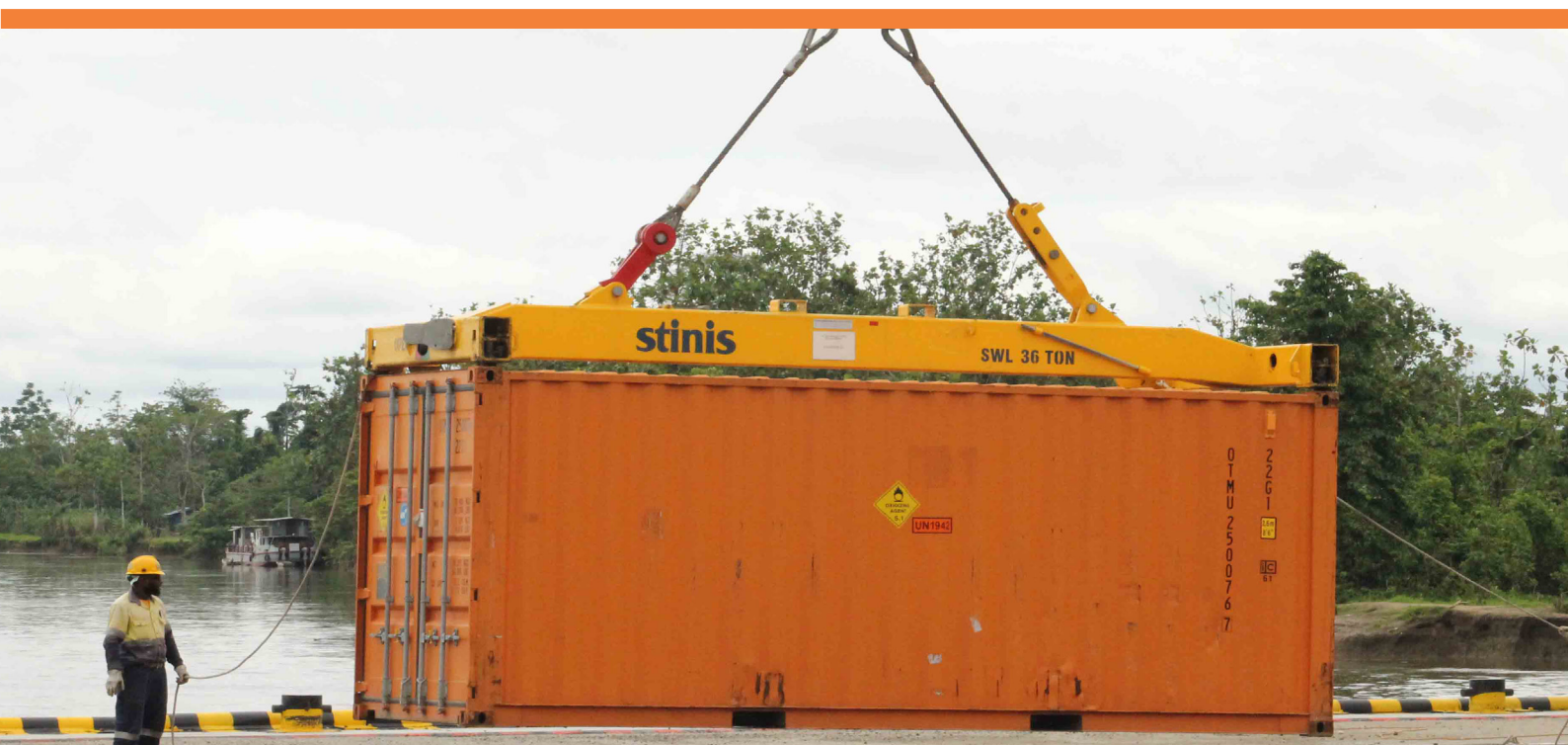


RIIHAN203D

Conduct Lifting Operations

Training Package



Safety Prompts

Symbols are used throughout this module to highlight specific points, particularly those that involve safety. The symbols and their meaning are shown below.



DANGER

This prompt is used when there is an immediate hazard that **IS LIKELY TO** result in severe personal injury or death if proper procedures are not followed.



CAUTION

This prompt is used to warn against potentially unsafe practices that **COULD** result in personal injury or death and/or property damage if correct procedures are not followed.



NOTE

This prompt is used when an operation, condition, or information is of sufficient importance to warrant highlighting.



ACTIVITY

An activity is a task to be done before continuing, this can be group based, one-on-one or external research.

Glossary of Terms and Acronyms

All industries have terms and acronyms that are specific to them. A list of commonly used terms and acronyms is included at the end of this training resource.

