

# SAFE LIFTING





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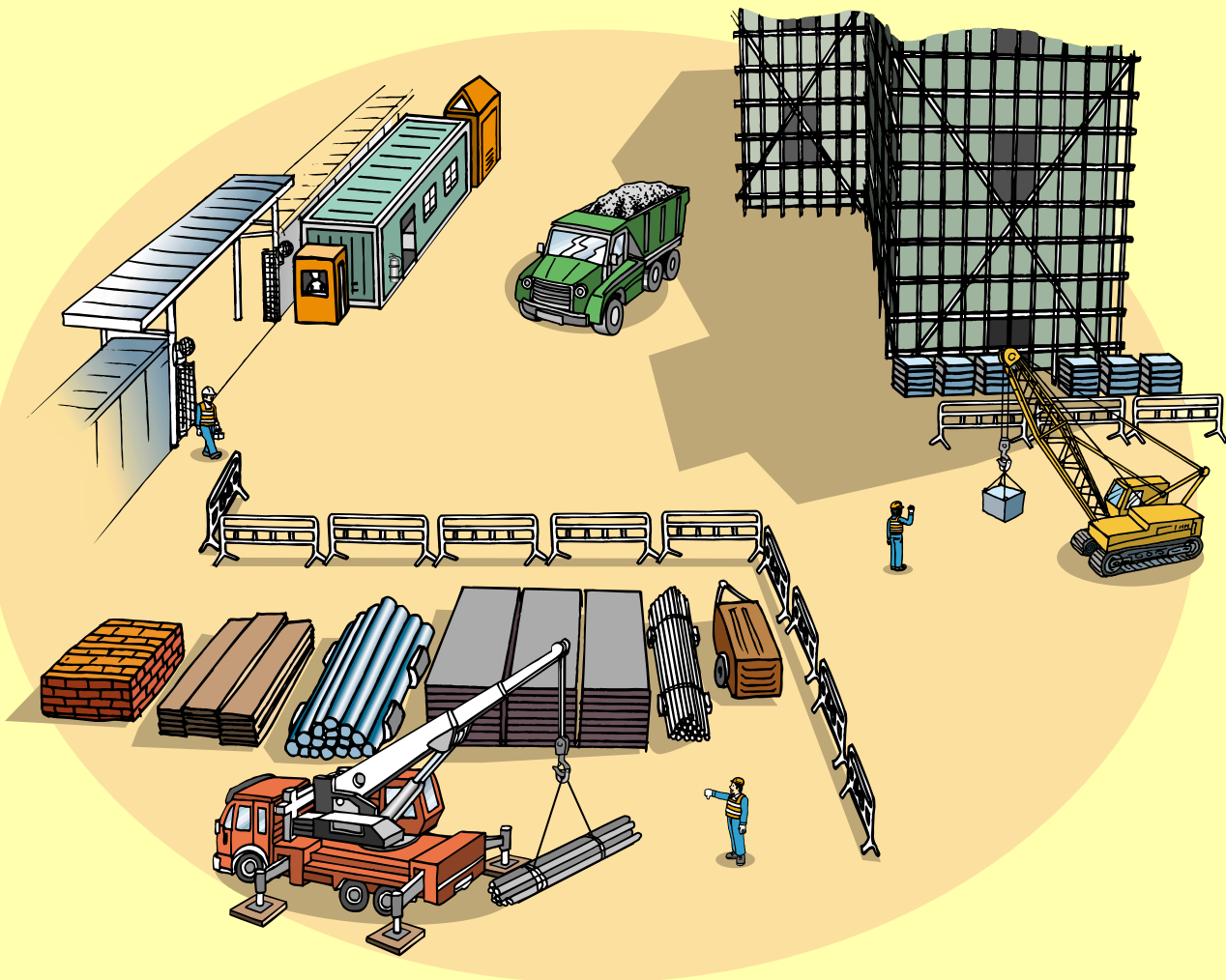
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## 1. Foreword

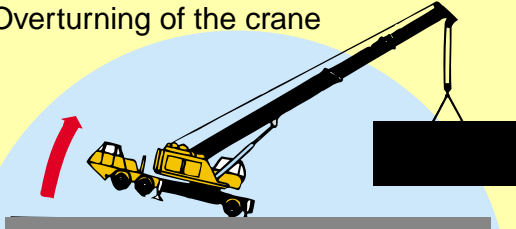
The lifting of objects generally occurs on construction sites, in factories and other industrial situations. Correct lifting can move large objects efficiently and reduce manual handling operations. Incorrect lifting however, can lead to disastrous accidents. Every year, incorrect lifting procedures cause injuries, loss of work time and property. People, machinery, loads, methods and the work environment, are all important factors for correct lifting. Provided that enough safety measures are fully implemented, lifting accidents can be reduced.





## 2. Common accidents in lifting operations

- Overturning of the crane



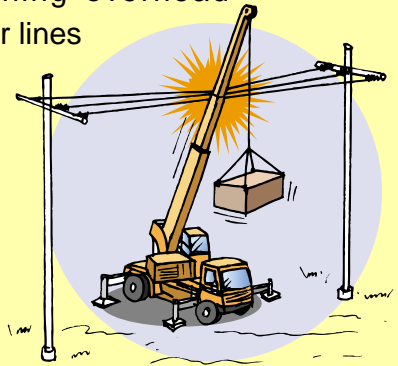
- Falling objects



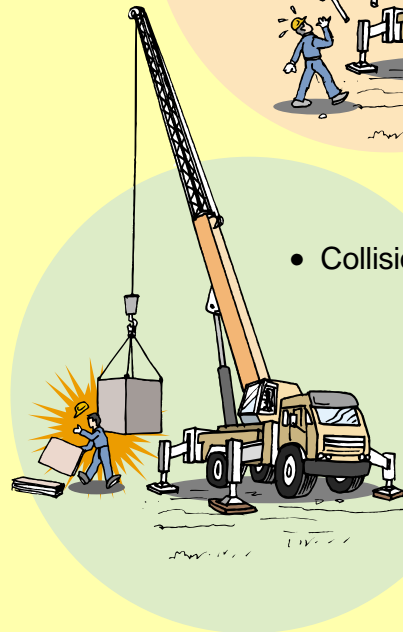
- Breaking the boom sling



- Touching overhead power lines



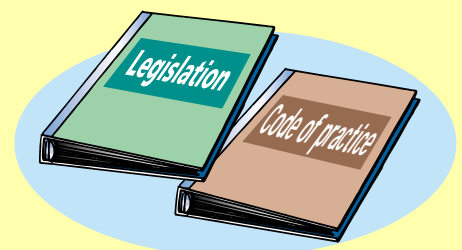
- Collision with obstacles



## 3. Legislative requirements and code of practice of lifting operations

Local legislative requirements that apply to lifting operations include Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations enforced by the Labour Department, and Shipping and Port Control (Cargo Handling) Regulations enforced by the Marine Department.

The Labour Department also published the code of practice for "Safe Use of Mobile Crane and Tower Crane" in 1998, and provides the trade with guidance for the safe use of cranes.





## 4. People

Personnel related to the lifting operation include "competent examiner", "competent person", "crane operator", "slinger", "signaler" and others working nearby.



- The "competent examiner" is responsible for regular examinations of the lifting appliances or lifting gears. He shall be:
  - appointed by the employer or the owner of the lifting appliances/lifting gears;
  - a registered professional engineer within a relevant discipline;
  - properly trained with relevant practical experience.

- The "competent person" is responsible for regular inspections of lifting appliances or lifting gears. He shall be:
  - appointed by the employer or the owner of the lifting appliances/lifting gears;
  - properly trained with relevant practical experience.




























- The "crane operator" is responsible for operating the crane correctly and safely. He shall:
  - be at least 18 years of age and hold a valid crane operation certificate;
  - be physically fit;
  - be familiar with hand signals for communication.



- The "slinger" is responsible for attaching and detaching the load to and from the crane. He shall:
  - have received appropriate training on general safe lifting operations;
  - be capable of selecting lifting gears suitable for the loads;
  - liaise with the operator and direct the movement of the crane safely.
- The "signaller" is responsible for relaying the signal from the slinger to the crane operator. He shall:
  - have received appropriate training on general safe lifting operations;
  - be able to direct the movement of the crane and loads.

