation. It is used to hoist a load or provide an anchor point. When the **Basket Hitch** is used to hoist a load, there is a risk of the load sliding out of the loop.

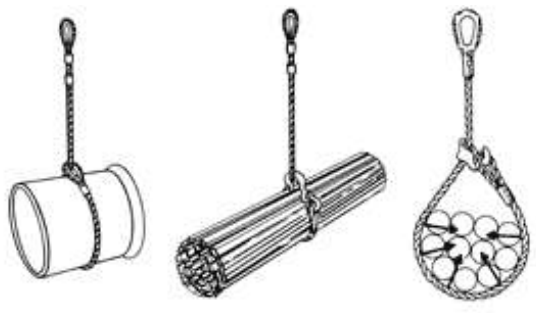


Basket Hitch



Choker Hitch

A **choker hitch** is used to tighten or snug a sling down securely to provide greater load control. When using a **choker hitch**, one eye of the hitch is wrapped around the load and then passed through itself and then attached to the crane or hoist hook.



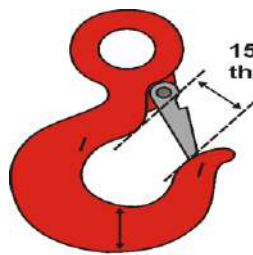
LIFTING GEARS INSPECTION & REJECTION CRITERIA



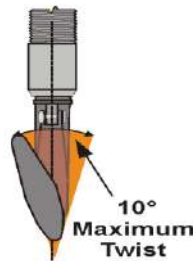
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Hook Inspection

Hooks must be removed from service when any of the following conditions exist:



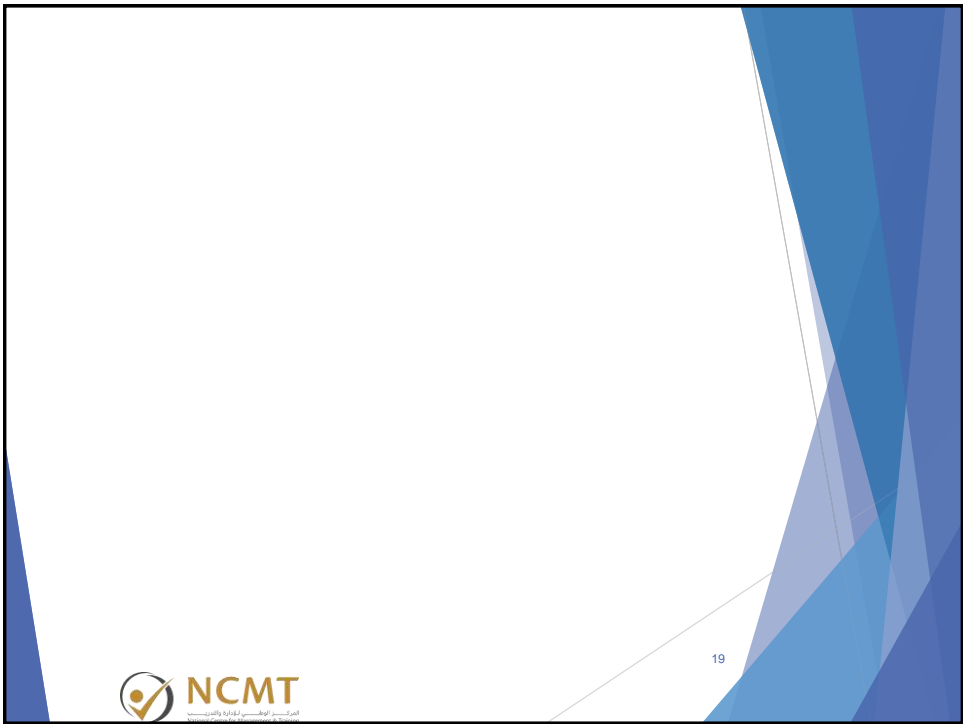
15% maximum throat opening



- Cracks, nicks or gouges.
- Twist exceeding 10° from plane of unbent hook.
- Latch engagement, damage or malfunction.
- Throat opening exceeding 15%.
- Wear exceeding 10% of original dimension.
- Damage from heat.
- Unauthorized repairs.