CONDUCT LIFTING OPERATIONS

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1. INTRODUCTION

This training resource provides information on your role in lifting operations and details how you can contribute to safety. It also outlines the requirements for operators working with various lifting equipment.

On successful completion of this training you will be able to demonstrate how to:

- comply with relevant legislation and standards for lifting operations and working with cranes
- work safely and communicate effectively on site
- identify hazards and apply appropriate controls
- inspect lifting equipment
- carry out slinging calculations
- select and use slinging equipment to move loads safely using cranes.



NOTE

This training resource is a guide only. Always follow OTML procedures when performing your work.

SECTION ONE: OPERATOR OBLIGATIONS

You have an obligation to ensure the safety and health of yourself and others and to protect the environment in which you work.

The following actions will help you to do this.

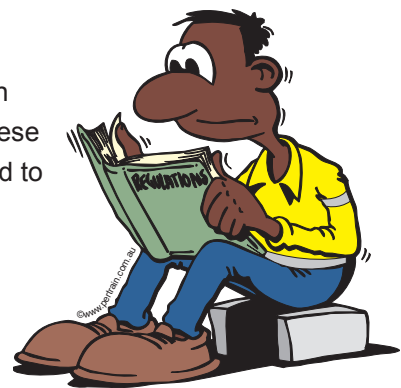
- Ensure that you are physically and mentally fit for work before starting any job.
- Comply with your organisation's Code of Conduct on how you interact with others, for example, no bullying, discrimination, unethical or unsafe behaviour.
- Do not attempt any task unless you are qualified and authorised to perform the task.
- Make sure that you have the required licences and authorisations to perform your work and that they are current.
- Select, check and use the correct personal protective equipment (PPE). Make sure that the PPE fits properly and is suitable for the task.
- Identify and report unsafe conditions, activities, incidents or near misses to your supervisor or safety representative.
- Report damaged or defective equipment for repair.
- Operate equipment within manufacturer specifications and limitations and according to site procedures.
- Use your site lock and tag system.
- Adhere to site environmental guidelines to prevent damage to the natural environment and designated heritage sites.



2. COMPLIANCE

During your general and site specific inductions you would have been familiarised with organisational and site policies and procedures. These have been developed in accordance with legislation and are designed to ensure that work is undertaken safely.

You must access and read all relevant documents and procedures for the task that you are doing. You must understand the documents and how they apply to your work. If there is anything that you do not understand, ask your supervisor before starting work.



The general hierarchy of compliance documentation is shown below.

GOVERNMENT ↓	ACTS OF PARLIAMENT (ACTS)	Written laws passed by government to set out the general obligations of employers and employees. EXAMPLE: PNG Mining (Safety) Act 1977
	REGULATIONS	Lawful requirements that provide additional details about how to comply with the Acts. EXAMPLE: PNG Mining (Safety) Regulations
INDUSTRY ↓	CODES OF PRACTICE	Developed by industry to provide practical guidance for complying with Acts and Regulations. EXAMPLE: Model Codes of Practice - Hazardous Manual Tasks (Safe Work Australia)
	STANDARDS (National and International)	Documents that provide practical guidelines, which when followed will ensure that a minimum quality benchmark standard is achieved for a product, service or process. EXAMPLE: ISO 31000 Risk Management Standard
ORGANISATION ↓	MANAGEMENT SYSTEMS	Developed by management to comply with legislation. Management systems provide overarching governance for all site activities including safety, human resources, finances, environment and community engagement. EXAMPLE: Code of Conduct, Environmental Management Plan
	POLICIES	Broad statements of the overall intent and direction of a specific activity or interrelated group of activities. Policies define roles and responsibilities. EXAMPLE: Safety and Occupational Health Policy
	PROCEDURES and WORK INSTRUCTIONS	Easy to understand, step-by-step instructions for carrying out tasks safely and in an environmentally sustainable way. EXAMPLE: Emergency Response Procedure
EXTERNAL ↓	EQUIPMENT SPECIFIC DOCUMENTS	Equipment manufacturer guidelines / manuals and specifications provide detailed information on the capabilities and limitations of equipment to assist with selection of equipment suitable for use and conditions. EXAMPLE: Maintenance Manual, User Guide, Parts Catalogue.



ACTIVITY

With the help of your trainer, obtain compliance documentation that applies to risk management. Discuss how these documents apply to your work task.

2.1 Environmental Issues

An environmental management plan must be prepared for all sites. The purpose of the plan is to minimise the environmental impact of operations. When isolating and accessing plant, you must be aware of procedures and practices for:

- dust prevention and minimisation
- control of fumes including exhaust gases and smoke
- water quality control
- waste management
- handling of dangerous substances and chemicals.