## Suggested hand signals

 1 Emergency stop	 2 Stop	 3 Ready to move	 4 Move away from the signalman	 5 Move towards the signalman
 6 Move slowly by indicating distance	 7 Move towards the hand stretched direction	 8 Move towards the hand stretched direction	 9 Swing towards the hand stretched direction	 10 Swing towards the hand stretched direction
 11 Raise the boom	 12 Raise the boom slowly	 13 Lower the boom	 14 Lower the boom slowly	 15 Raise the boom and lower the load
 16 Lower the boom and raise the load	 17 Extend the boom	 18 Retract the boom	 19 Use the main hoist	 20 Use whip line
 21 Lower the hoist	 22 Lower the hoist slowly	 23 Raise the hoist	 24 Raise the hoist slowly	 25 Stop every thing

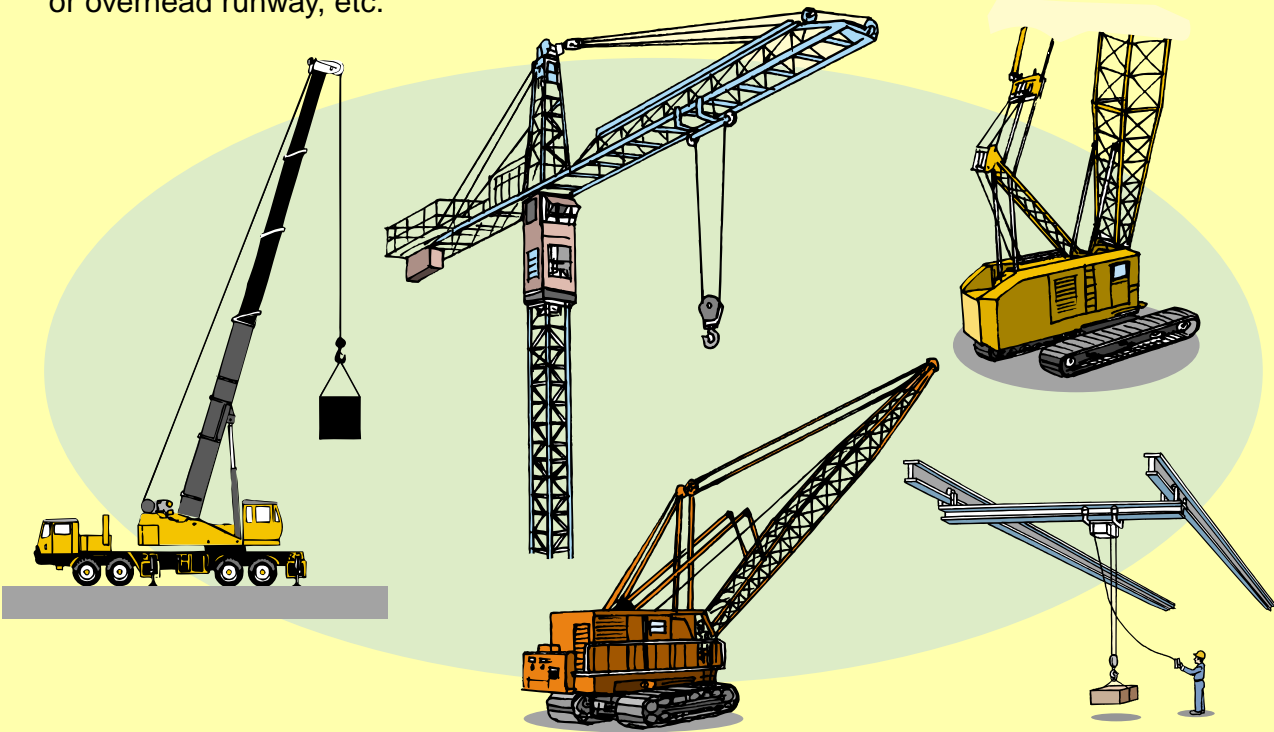
Note: During the lifting operation, either the slinger or signaller shall communicate with the operator. Other communication methods (e.g., wireless walkie-talkies, telephones, etc.) may also be used.



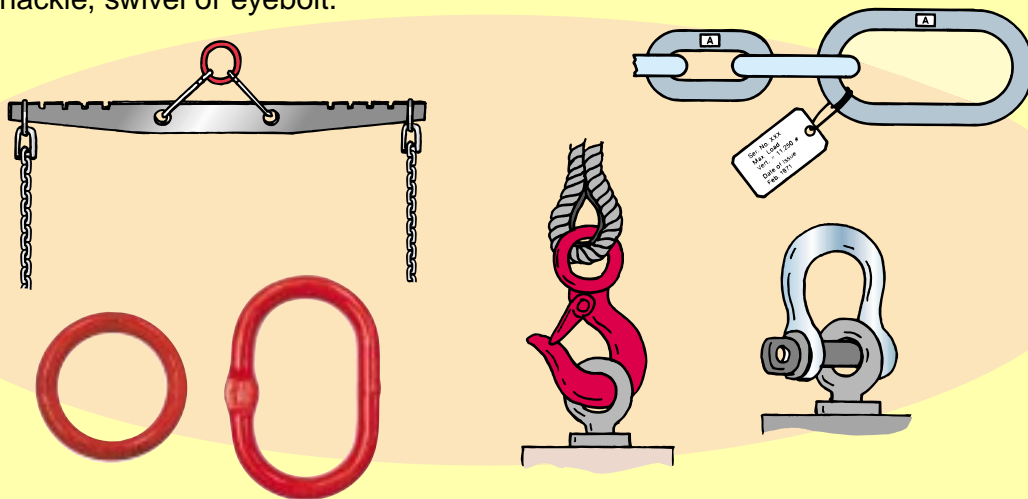
## 5. Machinery

**Machinery** – refers to lifting appliances and all lifting gears.

The lifting appliance includes a crab, winch, teagle, pulley block, gin wheel, crane, shearleg, excavator, pile driver, pile extractor, dragline, aerial rope way, aerial cableway transporter or overhead runway, etc.



The lifting gears includes a chain sling, rope sling, ring or similar gear, link, hook, plate clamp, shackle, swivel or eyebolt.





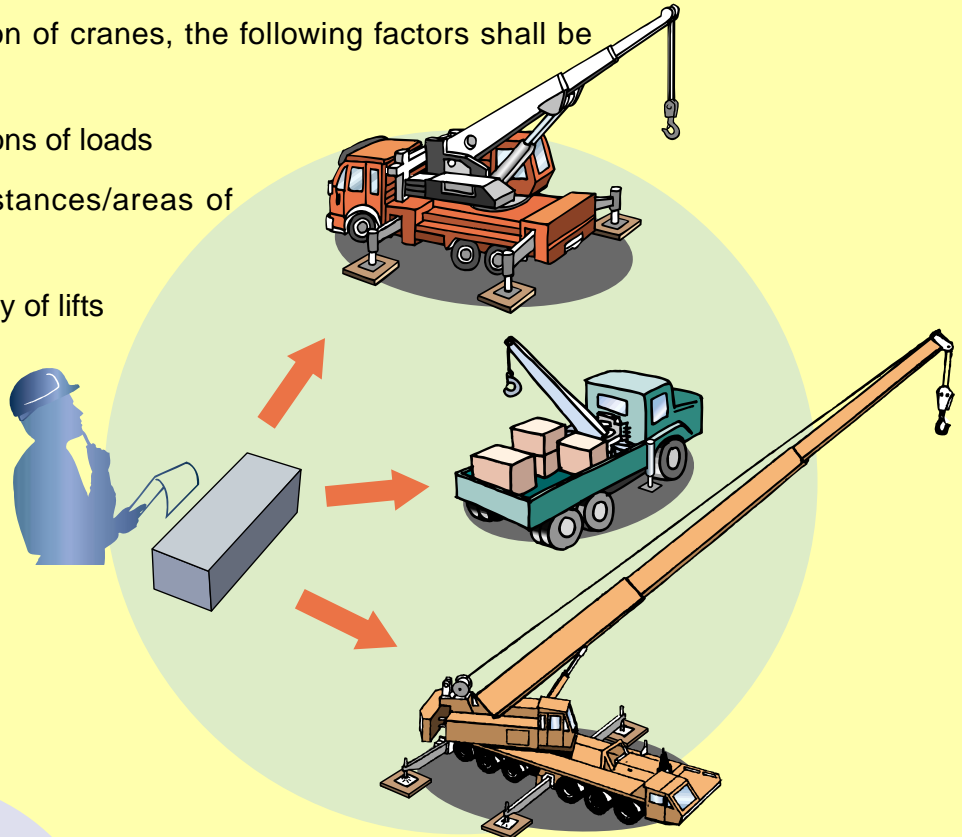


## 5.1 Cranes

### Selection of cranes

For the correct selection of cranes, the following factors shall be considered:

- Weights and dimensions of loads
- Height of lift and distances/areas of movement of loads
- Number and frequency of lifts
- Period of time for the lifting operation
- Ground conditions
- Other factors



### Testing, examination and inspection

All testing and examination of cranes must be carried out by competent examiners and the regular inspections completed by competent personnel. All testing, examination and inspection reports and certificates shall be properly kept.