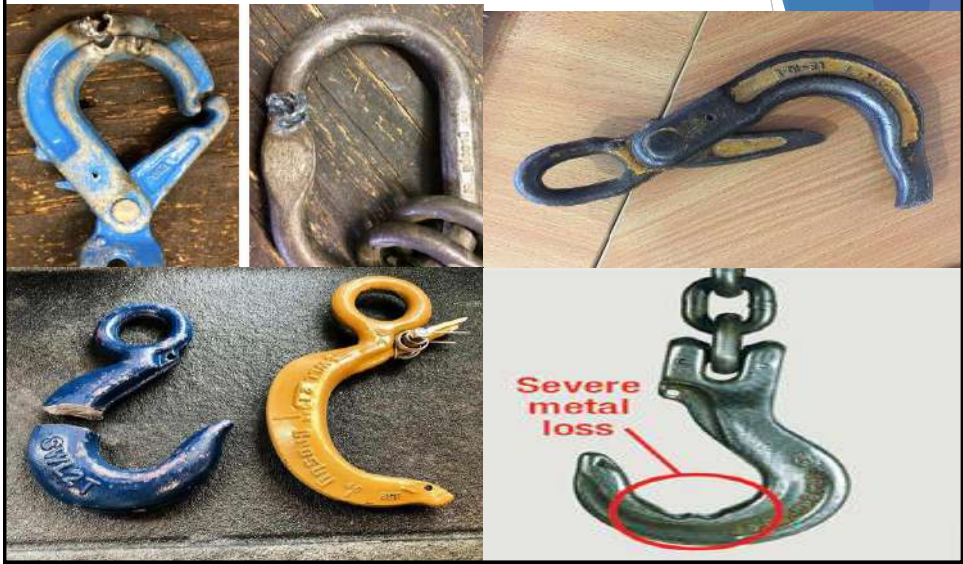


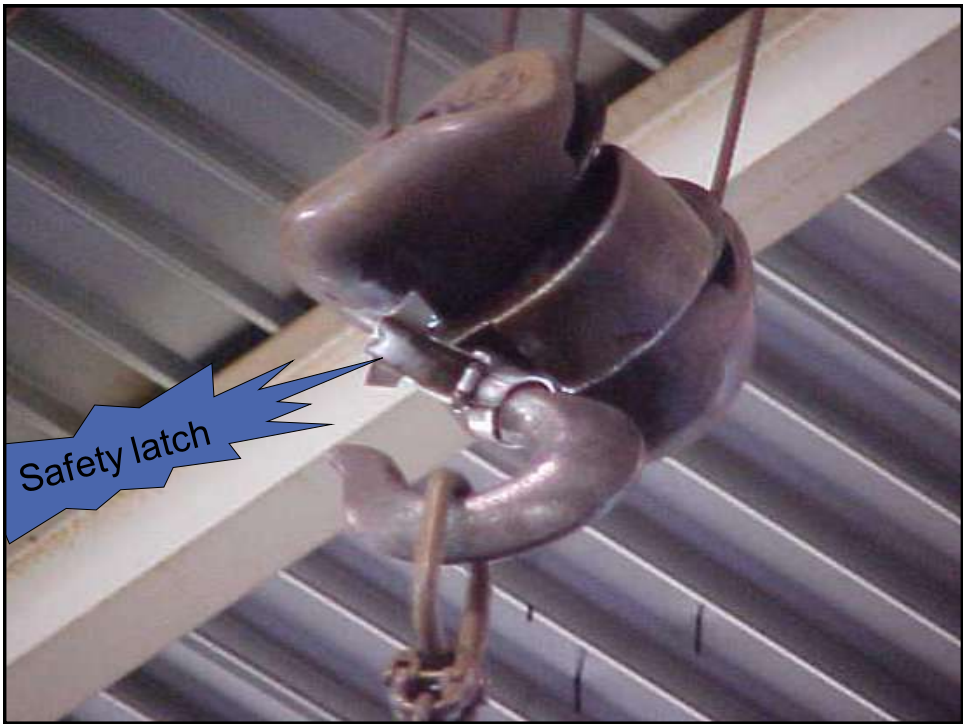
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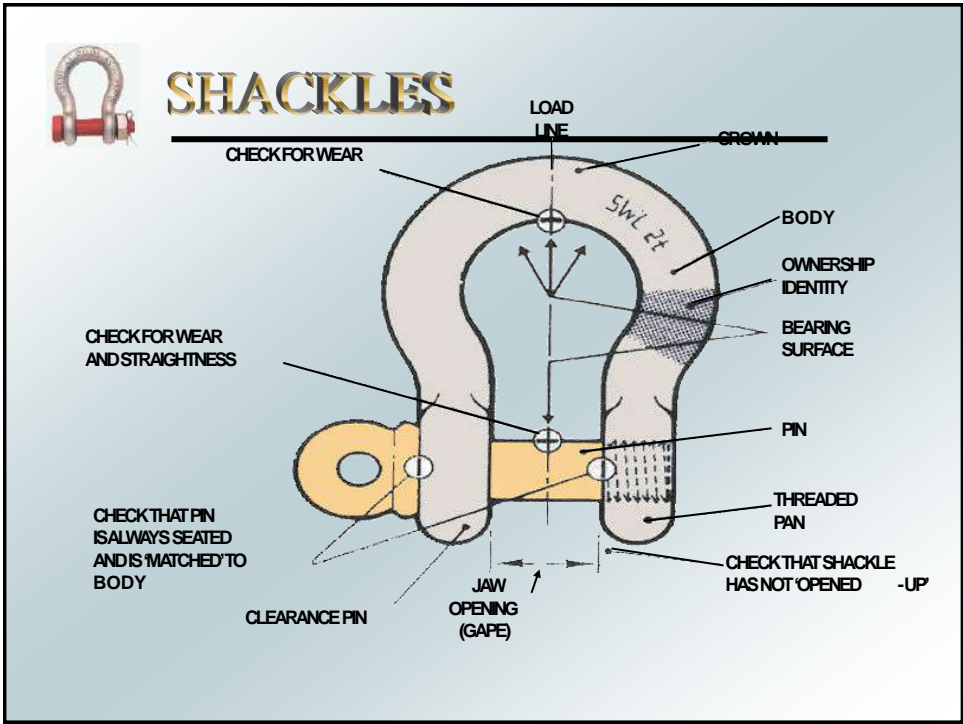
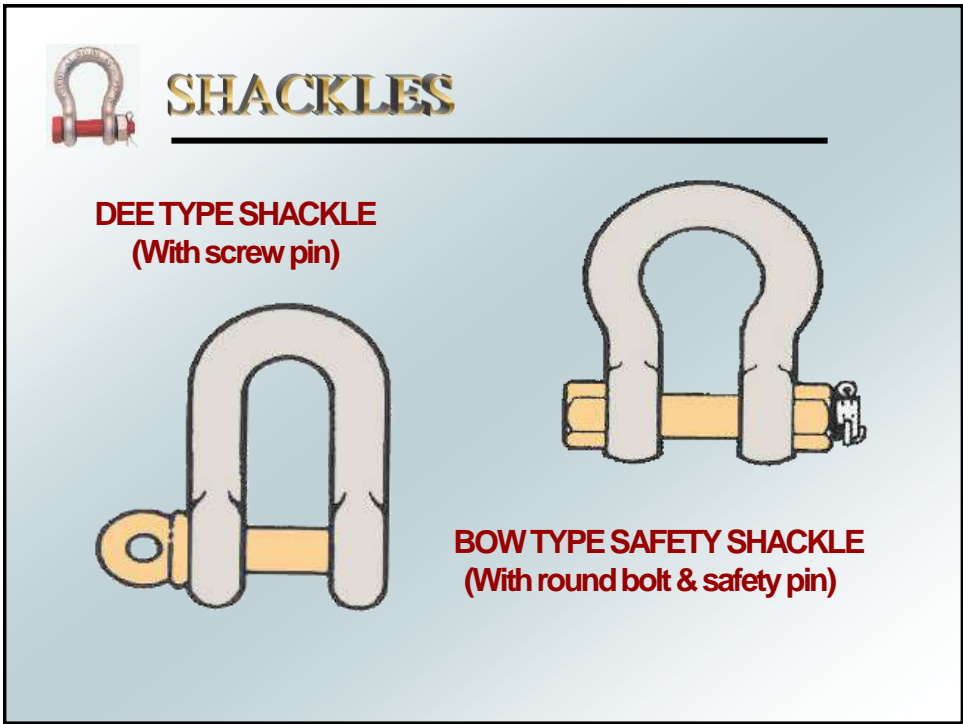


PRE-USE INSPECTION

Some common defects with attachments;









SHACKLES PRE - USE INSPECTION

- Select correct type shackle for the job in hand.
- Ensure the shackle is correctly colour coded.
- Check the safe working load of the shackle before use - no **SWL - quarantine** .
- Check shackle pin for excessive wear-if wear is **1/10th** or more of original diameter **quarantine**.
- Make sure the pin is free-but not loose in the tapped hole(s) of the shackle.
- Threads on pin and shackle should be undamaged and without appreciable wear.