Check that the proper environmental control measures are in place. If you find any damaged or missing controls, report them to your supervisor before work starts.

During the task environmental conditions may change, for example lighting may deteriorate or it might storm. This can cause new hazards to emerge. If conditions change reassess the situation by doing a hazard identification and risk assessment using your site risk management tools. You may need to adjust your work task and/or implement new controls. All relevant personnel must be informed of any changes. Follow the site procedures to confirm the changes and ensure that everyone is informed.



NOTE

Report any spills, damage or other environmental impacts immediately, according to site guidelines.

2.2 Approvals

Only site approved lifting equipment is to be used on site. The site approval process ensures that equipment is fit-for-purpose. A Lifting Equipment Register lists the approved lifting equipment (such as slings, shackles, chains, chain blocks).

The equipment user is responsible for performing equipment inspections and reporting defects before and after each use.

2.2.1 Authorisations

Only trained and authorised personnel are permitted to perform crane and load shifting operations. Personnel will include crane operators and doggers. In all lifting operations, a single person will have overall responsibility for the task and must be present throughout the lifting operation being performed.

2.3 High Risk Work

The use of cranes and lifting equipment for heavy and difficult lifts or for the lifting of personnel is considered to be a high risk task and additional approvals or controls may be required.

OTML's Authority to Work (ATW) System is a formal process used to plan, control and complete work in accordance with safe work practices. The system requires communication and coordination from management, supervisors, authority issuing officers and those who complete the task.

A risk assessment is conducted before issuing the ATW.

The ATW helps to ensure that:

- There is proper authorisation of the work
- Hazards are identified and controlled
- Clear and precise instructions are given to those completing the work.

An ATW is required for work conducted at height and work undertaken near power lines. An ATW or work clearance may be required for work in high traffic areas, or where there are certain known hazards present.

2.4 Training Requirements

The national standard for high risk work sets out the training and assessment requirements for a person performing high risk work and the arrangements for issuing a licence to that person. The standard applies to persons who perform the work as well as trainers and employers.

High risk work licences for lifting equipment include:

- Dogging
- Rigging
- Crane and hoist operation.

OTML will provide training for personnel assisting with lifting operations.

Identify the appropriate training for your task and ensure that you are competent and authorised to perform lifting operations.

3. PLAN AND PREPARE FOR OPERATIONS

Before starting a task, make sure that you have all the necessary information and resources to do your work safely and efficiently. Use the information to help plan your work and to ensure that the work complies with all site and project requirements.

Most information will be given to you during a shift briefing. However, you may need to source additional information if it is not given to you, e.g. site map, load details, risk assessment, procedure.



NOTE

It is your responsibility to make sure that you have accessed and understood all the required information before you start work.

3.1 Shift Briefings and Handovers

Before starting operations, ensure that you have received a shift briefing from your supervisor, and a handover from the previous operator (if applicable). Information that should be provided in the briefing includes:

- Personnel and equipment scheduled to operate in the area
- Known hazards in the work area
- Events that will occur on site during the day that may affect your task
- Any problems that occurred during the previous day such as breakdowns and schedule slippage
- Updates such as revised survey data or amended priorities of work
- Current progress towards job completion.

A toolbox talk or short safety discussion may also take place during the briefing. Do not start any work until you have fully understood the information given to you by the supervisor. Ask questions to clarify information and confirm that you understand the task and your responsibilities.

3.2 Site and Task Procedures and Work Instructions

Once you know what your task requires, you will need to obtain relevant site and task specific details. These will include instructions for PPE, isolations and details on how to conduct your allocated task. Read these instructions before starting work and consult them as necessary during the job. You may be provided with these during the work briefing. If this information is not provided you will need to know how to access it yourself. Never start a task without all of the required information.



ACTIVITY

Access and review relevant procedures and work instructions.

3.3 Interpret Information and Plan Work

Once all relevant information has been obtained, it must be interpreted. This should be done at the work site, if possible, so that you can relate what you see on site with the information that you have been given. Advise your supervisor if you find a variation between the site conditions and the documentation you received, e.g. survey markers in different positions, signs of ground instability.

Before starting the job you should:

- make sure that access and ground conditions are suitable for the operation
- ensure that support personnel and equipment are available
- coordinate the work schedule with other work area operators
- establish an exclusion zone to restrict unauthorised access into the work area, if required.

Notify your supervisor if you feel that the work site is unsafe or there is a potential for damage to personnel, equipment or the environment.

After receiving the information, you, your work team and your supervisor can discuss a work plan for conducting the job.