### Safe Working Loads

The Safe Working Load (SWL) for operating the crane shall be specified according to the results of test and examination certificates, and such loads must not be exceeded during the lifting operation.

### Repair and maintenance

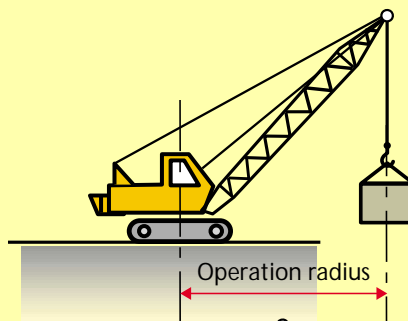
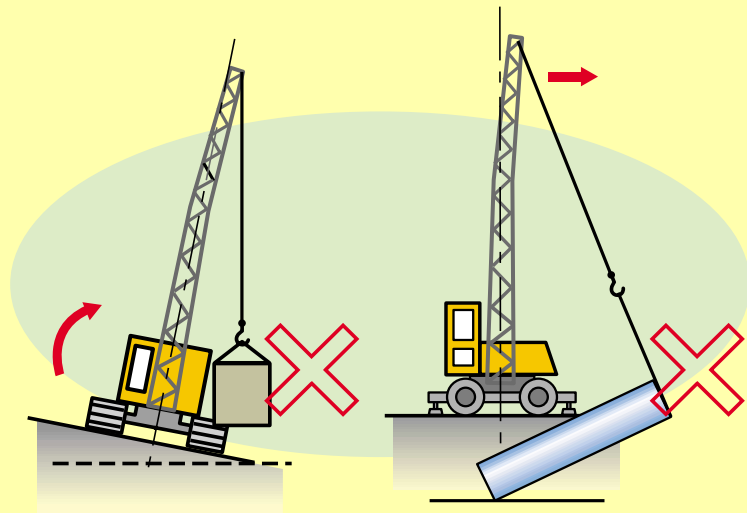
All cranes shall have regular maintenance, to ensure they always kept in good operating conditions.



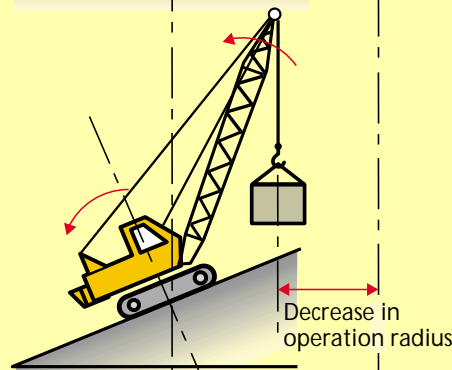
## 5.1.1 Mobile crane

### Operation points:

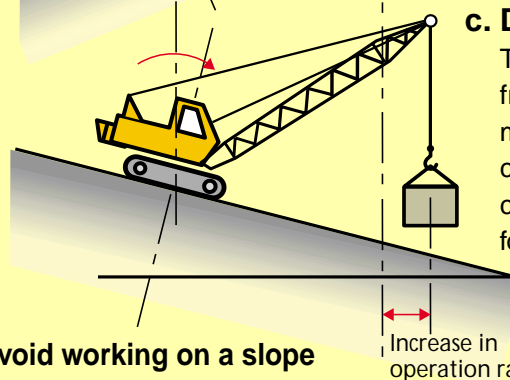
- The mobile crane shall only be operated on a firm, level ground that adequately supports the weight of the crane and loads.
- Before lifting, fully extend outriggers and ensure their stability on the ground.
- The weight of the load shall not exceed the Safe Working Load.
- Never abruptly swing or stop the crane.
- Loads shall not be dragged on the ground.
- Move the load at a safe speed - use low speeds within several metres of the load's destination.
- Adjust the boom length to ensure the crane is operating within the extent of the safe operation radius.
- When moving uphill or downhill, the boom angle shall be adjusted to the safe working condition.



**a. Level ground**  
Correct operation radius.



**b. Uphill position**  
The load moves toward the crane and reduces the operation radius that may cause the crane to tip over backwards.



**c. Downhill position**  
The load moves away from the crane and this may overload the crane and cause the crane to tip over forwards.

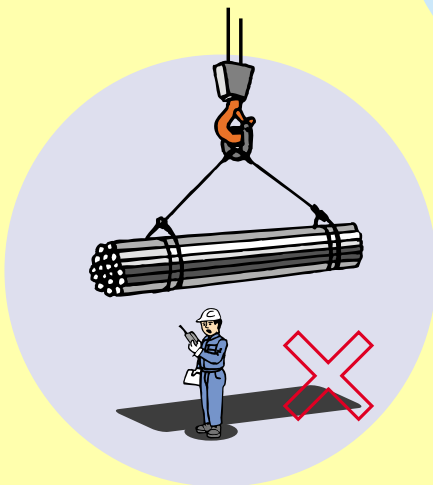
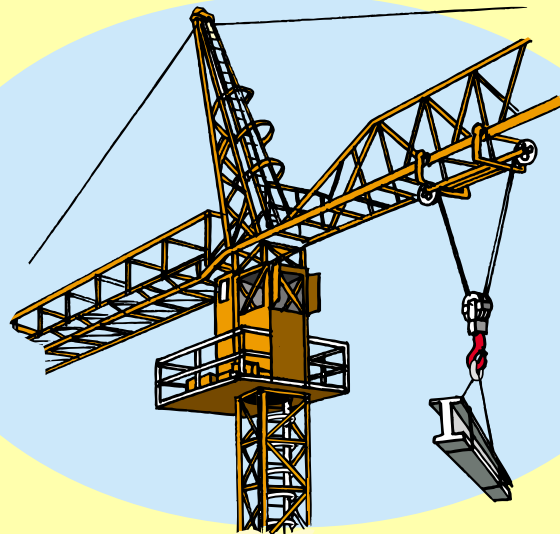
**Avoid working on a slope**



## 5.1.2 Tower crane

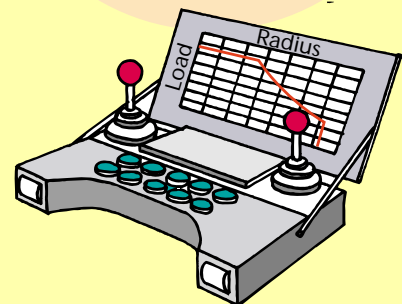
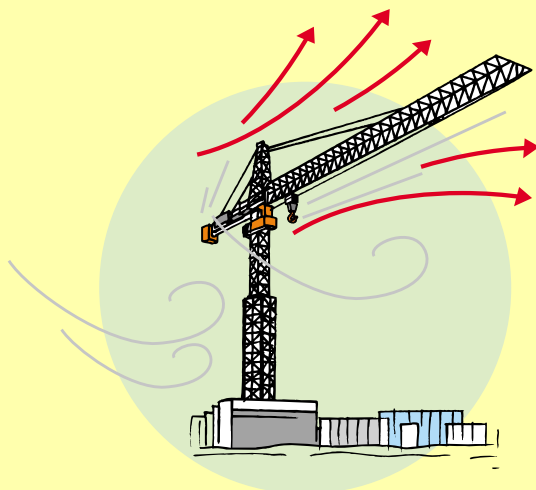
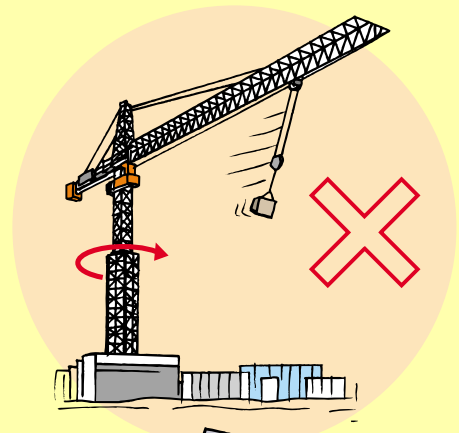
### Operation points:

- Ensure that the automatic safe load indicator is installed.
- Provide safe means of access and egress.