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SHACKLE INSPECTION

Incorrect Pin

Bent, twisted, distorted, stretched, elongated body & pin

Material Reduction

Cracked / Broken Body

Excessive Corrosion

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Unsuitable Alloy Steel Chain Attachments

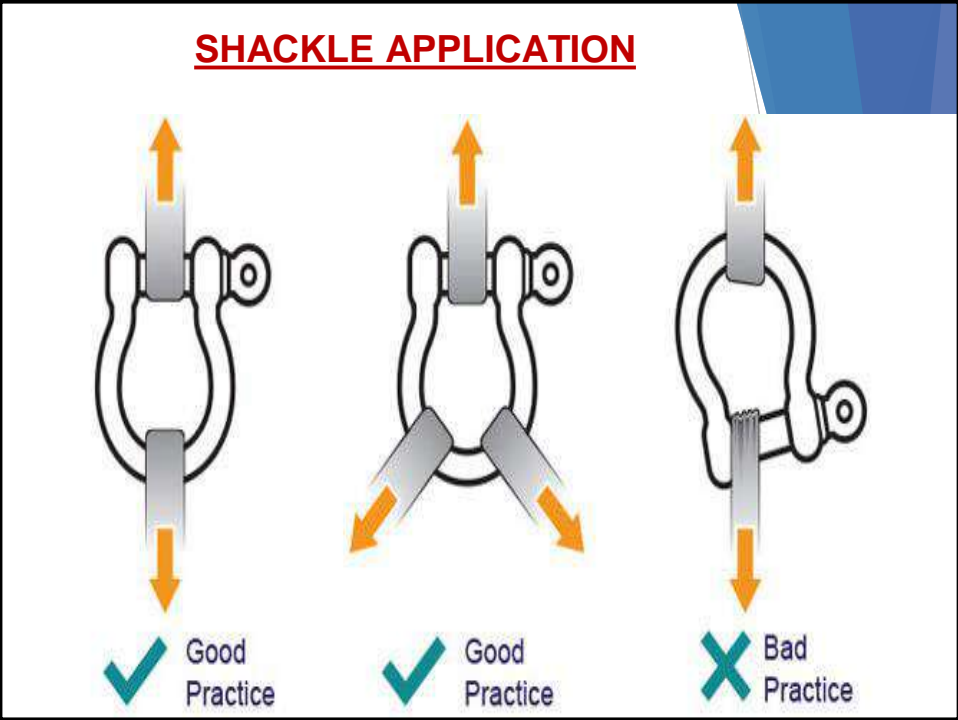
Right

Wrong

Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, can't be used

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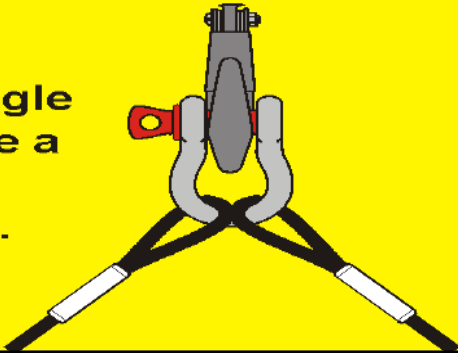




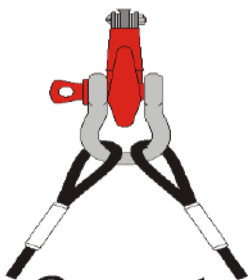
Hardware Application



When the included angle is greater than 90° use a shackle to attach the sling legs to the hook.



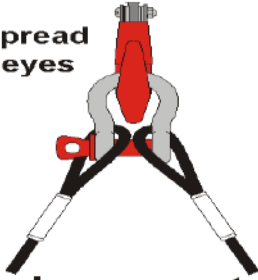
Shackle Application



Correct

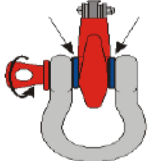
Pin should be tight, not backed off.

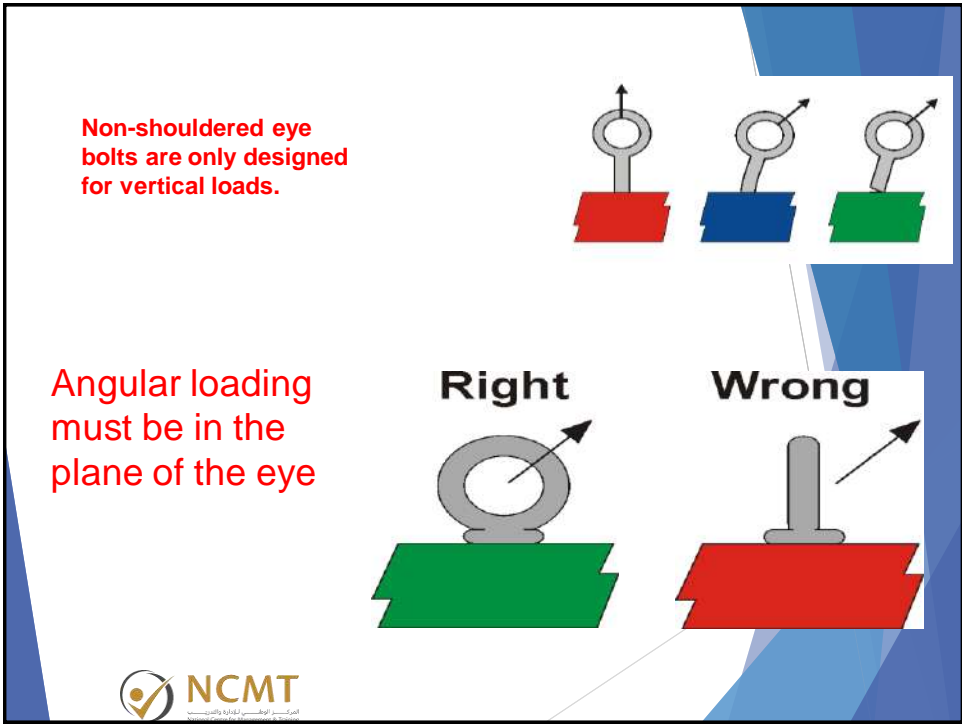
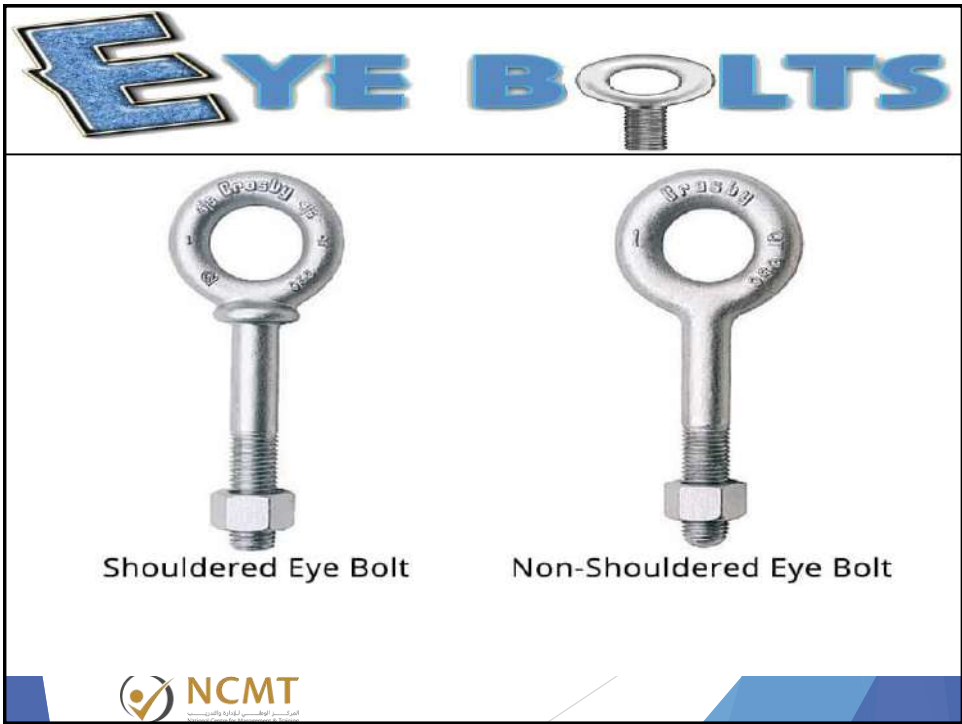
Shackle spread and sling eyes can be damaged.