Your plan should include the following information:

- how the task will be safely and efficiently accomplished
- set out task priorities
- what equipment or plant may be needed
- how hazards will be controlled
- what work area preparation needs to be conducted
- how you will work with other personnel in the area.

Make sure that all people involved with the work are aware of the work plan and understand their tasks and responsibilities.



NOTE

You may be required to develop a lift plan with the dogger or rigger involved with the task. Lift plans are detailed later in this resource.

3.4 Checks and Inspections

Conduct a thorough inspection of the lift site. Check that the travel route and work area is level and clear of obstructions and that there is clear access and exit points. Check for:

- Power, communication and water lines
- Service drains and ditches
- Obstructions and overhead clearances
- Unprotected cables and overhead power lines

Inspect lifting equipment and the load before starting a job and when the job has been completed. Do not assume that slinging and lifting equipment is in perfect working order because it has performed well during the previous shift. The crane operator and the dogger (or the rigger) both have a responsibility to check all lifting equipment before conducting the lift.



3.4.1 Housekeeping

A clean well-ordered work environment is not only more pleasant to work in, but safer for all personnel.

- Don't allow rubbish and waste to accumulate. This makes the place a lot safer by removing tripping and slipping hazards.
- Clean as you go. Remove spills of oil, grease or other materials off the floors, walkways and access steps as soon as practicable.
- Return equipment and materials to their proper places as soon as you have finished with them.
- Discard used containers, rags and packaging into the correct receptacles after use.

3.5 Select and Inspect Equipment for the Job

Lifting equipment is generally designed for a specific use. In many cases you will be assigned equipment to carry out your work. However, you will still need to evaluate the suitability of the equipment to carry out the job safely and efficiently. Confirm that lifting and slinging equipment is certified for its intended use.



NOTE

All lifting equipment and slings must be inspected before and after use by a person licenced to conduct dogging or rigging work.

Select and check PPE at the planning stage and again before starting the lifting task. Information on specific lifting equipment and PPE is covered later in this resource.

3.5.1 Defect Reporting

Defects or faults may be noticed during inspections or other activities. If the slinging and lifting equipment is unsafe to operate, attach an Out of Service tag to the appropriate position to ensure that the faulty component or lifting device is not operated. Unserviceable lifting equipment is to be removed from service and tagged out. Items will be destroyed or returned to the manufacturer for repair depending on the equipment and the damage/fault.

Follow the site procedure to ensure that the defect/fault is tagged and reported to the supervisor.



4. WORKING WITH OTHERS

Many tasks on site require you to communicate and coordinate your work with others, including:

- Conducting a hazard identification and risk assessment of the task or work area and determining and implementing the most suitable risk controls
- Preparing the work area to ensure that access and ground conditions are safe and suitable for operations (you may be responsible for conducting this work, or notifying/organising relevant support personnel to do the work)
- Coordinating the work schedule before starting work to ensure resources are available and/or to minimise disruption to other workers in the area
- Advising others of changes to work plans, or conditions. If there is a need to change the work plan, you must inform all personnel who may be affected.

Working in a team has many benefits for the work and the safety of all involved. Effective teams:

- Provide access to people with different areas of expertise and experience
- Make the most of individual talents to help complete the task more efficiently
- Encourage ownership of the risk management process by everyone concerned.



4.1 Communication

Communication is a two-way process that, in its simplest form, involves a sender, a message and a receiver. Both the sender and the receiver must actively participate, to ensure that the message is delivered effectively and that a common meaning is understood. The best way to do this is to ask questions and provide feedback.

Familiarise yourself with the language used on site so that you can select, use and understand the most appropriate terms. Using established industry terms enables you to send your message more accurately, and reduces ambiguity and confusion that can lead to a less safe and less productive work environment.

Information may be communicated:

- In person
- In writing
- Using equipment
- Using agreed signals.

4.1.1 Person to Person

Verbal communication such as a discussion, meeting or briefing, allows for instant feedback and the opportunity to confirm the meaning and understanding of the message. Consider the following guidelines when communicating in person.

- Speak clearly and directly.
- Listen carefully to instructions and information.
- Ask questions and give feedback to confirm your understanding.
- Respond to directions promptly.
- Be aware of your body language and make sure that your words and actions are sending the same message.



4.1.2 Written Communication

Written communication can be paper-based or electronic. Written communication provides a permanent record of the information being communicated and can include procedures, log books, reports, checklists, forms and tags. Make sure that you read and understand all written instructions. If you do not understand any part of a written instruction, ask your supervisor for help. When communicating in writing:

- Write legibly or type the message
- Keep the document brief and to the point
- Use templates and forms if available
- Read and check the spelling before submitting
- Use plain words
- Write in a logical sequence.