- Ensure that the lifting routes do not collide with any object.
- Lifting routes shall not come across any building or pass over any person.

- Travel speed shall be as slow as possible, to ensure the load's stability.
- Be aware of the height of lifting, the length of the crane's trolley and refer to the load chart.
- When the tower crane is not in operation, the crane's trolley must be positioned near the tower at minimum radius, with the hook raised to its highest position.



- During typhoons, the jib shall be set to the typhoon's leeward side with the brake released allowing the jib to swing freely.

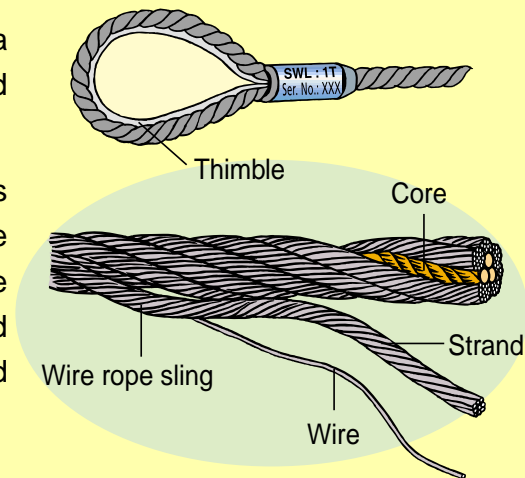


## 5.2 Lifting gears

Lifting gears play an important part in the lifting operation. Their function is to tie the objects tightly and hang them on the crane. There is a great variety of lifting gears. If there is insufficient knowledge or a wrong choice is made, lifting may fail and accidents may result. All lifting gears shall be tested by qualified examiners and suitably marked with a Safe Working Load (SWL).

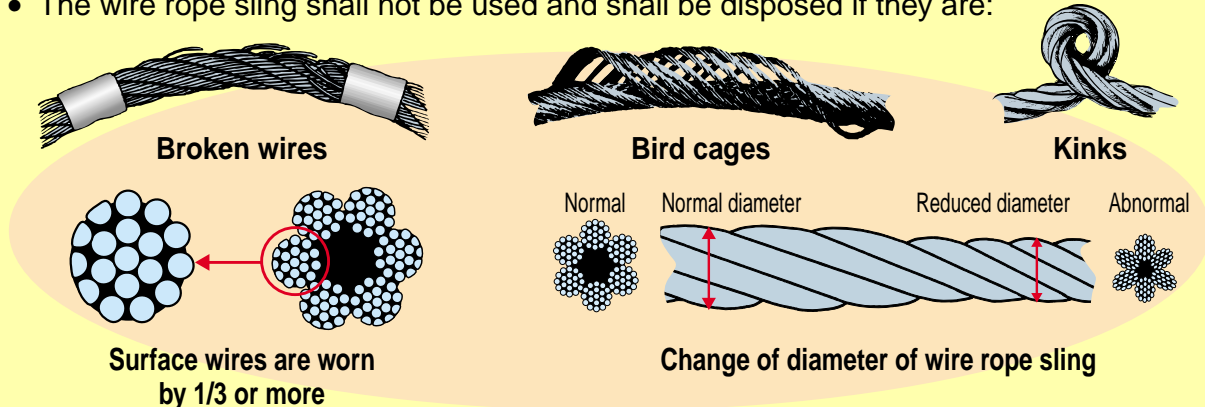
### 5.2.1 Wire rope slings

- Wire rope consists of individual wires laid into a number of strands, which are then wrapped around a central core.
- Different number of wires in the strands and various methods of arrangement may affect the characteristics of the wire rope sling. The wire rope shall be equipped with a thimble and with pressed metal sleeve and marked with a Safe Working Load (SWL).



#### Inspection points:

- The wire rope sling shall not be used and shall be disposed if they are:



#### Points for attention:

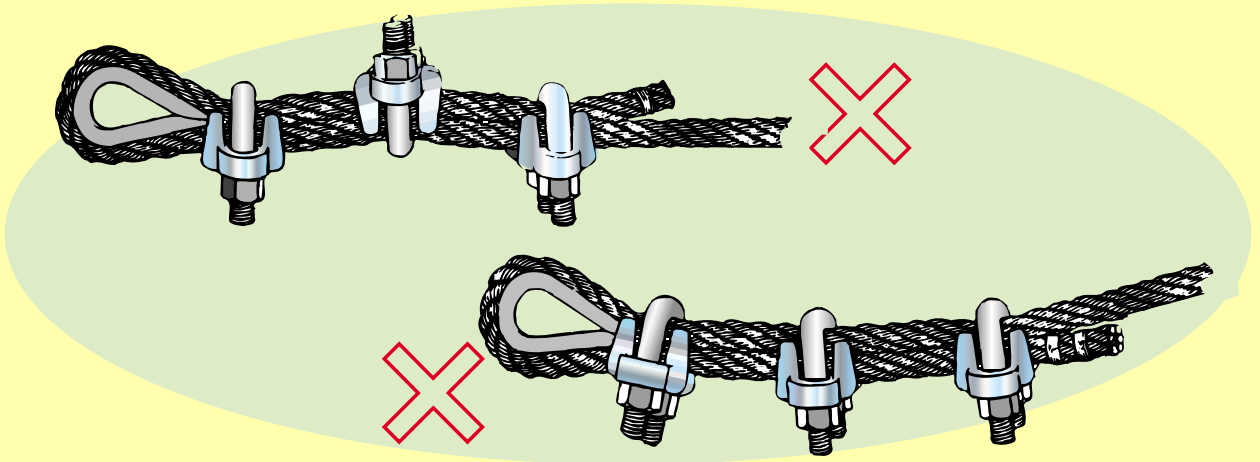
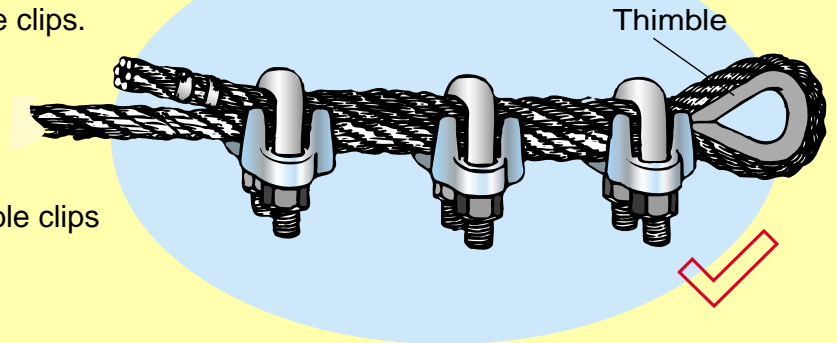
- Use only suitable wire rope slings.
- Never use damaged wire rope slings.
- During lifting, the Safe Working Load must not be exceeded.
- Regular inspections shall be conducted
- Sudden elevation is not allowed
- If more than one wire rope sling is used in lifting, pay attention to the angle between the slings.