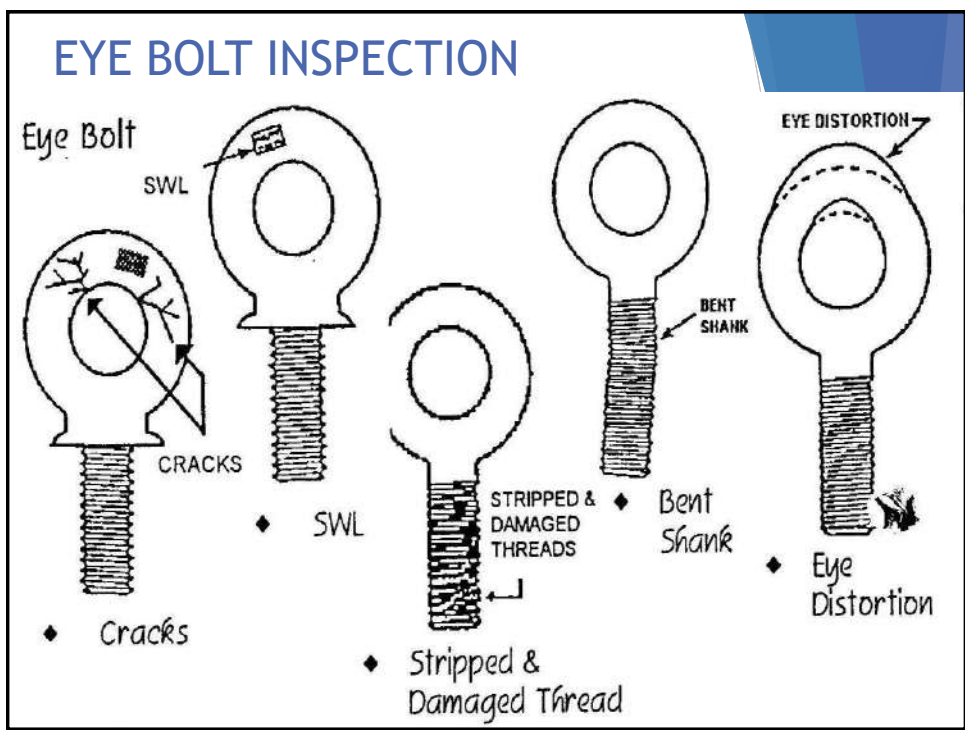


Incorrect

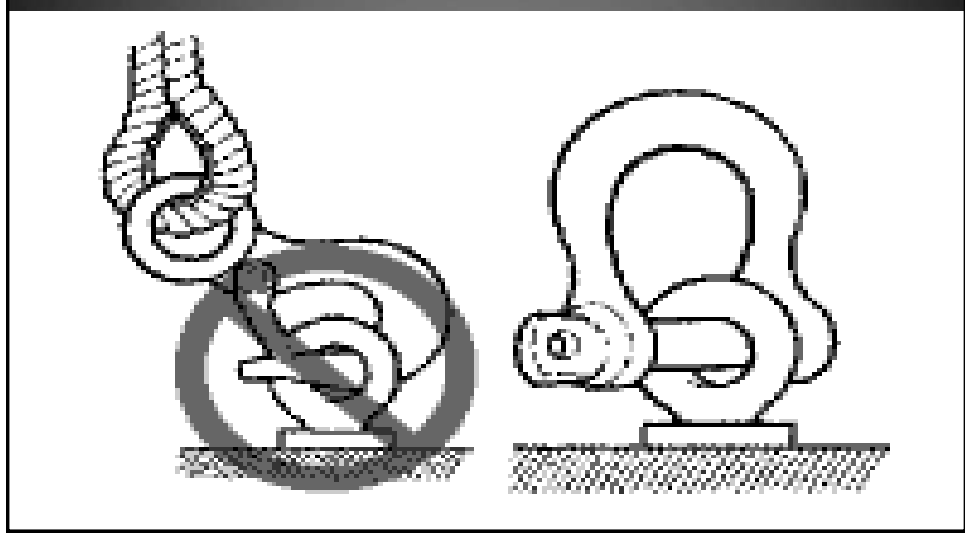
Washers can be used to take up the space between the shackle and hook.

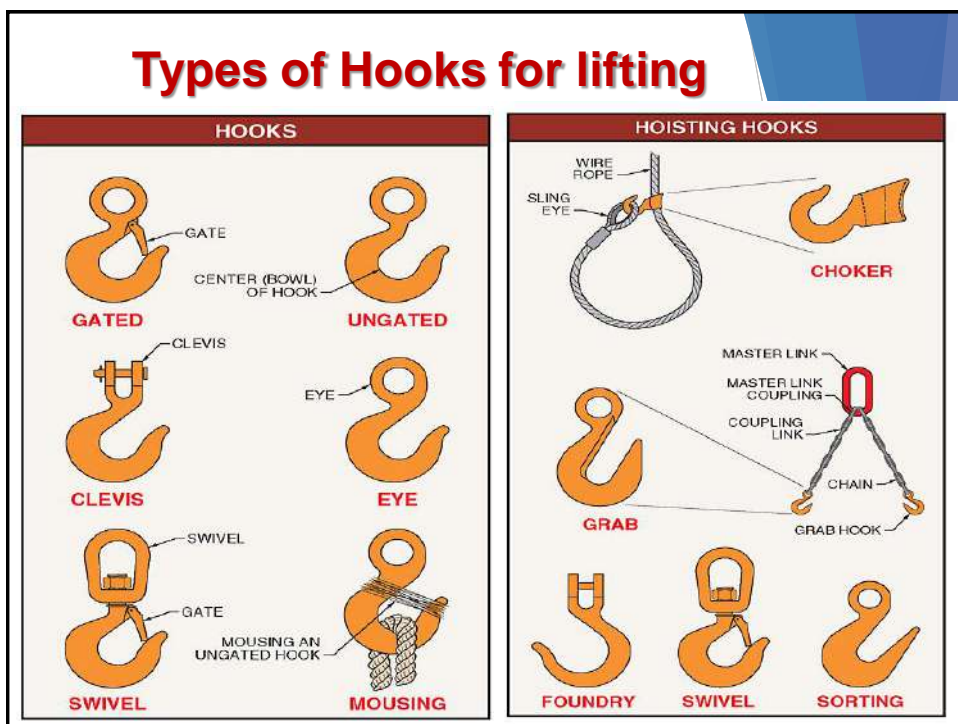






1. Do not use eye bolts that have worn threads or other flaws.
2. Do not insert the point of a hook in an eye bolt. Use a shackle.