4.1.3 Communication Equipment

Inspect communication equipment and check that it is operating correctly before starting the task.

When using the two-way radio, identify yourself at the start of the message and wait for confirmation before proceeding (Positive Communication).



Conduct Lifting Operations

When using communication equipment:

- Make sure you know how to use equipment before you need to use it
- Know the site area and emergency radio channels
- Inspect equipment before use and make sure that it is operational (tag out and report if damaged or faulty)
- Have spare power source (batteries, power cable)
- If working in a remote area, consider having more than one method of communication available (e.g. radio and satellite phone) in case one does not work in an emergency situation
- Acknowledge communication directed at you



CAUTION

Do not use a mobile phone when operating equipment.



4.1.4 Signs and Signals

Where distance or noise is a problem, or where a message must be provided to a number of receivers over an extended period of time, communication may be via signs or signals.

A sign displaying a safety message carries the same authority as a direct instruction from your supervisor. Failure to obey a sign can result in disciplinary action, injury or death.



NOTE

Signs are placed for your protection. Always keep signs clean and in good condition. Do not remove a sign unless you are authorised to do so.

Signals vary between sites so it is essential that relevant personnel are aware of, and understand the signals to be used before commencing a task. Signals include hand signals, whistles and horn signals.

4.1.5 Communication During Lifting Operations

If two or more cranes are working close together, a different type of signal must be used for each crane, for example one uses whistles and the other uses hand signals.

The signal person should be the only one giving signals to the crane operator at any one time. That person must remain visible to the crane operator at all times.



NOTE











Any person may give a STOP signal. The crane driver must obey it immediately.

In general, during lifting operations:

- Hand signals are used when the crane operator is always in direct view of the person directing the load
- Whistle signals are used when the crane operator is in or out of sight of the person directing the load

- A fixed channel two-way radio is used:
 - when hand signals can't be used because the crane operator is not always in direct view of the person directing the load
 - when whistle signals can't be heard or can be confused with other signals due to multiple cranes operating in the area
 - when it is more efficient to use than other methods.

The following table shows the standard hand and whistle signals that are used when directing the crane or hoist operator during lifting, movement and landing of a load..

Motion and Hand Signal	Whistle/Horn Signal	Motion and Hand Signal	Whistle/Horn Signal
Hoist/Load Raise 	2 Short ••	Slew/Load Left 	1 Long 1 Short — •
Hoist/Load Lower 	1 Long —	Boom Extend 	1 Long 3 Short — •••
Luffing Boom Up 	3 Short •••	Boom Retract 	1 Long 4 Short — ••••
Luffing Boom Down 	4 Short ••••	Travel 	Not Applicable
Slew/Load Right 	1 Long 2 Short — ••	Stop 	1 Short •

Conduct Lifting Operations

Radio Communication During Lifting

All radio communications during a lifting operation should be made on UHF two-way radios that operate on a dedicated commercial frequency.

That frequency should also have a Private Line (PL) code for added protection from interference from other radio users. The use of a Digital Private Line (DPL) code will offer even more protection against any unwanted voice traffic.



NOTE

If interference is received the PL code will not protect the channel from being tied up, but will stop any unwanted voice traffic.

Personnel should use a UHF hand-held portable radio with either a remote speaker microphone or lightweight single muff headset with press to talk operation. Voice activated headsets should not be used as accidental transmission may be caused by background noise. Radio equipment should be serviced regularly, according to the manufacturer's guidelines, to ensure correct performance.

Trunked Radio

A trunked radio is a computer-controlled two-way system that locks other radio users out of your frequency. No other operator can cut in and overpower your signal. Trunked radios can have separate groups communicating on one site without interfering with each other.

When using two-way communications during a lifting operation, give directions using the following method.

1. Give the motion first.
2. Followed by the direction.
3. Repeat the motion and direction.

For example:

- Hoist up Jim, hoist up.
- Jib down Fred, jib down.
- Slew right George, slew right.



NOTE

Turn on and inspect communication equipment before starting your task to make sure that it is fully charged and serviceable. Know how to use the communication equipment correctly.

Before conducting lifting operations, agree on the best method to communicate with the crane operator and/or other personnel.



NOTE

You must maintain communication with the crane operator throughout all lifting activities.

5. HAZARDS

On arrival at the work area take a few minutes to inspect the site so that you can identify and control any hazards. Although you will have a plan, it is still important to inspect the work site before commencing the lifting operation. Conditions may have changed since the plan was made.