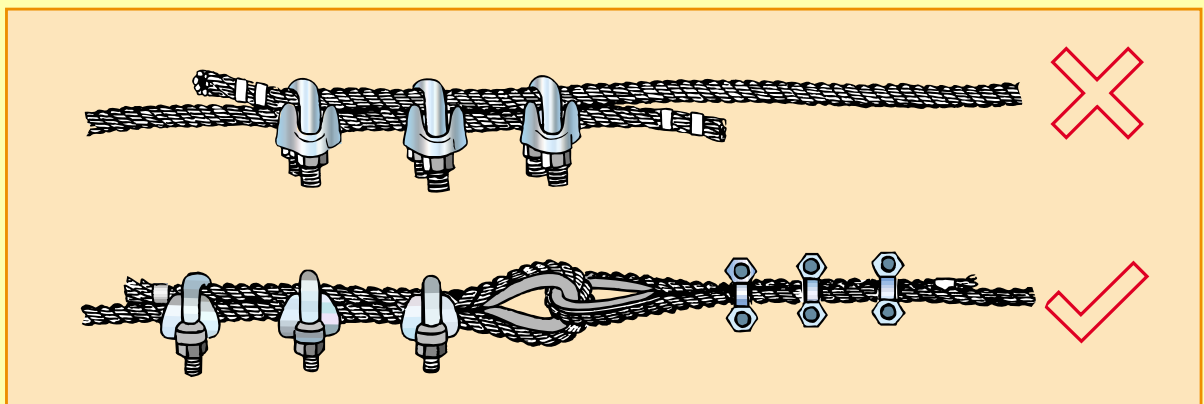
## 5.2.2 Wire rope slings - cable clip

The cable clip shall be properly installed according to the following points:

- The wire rope sling is equipped with thimble.
- There is a minimum of 3 cable clips.
- The direction of installation shall be correct.
- The distance between the cable clips shall be the same.



Method of connecting the wire rope slings:





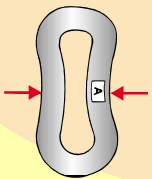
## 5.2.3 Chain slings

Chain slings are made up of chain rings. The advantage of chain slings is that they deteriorate and corrode less. Chain slings are made of alloys. They can maintain their Safe Working Loads under temperatures of 50°F. However, the entire chain becomes unsafe if problems arise in any section. A damaged chain sling will suddenly break and the damage is not as easily detectable as compared to rope slings. Therefore, a rope sling must be selected wherever possible for lifting.

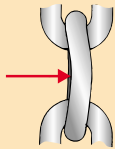
### Inspection points:

- The chain sling shall not be used under the following conditions:

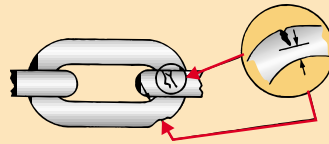
**Stretched**



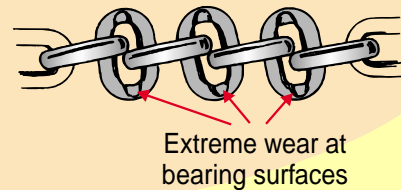
**Bend**



**Cuts, cracks**

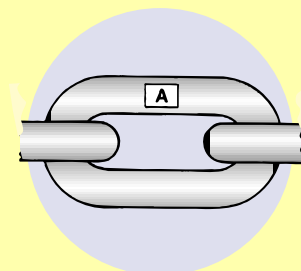
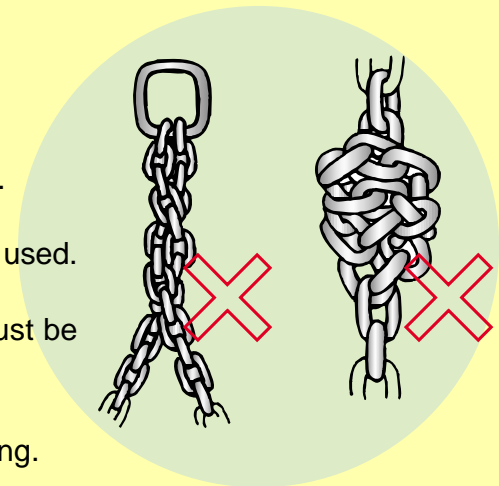


**Wear**



### Points for attention:

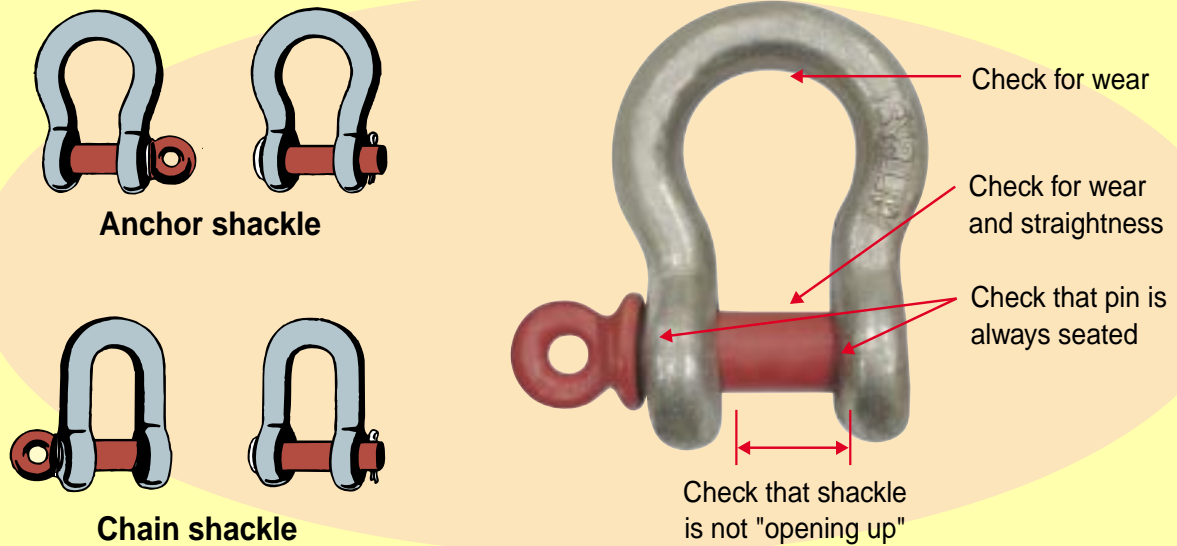
- No ordinary chains shall be used for lifting.
- The Safe Working Load (SWL) shall not be exceeded.
- No knots or bolts that shorten the chain length shall be used.
- Chain slings have no flexibility, so striking objects must be avoided while lifting.
- Do not use hammers to reshape a deformed chain sling.
- When purchasing chain slings, those marked "A" should be selected as they are of premium for normal use.
- Regular inspections shall be conducted.





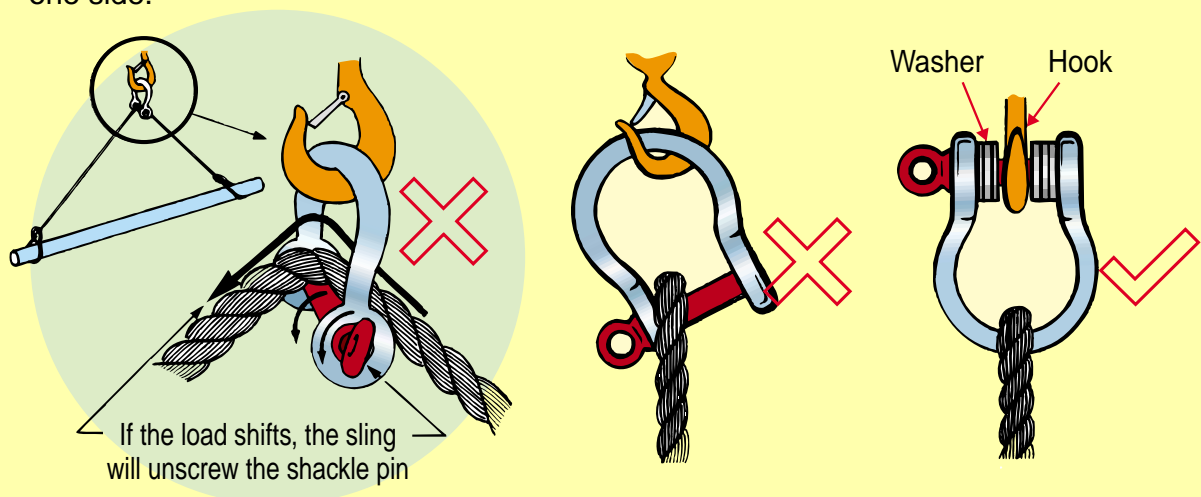
## 5.2.4 Shackles

Hook rings are divided into two main categories: Chain ("D" type) shackle and anchor (bow) type shackle. Both are available with screw pins or round pins.