Chain Sling

- Adapts to shape of the load
- Can damage by sudden shocks
- Best choice for hoisting very hot materials
- When one link in a chain fails, the load will come down.
- Must have an affixed tag stating size, grade, rated capacity, and sling manufacturer



Chain Sling Parts



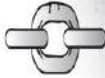





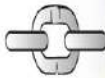





Chain configuration



Chain Sling Inspection

- ▶ Check inside ends and outside edges
- ▶ Excessive stretching is unsafe
- ▶ Watch for binding

 Bent/Deformed Chain Link	 Incorrect Hardware & Pitting	 Wear
 Broken Chain	 Stretched Chain Link	 Localized Bending
 Heat Damage	 Weld Splatter	 Shearing/ Cracks
		 Nicks or Gouges
		 Stretching



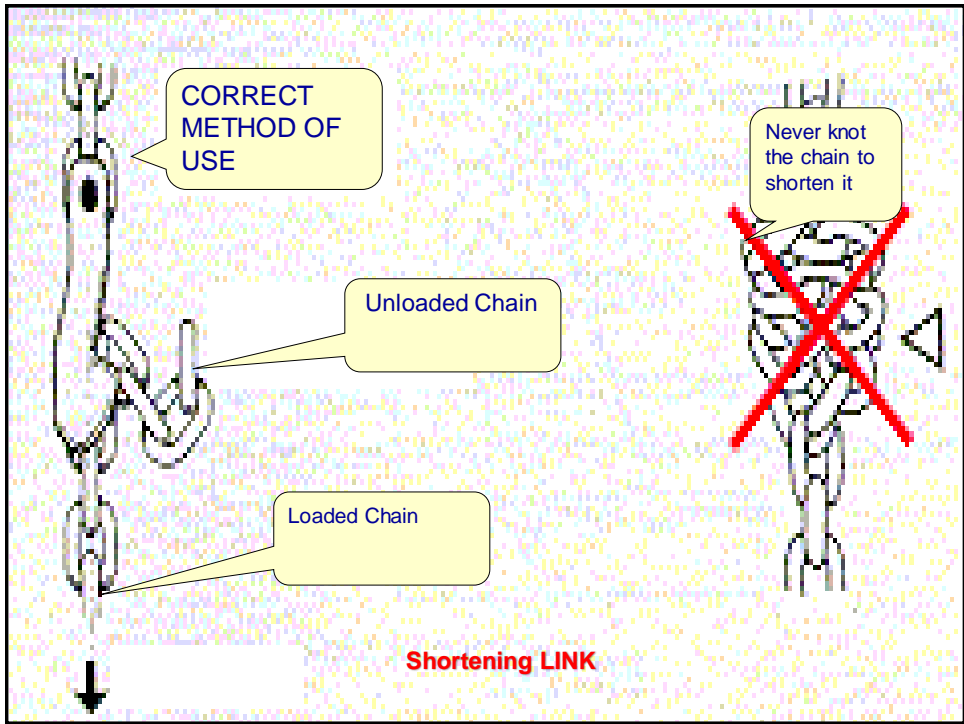
Chain Wear

When a chain shows excessive wear, or is cracked or pitted, remove it from service

Non-alloy repair links can not be used



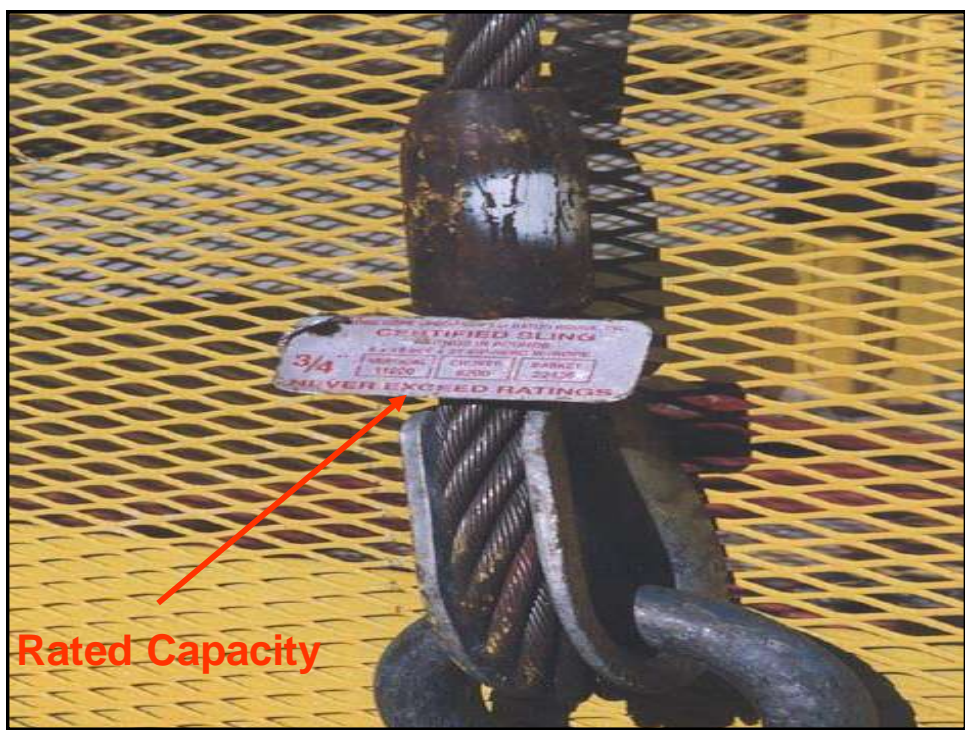




Wire Rope Slings

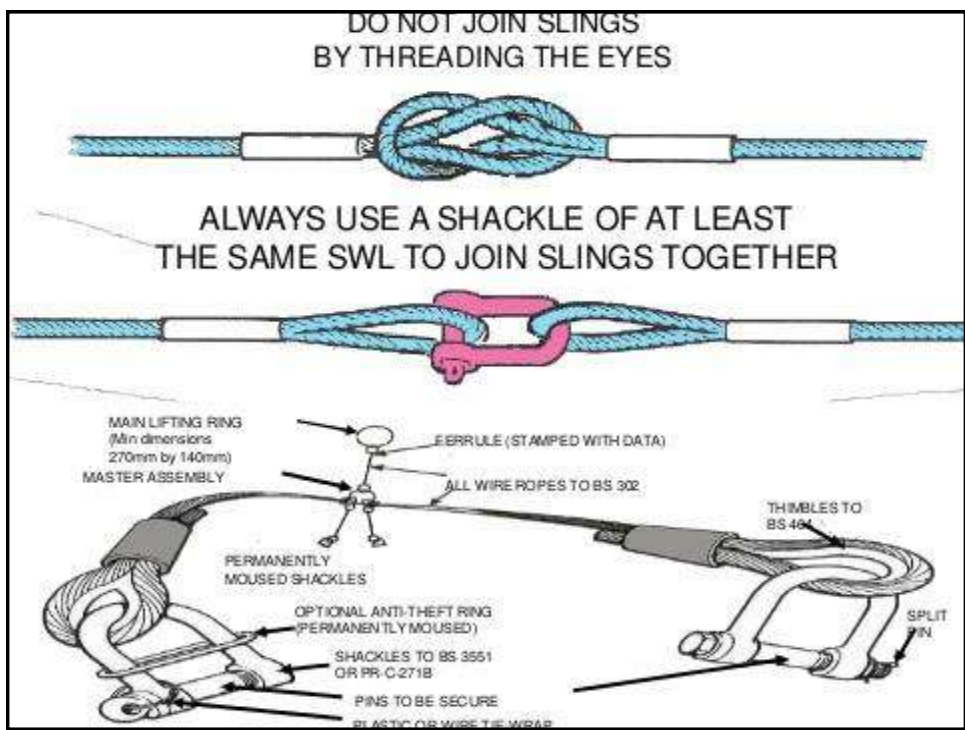
Wire rope slings are an important piece of rigging hardware **used in lifting and hoisting operations** and are commonly used across different industries. These slings connect the load to the lifting device and are available in a wide range of configurations that support a broad range of applications