Before starting work, consult with other personnel who have knowledge of the task, the site and / or potential hazards. These people may include:

- Safety Officers
- Supervisor
- Colleagues
- Subject Matter Experts (SME)
- Managers who are authorised to take responsibility for the workplace or the task
- Site Engineers (if applicable).

Consider the following potential hazards that may impact lifting operations:

- site specific issues
- electrical power lines
- underground services
- pedestrians and personnel
- plant and equipment
- buildings
- obstructions
- potential non-weight bearing surfaces
- wind and other bad weather conditions
- lighting and illumination
- trees
- overhead service lines
- surrounding structures and facilities
- dangerous materials, chemicals and substances
- vehicle traffic
- load configuration and condition
- type of crane.

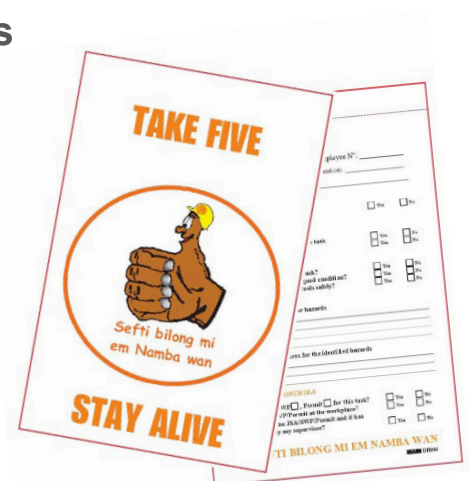
5.1 Hazard Identification and Risk Analysis

Every person should do a Take 5 before starting a new task, particularly if:

- the task is unfamiliar to you
- you are unsure that your work can be carried out safely
- the task is potentially hazardous
- the task is potentially a high-risk activity.

The Take 5 tool requires you to:

1. Stop work
2. Think about the task you are about to do
3. Identify the hazards by asking yourself a series of questions
4. Plan how you can control the hazards
5. Proceed with the task when you are satisfied that it can be done safely.



5.1.1 Job Safety Analysis

Conduct a Job Safety Analysis (JSA) if:

- you answered 'No' to a Take 5 question
- there is no written procedure for a complex task
- the task involves multiple people
- an Authority to Work or Clearance Certificate is required, for example working in a confined space or near high voltage lines
- people, conditions, equipment or procedures have changed and new hazards may exist
- an incident has occurred during operations.

A JSA is carried out by two or more people. Every person involved in the task should must read and understand the information before signing the JSA form and commencing work.

5.1.2 Hazard Report

A hazard report provides a means of communicating an uncontrolled hazard to your supervisor and management. The purpose of reporting the hazard is to prevent an unsafe condition or behaviour from causing an incident or an emergency. Controls can be put in place to permanently reduce or eliminate the hazard.

5.2 Types of Hazards

Be aware of your surroundings and make sure that you understand the hazards that may be present as you perform your work. Some of the hazards associated with working on site are shown below.

Hazard Type	Risk
Mechanical (Vehicles, tools, mobile equipment)	Collision with operating plant and equipment
Chemical (Fuels, oils, acids, alkalis, poisons, drugs, alcohol, explosives)	Poisoning, fire, explosion, corrosion
Stored Pressure (Hydraulic systems, compressed air, liquid, gas)	Explosion, fire, penetration injury
Thermal (Hot liquids, hot mechanical components, fire)	Burns, explosion
Radiation (Arc welding, radioactive material, UV)	Burns, eye injury, illness, sunburn
Acoustic/Noise (Vehicle, plant, machinery, blast noise)	Hearing loss, stress, poor balance
Vibrational (Vehicle, plant, machinery and blast vibration)	Injury, environmental issues, site collapse
Electrical (Power supply to electrical equipment, cables, power lines)	Electrocution, fire
Biological (Bacteria, viruses, parasites, infections, insects)	Illness, site closedown, loss of production

Hazard Type	Risk
Ergonomic (Manual Handling, equipment design)	Back, knees and other injuries, eye strain, headaches
Environmental (Dust, fumes, flooding, lighting)	Respiratory problems, death, environmental issues
Gravitational (Suspended loads, falling objects, fall from height)	Injury due to fall, contact injury due to object falling from height
Physical (Muscular strain, injuries, dehydration, illness, fatigue)	Worsening of injury or condition, development of secondary injury or illness
Psychological (Work pressure, stress, discrimination, bullying)	Stress, headaches, depression

Some of the hazards associated with the use of cranes and lifting gear are listed below.