### Points for attention:

- Never replace the shackle pin with a bolt.
- Ensure the pin is totally locked.
- Do not use screw pin shackles if the pin can roll and unscrew.
- During lifting, shackles shall not lean to one side.
- Shackle pins must always be attached to the hook.
- Washers may be used to centre the shackle.

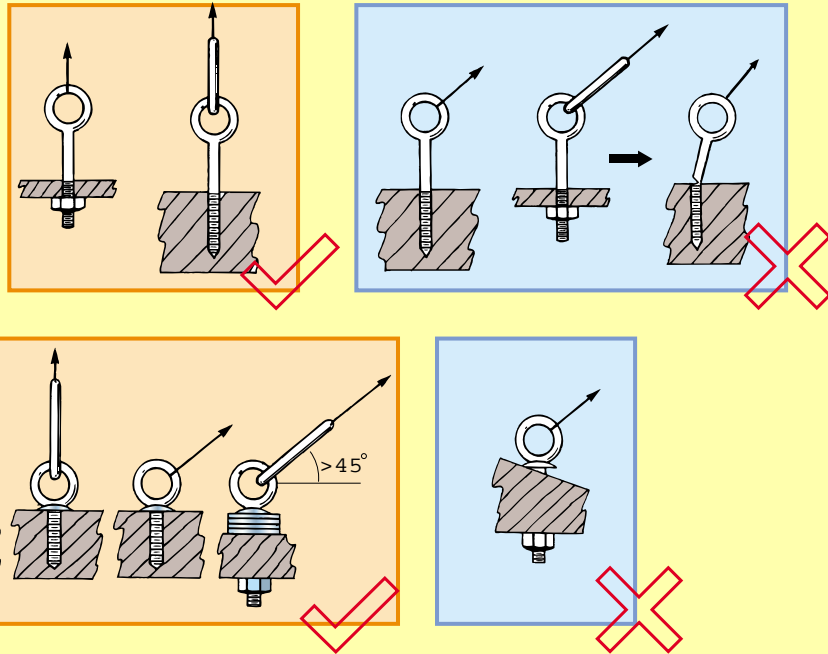




## 5.2.5 Eye bolts

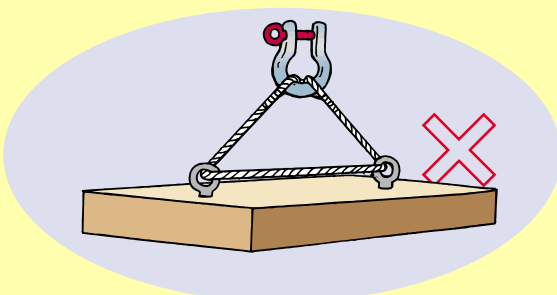
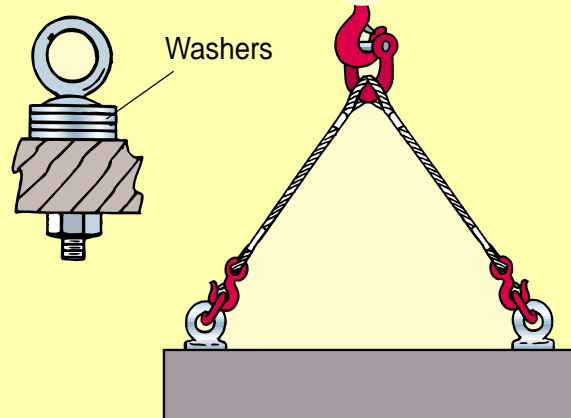
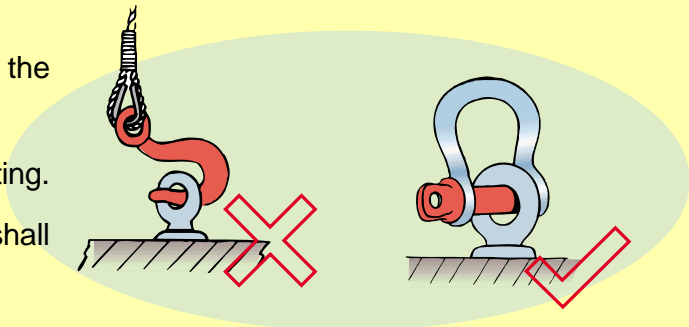
Eye bolts are mainly classified into plain (shoulderless) eye bolts and shoulder type eye bolts.

- The bolt length shall be 1-1.5 times the diameter of the bolt and totally drilled on the load.
- The bolt hole shall fit into the bolt



### Safety points:

- The hook shall not be directly fixed on to the eye bolt.
- Plain eye bolts only apply to the vertical lifting.
- The angle of lifting of shoulder eye bolts shall not be less than  $45^\circ$ .
- Washers may be used to ensure that the shoulder is firmly in contact with the surface.
- Never use a sling through a pair of eye bolts.

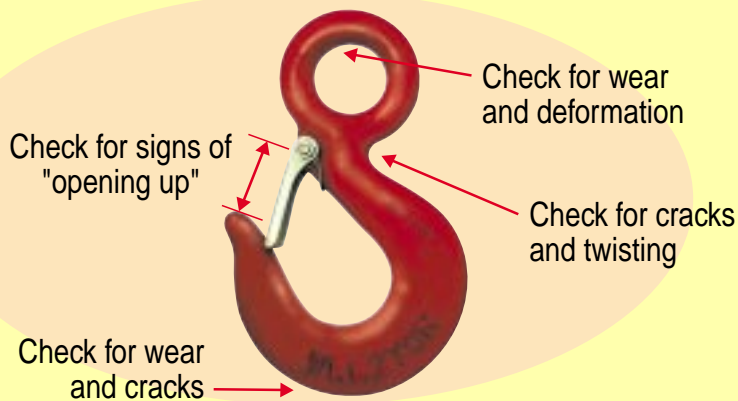






## 5.2.6 Hooks

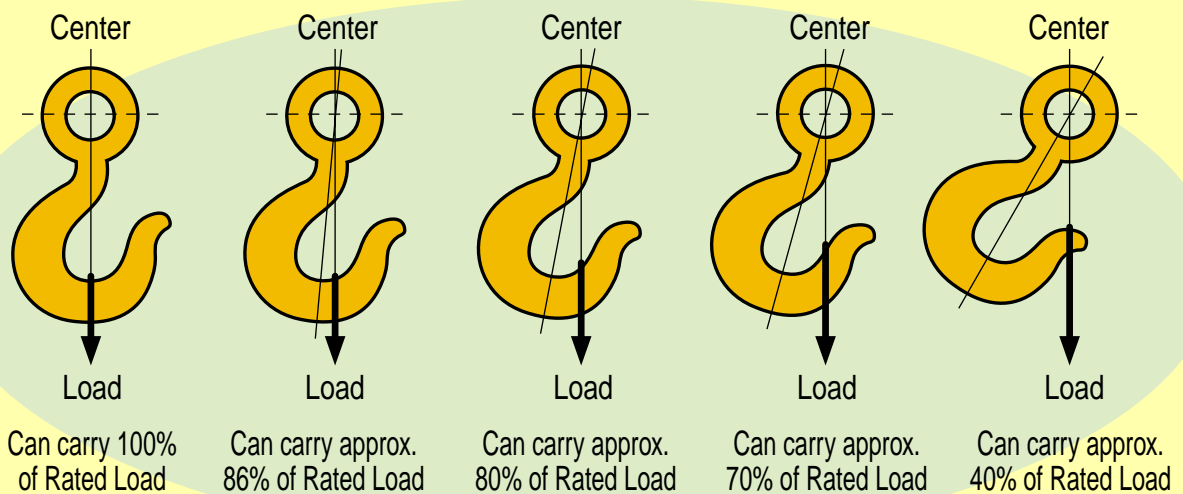
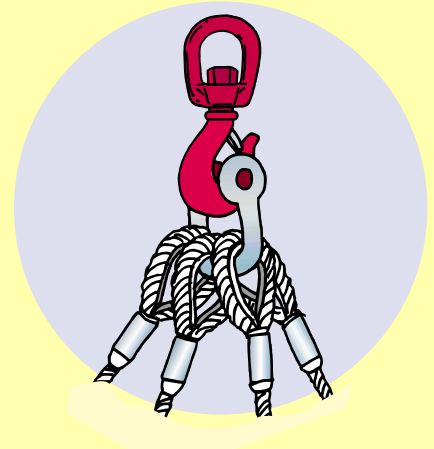
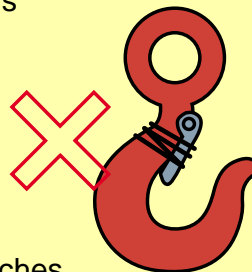
Hooks are a vital part of lifting gear. A variety of them cater for different lifting purposes.