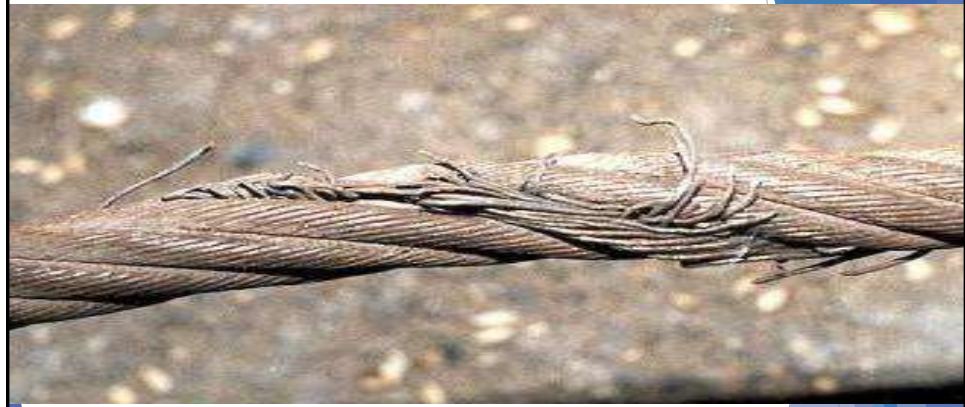


Wire Rope Inspection

			
KINKING	DOGLEGS	BIRDCAGING	SEVERE WEAR
			
BROKEN WIRES	CORROSION	DAMAGED FITTINGS	ILLEGIBLE TAG / ID



Remove From Service

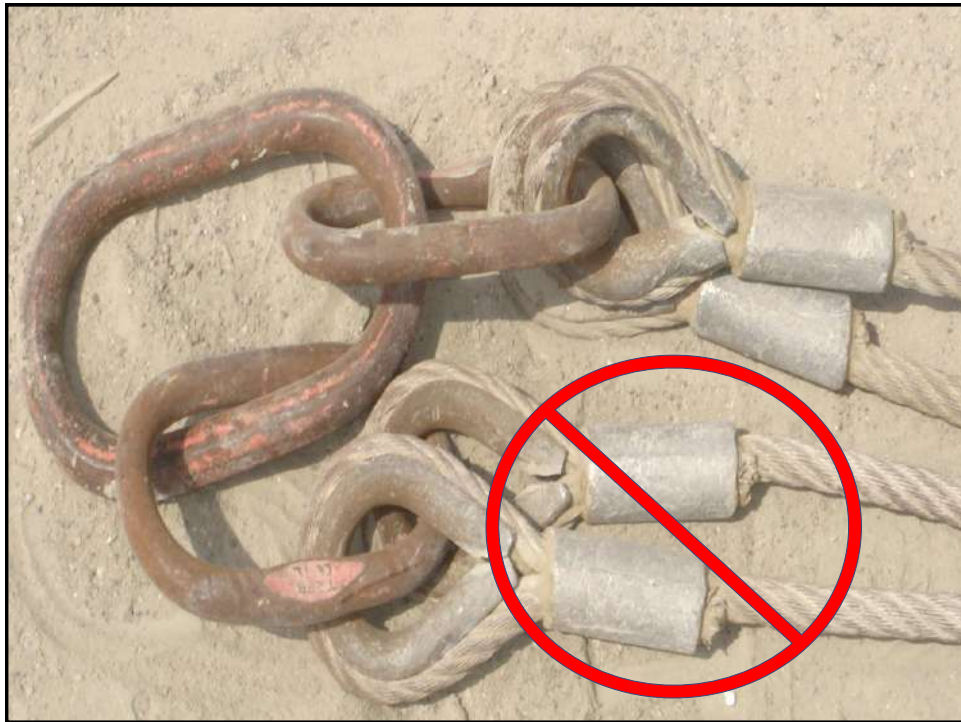


Immediately remove damaged or defective

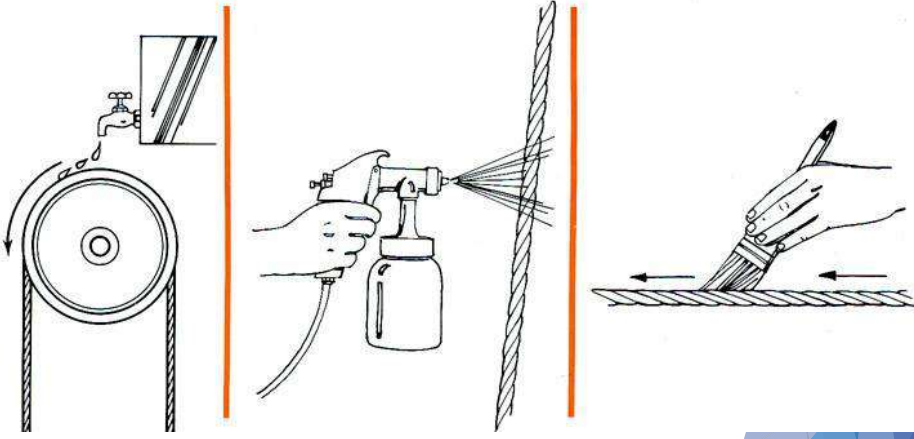


Wire Rope Slings Remove From Service


these happen, remove the wire rope sling from service



Lubrication




Regularly lubricate ropes and chains




Wire Rope Clips

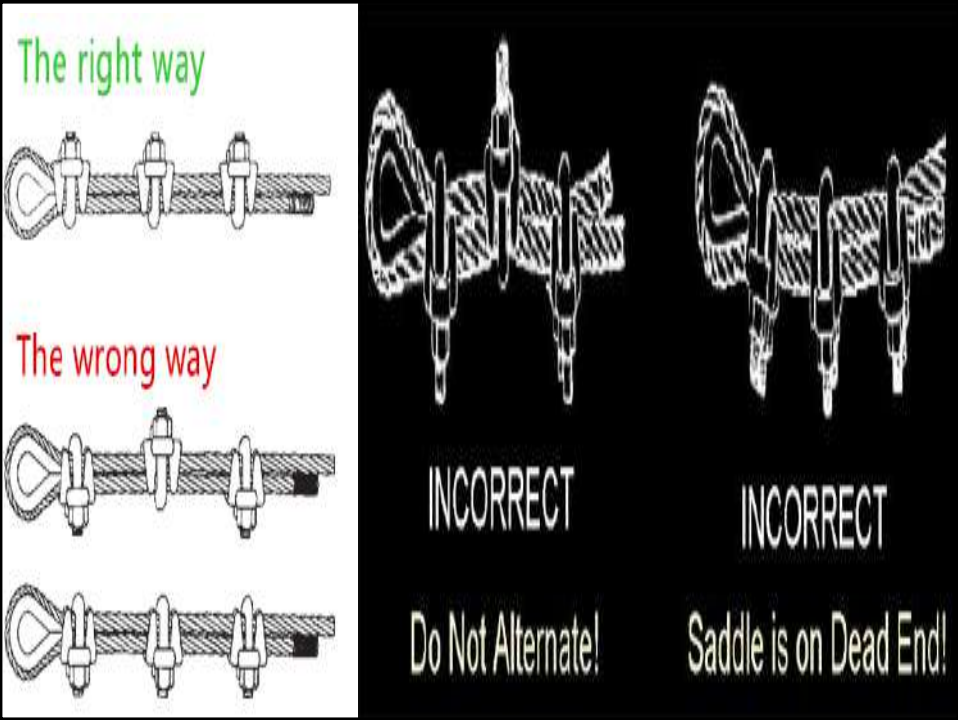
When using U-bolt wire rope clips to form eyes, ensure the "U" section is in contact with the dead end of the rope



U must always be on shorter side



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Web Sling

Webbing sling is a sling belt manufactured from polyester, Polyamide, and Polypropylene that is used for **heavy lifting where wire rope sling or chain lifting is not applicable.**



COLOUR CODE FOR WEBBING SLING

Colour	Width mm	Working load kg					Breaking Load. Kg
		100% 	80% 	200% 	140% 45° 	100% 45° - 80° 	
Violet	25-30	1000	800	2000	1400	1000	6000
Green	50-75	2000	1600	4000	2800	2000	12000
Yellow	75-100	3000	2400	6000	4200	3000	18000
Grey	100-125	4000	3200	8000	5600	4000	24000
Red	125-150	5000	4000	10000	7000	5000	30000
Brown	150-175	6000	4800	12000	8400	6000	36000
Blue	200-250	8000	6400	16000	11200	8000	48000
Orange	250-300	10000	8000	20000	14000	10000	60000



Synthetic Web Sling Inspection



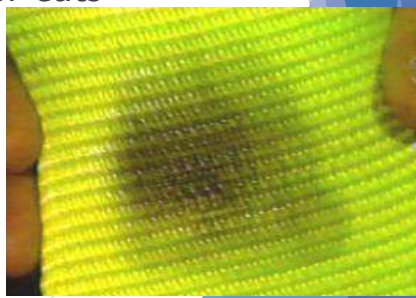
- ✓ Acid or caustic burns on the sling.