Hazards (Cranes)	Risk
Overhead powerlines	<ul style="list-style-type: none"> • Interaction resulting in burns, shock, electrocution • Equipment and infrastructure damage • Disruption to services
Structures (e.g. buildings, bridges, trenches) on travel path or load/unload area	<ul style="list-style-type: none"> • Interaction resulting in equipment and / or structure damage • Damage to load
Dropped load	<ul style="list-style-type: none"> • Crush injury or fatality • Damage to load
Load shift or swing	<ul style="list-style-type: none"> • Personnel injury or fatality • Damage to load • Damage to equipment and / or nearby structures
Equipment rollover	<ul style="list-style-type: none"> • Personnel injury or fatality • Equipment damage • Lost production
Crane structure collapse	<ul style="list-style-type: none"> • Personnel injury or fatality • Equipment damage • Damage to load
Personnel struck by crane or lifting gear	<ul style="list-style-type: none"> • Personnel injury or fatality • Lost time
Adverse conditions (e.g. wind, electrical storms, dust, rain / wet, fog, lighting)	<ul style="list-style-type: none"> • Personnel injury or fatality • Equipment damage • Loss of control of equipment and / or load
Operator fatigue	<ul style="list-style-type: none"> • Loss of control of equipment and / or load • Interaction with structures, equipment or personnel

Let's look at some of these hazards in more detail.

5.2.1 Manual Handling

Incorrect manual lifting and handling of heavy or awkward loads is one of the most frequent causes of workplace injury. Follow these guidelines to avoid injury.

- Know what you are moving, how heavy it is and its destination before lifting.
- Make sure that the travel path is clear of trip, slip and obstruction hazards.
- Consider whether you need a lifting aid or team lift.
- Perform a trial lift. If the load is too heavy or bulky, break it down into smaller loads, or get help to lift and transport it.
- Keep your back straight and lift with your legs.
- Lift slowly and smoothly.
- Do not twist as you lift.



5.2.2 Noise

Use ear muffs and / or ear plugs in areas where signs indicate that hearing protection is required. Where there is no signage, the need to wear hearing protection can be identified by the following situations:

- need to frequently speak louder than normal in order to be heard or understood, while standing within one metre of your listener
- noticeable, though temporary, loss of hearing on leaving an area of noise after an extended period of exposure
- ringing in the ears on leaving an area of noise after an extended period of exposure.

Exposure to excessive noise can lead to:

- temporary or permanent hearing loss
- poor balance
- stress
- tiredness, irritability and headache
- raised blood pressure
- reduced sight and colour perception.

The general standard for a maximum daily noise dose is 85dB(A). This is based on an eight-hour day. Where there is an extended shift, (for example 10-12 hours) the standard level is reduced.

If you are about to perform any task that you suspect could involve excessive or constant noise levels, wear the appropriate hearing protection for the duration of the job.



CAUTION

Be extremely vigilant as noise and hearing protection can mask the sound of approaching danger or audible warning signals.

5.2.3 Electrical Storms

Lifting equipment such as cranes and rigging can provide an electrical conduit for lightning in electrical storms. Lightning strikes can seriously injure or kill personnel on or near cranes, and lightning will also damage equipment. Do not conduct lifting operations during electrical storms.

5.2.4 Windy Conditions

Wind directly affects load stability and decreases the working load limit (WLL) of the lifting equipment, crane stability and lifting methods. Stop operations when wind speed exceeds 45 kph and wait until the wind reaches a safe working level. If possible, avoid lifting in windy conditions.

Consider the following points when operating in windy conditions:

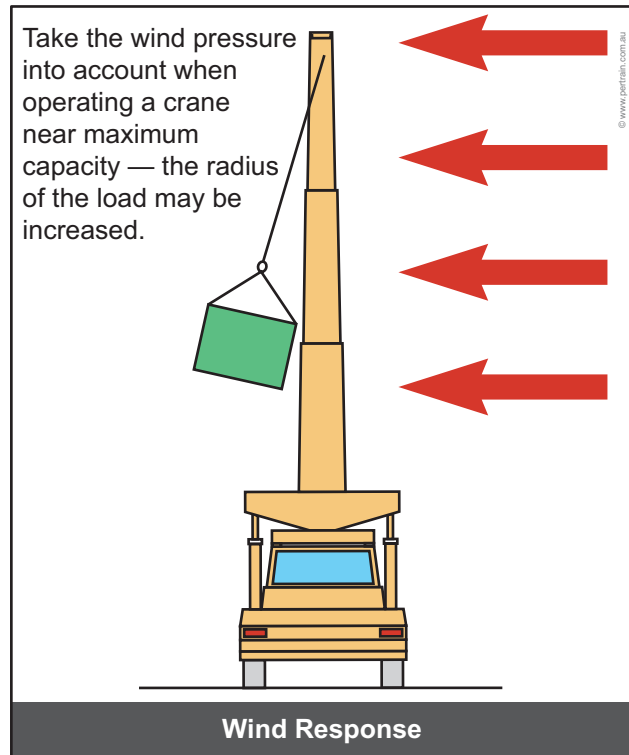
- higher level winds are usually stronger than winds at ground level
- high wind speed gusts are common in windy conditions
- derate the capacity of the crane and lifting equipment to suit the conditions
- maintain effective communications with all team members
- use restraining lines to snub any load swing
- avoid handling loads that present large wind-catching surfaces.