- All hooks shall be installed with safety latches (other than the specially designed hooks).
- Hooks can be installed with swivels to allow the load to revolve.

### Points for attention:

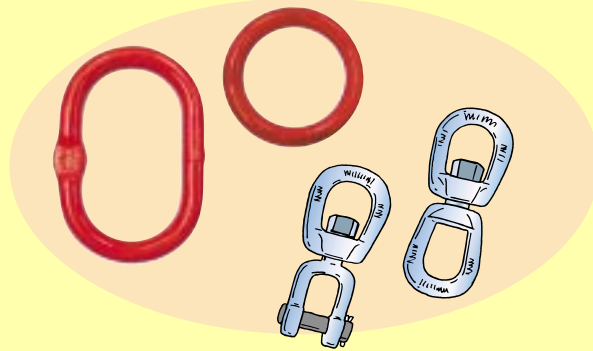
- Select hooks of the right size.
- Do not tie or remove the safety latches.
- Maintain the hook in a vertical position. If the hook is eccentrically loaded, the Safe Working Load will be reduced.



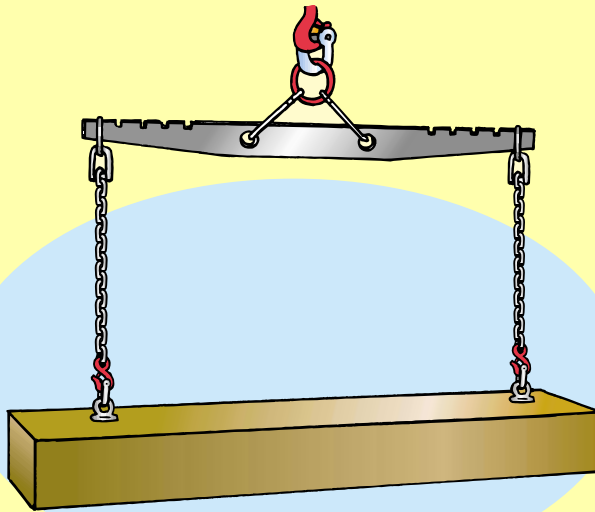


## 5.2.7 Rings, links, swivels

- Most of the rings, links and swivels are marked with Safe Working Loads (SWL). If no SWL is marked, the SWL tables shall be checked according to their diameters.



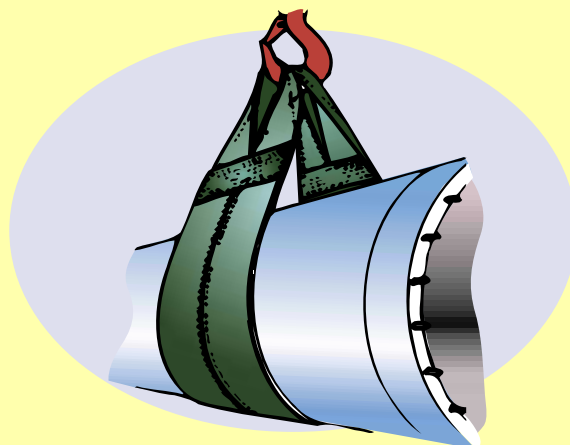
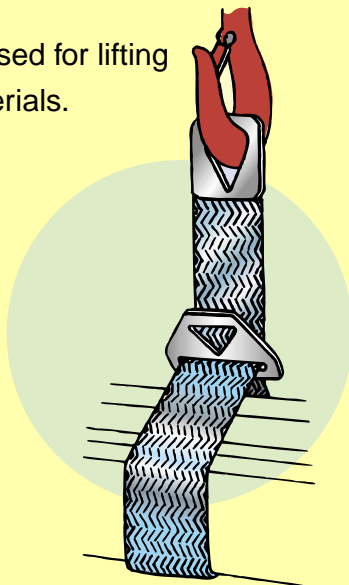
## 5.2.8 Spreader beams



- Spreader beams are commonly used for lifting long loads.
- The weight of spreader beams shall be included as part of the lifting load.
- Each of the contacted points shall not exceed the SWL.

## 5.2.9 Chain mesh slings and fibre slings

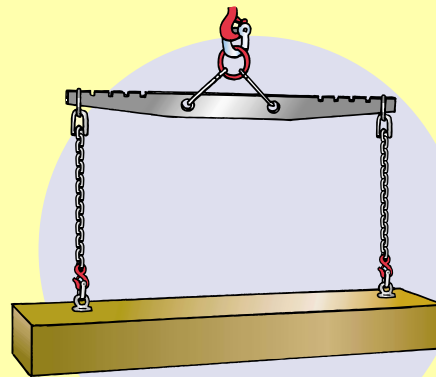
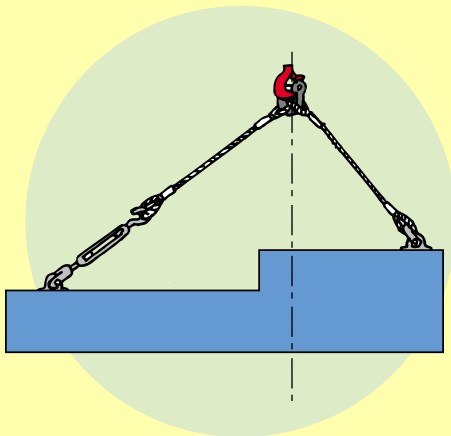
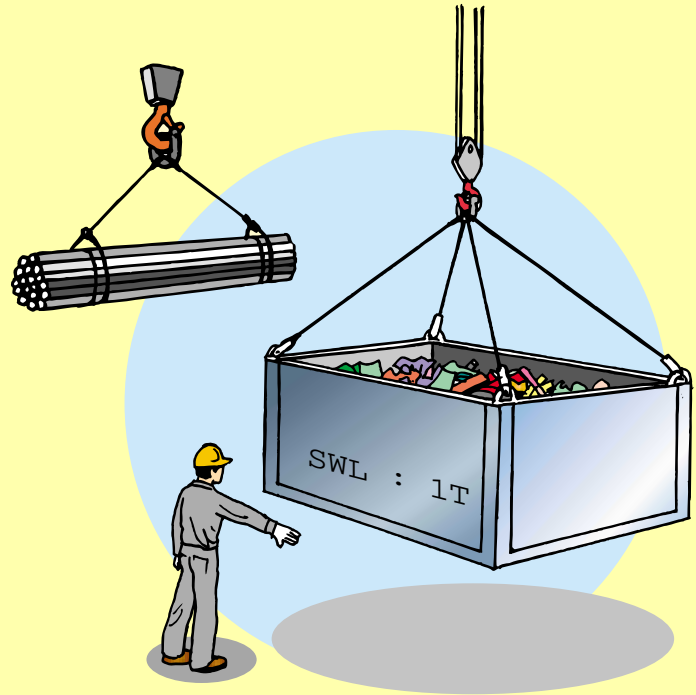
- These are used for lifting special materials.