- ✓ Melting or charring of any part of the sling's surface.
- ✓ Snags, punctures, tears, or cuts.
- ✓ Stitching is broken or worn.
- ✓ The sling is stretched. To assist operators in determining if a sling is stretched, manufacturers incorporate a **red wear cord** inside of the sling. When this red wear cord can be readily seen upon inspecting the sling, the sling has been stretched and is to be removed.



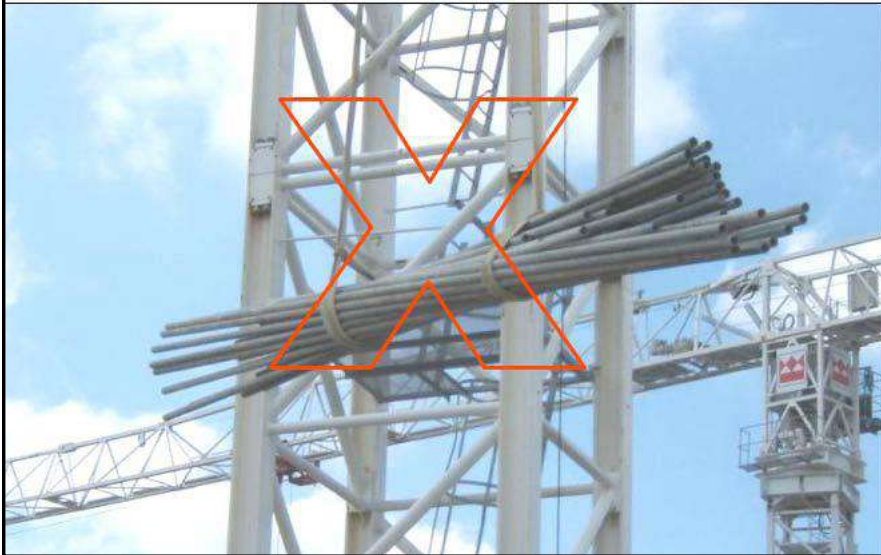
Synthetic Web Slings - Remove from Service

Remove from service if any of these are present:

- ▶ Acid or caustic burns
- ▶ Melting or charring of any part
- ▶ Snags, punctures, tears or cuts
- ▶ Broken or worn stitches
- ▶ Distortion of fittings



Slings wrapped in opposite directions



ADVANTAGE OF SLINGS

Chain sling;

- Long life than other types
- Good for wear and abrasion
- Flexible & high-rise lift

Wire Rope Sling;

- Good for impact or shock loading
- Heavy lifting
- IWRC is resistance to crushing (Independent wire rope core)

Web slings (Synthetic);

- Light Weight
- Reduces load damage
- Good for loose material because of high contact

DISADVANTAGE OF SLINGS

Chain slings;

- First time cost
- Weight
- Difficult to inspect

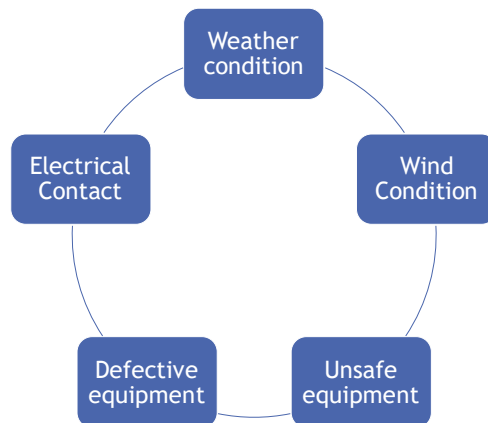
Wire rope slings;

- Easily kinked
- Weight
- Not flexible

Web slings;

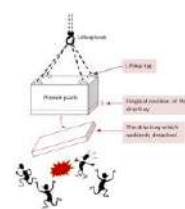
- Low heat tolerance
- Subject to cuts and abrasion
- Not repairable

HAZARDS ASSOCIATED




TYPES OF HAZARD

Fall of material




Labels in diagram: Worker, Lifting rig, Vertical position of the lift, Work being which suddenly detached.