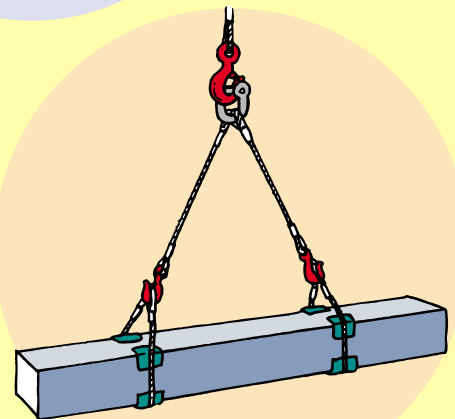


## 6. Load

- Know the weight and shape of the load.
- Loose loads shall be packed or placed in suitable containers before lifting.
- The containers must be structurally sound and 4 slings must be used to avoid inclining.
- The containers shall be examined and marked with Safe Working Loads (SWL).
- Pay attention to the load's centre of gravity - ensure that it is kept directly under the main hook.



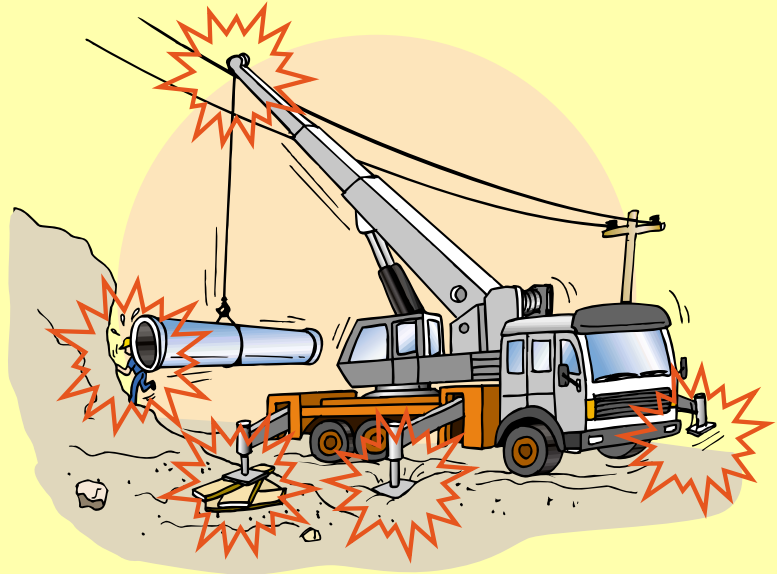
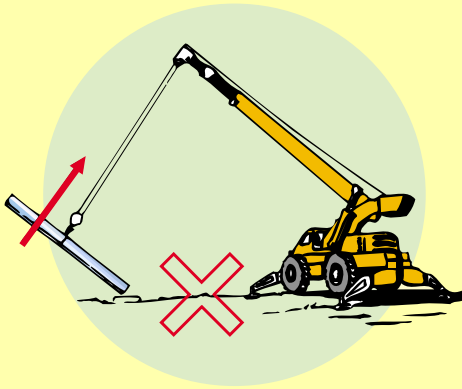
- Corner pads shall be used for loads with sharp edges.
- When lifting large or heavy loads, wind and operator visibility must be considered.



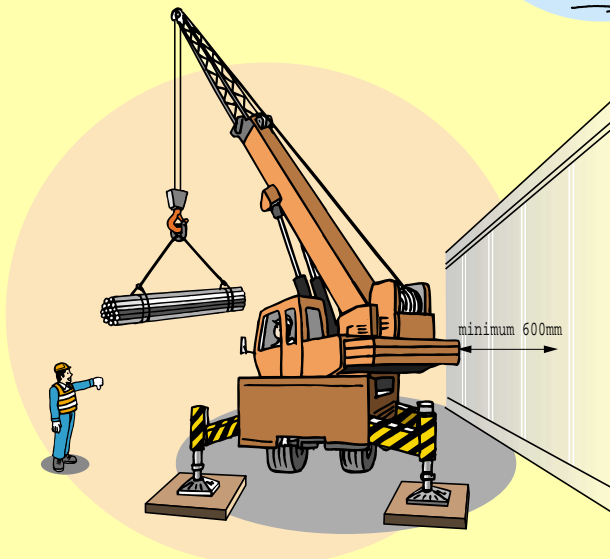
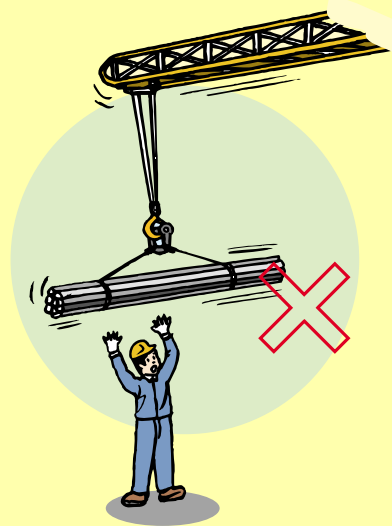
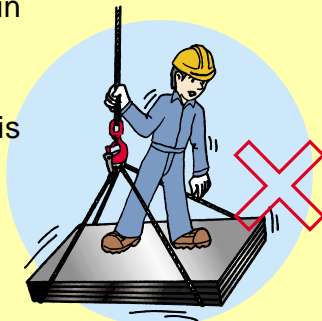


## 7. Method

- Plan a suitable lifting route, to avoid collision with any persons, objects or overhead power lines.
- Do not drag loads.



- Move the loads as near to the ground level as possible.
- Stop people from standing in the lifting area.
- Do not ride on a load that is being lifted.



- When the crane is in operation, it must maintain a distance of at least 600 mm from any barriers or buildings.
- When visibility is blocked, the signal man shall render assistance.
- Lifting the load at a low speed so that the sling tightens slowly and maintains a balanced position.



## 8. Environment

Safe lifting can be affected by rain, thunderstorms, strong winds, ground conditions and overhead power lines.

### Rains

- Rains creates wet and slippery ground, loose soil and landslides, etc. Depending on the situation, the operator shall decide whether to continue working or not. When the soil is loose and could cause danger to the crane's stability, lifting work must be stopped.

### Thunderstorms

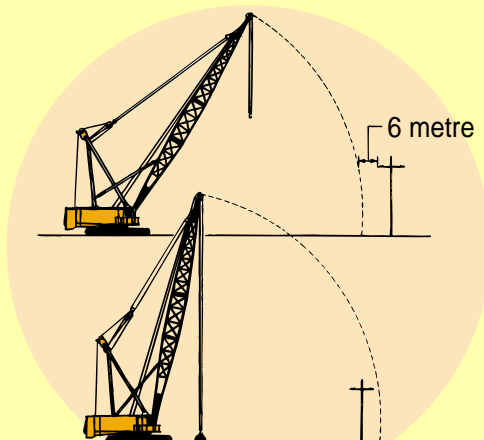
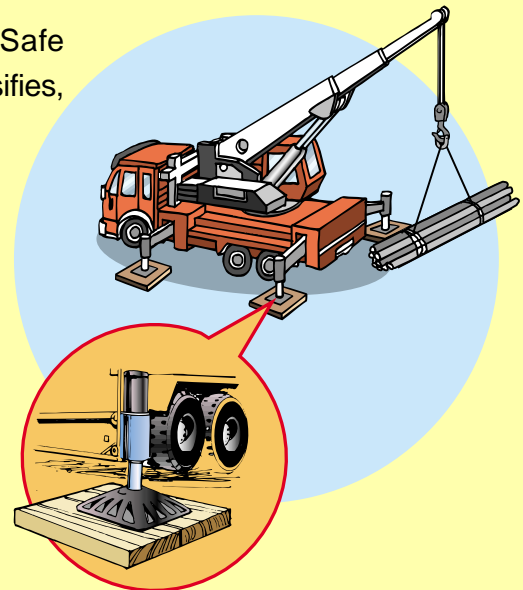
- During thunderstorms, stop lifting operations immediately.

### Strong winds

- In strong winds, decrease the weight of the Safe Working Load to improve safety. If the wind intensifies, work must be stopped.

### Ground situation

- Loose soil - use firmer, larger wooden planks to distribute the load and reduce the weight on the soil.
- When on a slope, adjust the outriggers to keep the crane horizontal.
- If there are excavations near the lifting appliances - strengthen excavations' supports.



Instruction from the signalman is required for safety operation

### Overhead power lines

- Stay well clear of overhead power lines. The safety margin must be the jib's distance + 6 metres, or the distance suggested by the electricity suppliers.



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