Mechanical Failure




Structural Failure





Over Turning



Contact with power lines









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ACTUAL INCIDENT

Wrong Lifting - 1

- Over loading
- Poor planning
- Area of operation not cleared
- Poor Communication





ACTUAL INCIDENT

Wrong Lifting - 2

- Load Assessment
- Poor planning
- Poorly placed Crane

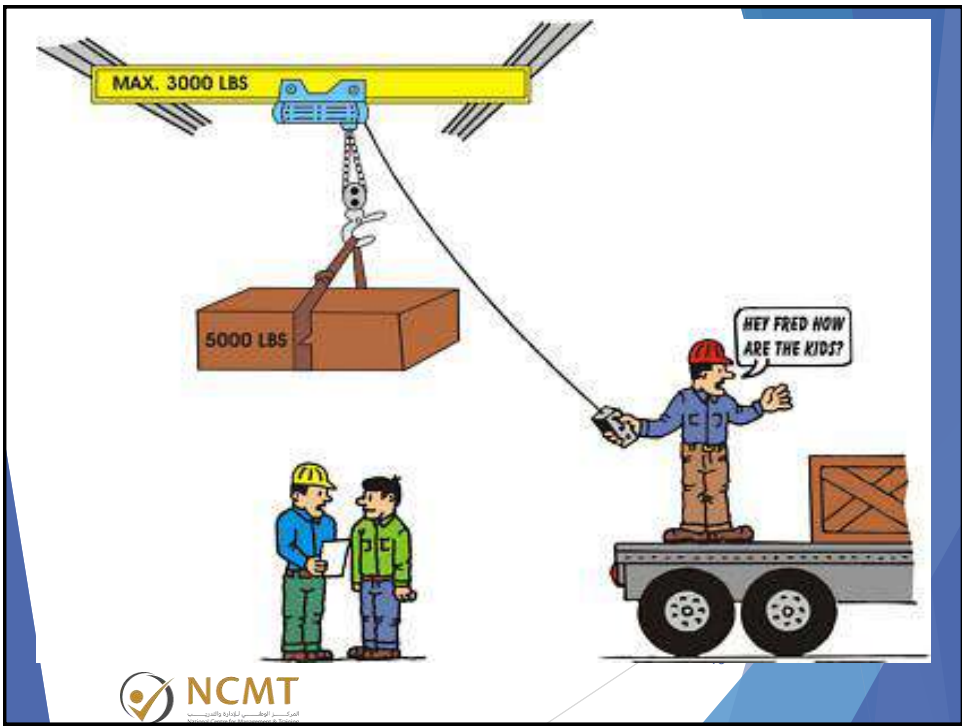


ACTUAL INCIDENT

Wrong Lifting - 3

- Centre of gravity
- Point of attachment





LOAD ANGLE CHART

Angle factor must be applied to calculate the **reduced sling capacity** when lifting force is not at 90° to the plane of the load!

Multiply angle factor x sling's vertical rated load to calculate the reduced capacity at the angle.

Angle	Factor	Angle	Factor	Angle	Factor	Angle	Factor
90°	1.0000	70°	0.9397	55°	0.8192	40°	0.6428
80°	0.9848	65°	0.9063	50°	0.7660	35°	0.5736
75°	0.9659	60°	0.8660	45°	0.7071	30°	0.5000

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Sling Angle

Sling angle = Load + Force

Load is constant

Force changes with sling angle

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What is TAG LINE??

A tagline is a rope attached to a load during a lifting operation to allow a rigger to control swinging and/or rotation of a suspended load. Multiple taglines may be required to exercise full control.



How To Communicate



RADIO COMMUNICATION

Radio communication;

Radio messages should be used to convey work requirements only and should not be used for general conversation. Under broadcasting regulations, profane language is prohibited so refrain from swearing



Always ensure that the transmission button is fully depressed before speaking into the microphone. Identify the station you are calling, eg:- “west crane”, Speak slowly and clearly at all the times and finish your transmission with the word “OVER”. **Do not release the button until a few seconds after completing your message**




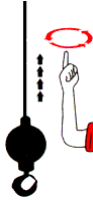
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RADIO COMMUNICATION




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HAND SIGNALS



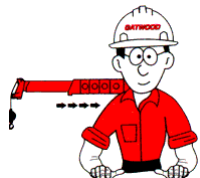
HOIST THE LOAD




LOWER THE LOAD




EXTEND BOOM




RETRACT BOOM



SLOWLY RAISE THE LOAD

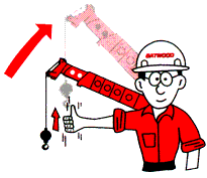


SLOWLY LOWER THE LOAD




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HAND SIGNALS




RAISE BOOM




LOWER BOOM




RAISE BOOM / LOWER LOAD




LOWER BOOM / RAISE LOAD



STOP




SWING

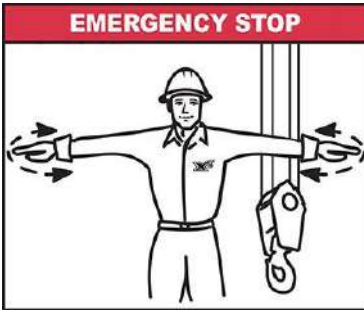


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HAND SIGNALS



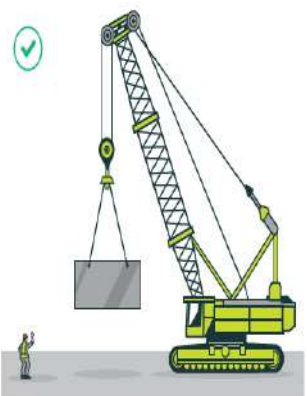
DOG EVERYTHING

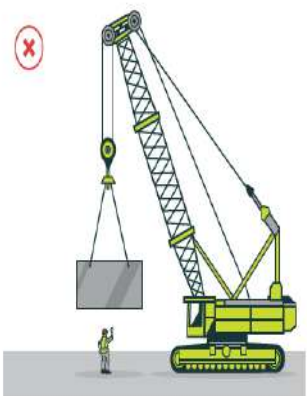



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STANDING POSITION







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GUIDELINES FOR SLINGER/BANKSMAN

1. Do everything possible to ensure the safety of personnel and equipment.
2. Be familiar with the crane working range, load radius and boom angle.
3. Know and understand appropriate safe slinging principles.
4. Inspect lifting accessories each time before use.
5. Know the weight of the load and the slinging methodology.
6. Be able to select the correct equipment for the job in hand.
7. Be aware of obstructions and hazards within operating range.
8. Know and understand the method of banksman hand signals.
9. Give clear and precise hand signals.
10. Use correct protocol during radio communication.

GUIDELINES FOR SLINGER/BANKSMAN

11. Warn personnel in the area of the movement of the load.
12. Never lift a load over personnel.
13. Never stand beneath a load or allow other personnel to do so.
14. Ensure hands are clear from lifting gear prior to lifting loads.
15. Always ensure an escape route is available prior to lifting loads.
16. Always use tag lines especially for awkward loads.
17. Ensure a minimum of **3** personnel is deployed for each lifting operation. I.E. Crane operator, Banksman and slinger.
18. If anything out of the ordinary occurs - **STOP and CHECK.**
19. Be aware of potential snagging points in the vicinity of the load whilst hoisting/lowering in restricted areas.
20. Be aware of wind speed and direction which could affect the lifting operation.



**THANK YOU FOR
CHOOSING NCMT!**

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