Wind can create hazards for moving loads by crane, including:

- load swing
- load spin
- uncontrolled slewing
- possibility of crane damage or instability.

The effect of wind on the crane can be minimised by:

- applying the slew brake
- applying guy ropes and braces
- ceasing work if wind exceeds allowable limits and / or unsafe limit.



5.2.5 Wet or Slippery Conditions

Extra care is needed when conducting a lifting operation in wet or slippery conditions. The capabilities of cranes are limited because of reduced traction. Wet conditions may also soften the ground and therefore affect crane stability. Ensure that you inspect the ground conditions before positioning a crane for a lifting operation.



5.2.6 Electrical Hazards

Check for the presence and location of electrical conductors and power lines before conducting lifting operations. Ensure that there is adequate clearance. Conduct a risk assessment to make sure that the work area is safe. Check for:

- overhead power lines
- cables and conduits
- earth leakage boxes
- trip hazards from electrical cables.

Always assume that overhead power lines are live. The best method to determine the voltage of power lines is to contact the local electrical authority for advice. You may need to contact the electricity supply company to arrange insulation or have the power disconnected.

Work outside the recommended minimum safe distances from electrical conductors. The distances will vary depending on whether the power is low voltage or high voltage, and whether you are working with or without a spotter.



NOTE

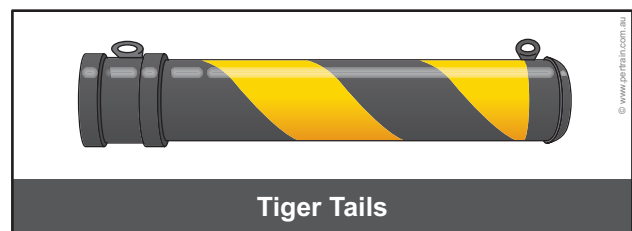
The legal requirements for minimum safe distances from electrical conductors vary depending on the state or territory where you are working. Check the local requirements and procedures before starting work.

If you are required to work closer than the minimum safe distances, you will need to consider the following options.

- Seek an exemption from the relevant authority.
- Where possible, have the electrical power shut off. If this is not possible, the power lines must be insulated by an authorised and competent person.

In some states/territories, you may be permitted to use a spotter within the electrical exclusion zone.

Use approved power line warning systems such as tiger tails on low voltage power lines in locations where this is permitted. Tiger tails are black and yellow striped tubes that hang off power lines to indicate the location of overhead electrical lines.



Contact With an Electrical Conductor

If the crane or load comes into contact with an electrical conductor, take the following steps.

1. Stop work immediately
2. Activate the site emergency procedure.
3. Do not touch any electrocuted person
4. Warn all personnel to stay clear.
5. Do not try to remove or push aside the electrical conductor.



6. Wait until the power has been isolated and you are instructed to act before approaching the crane.
7. Report the incident as required.

5.2.7 Clearance from Buildings, Vessels, Structures and Equipment

Be aware of nearby structures or other cranes when positioning lifting equipment at the work site, especially when the crane working areas overlap. Position lifting equipment so that there is a clear view of the other equipment operating in the area. The overall work program should be set out and controlled by an authorised person.

Area Hazard	Possible Impact on Your Job
Buildings/Structures	<ul style="list-style-type: none"> • Can cause shadows and reduce visibility. • Force the wind to cause eddies, which create dust and noise hazards or unintended load movement. • Restrict the movement of lifting equipment operations.
Vessels	<ul style="list-style-type: none"> • Restrict crane operating radius area. • Generate a potential hazard if pressurised.
Other Equipment	<ul style="list-style-type: none"> • Creates noise, dust and distraction hazards. • Overlapping work areas could cause a collision.

5.2.8 Poor Visibility

Poor visibility can cause communication problems, preventing hand signals from being seen. If visibility is a problem at the lift site, stop the lifting operation or arrange to have a lighting plant stationed to provide adequate lighting.

Poor visibility may be caused by the following conditions.

Cause	Controls
Inadequate Light	During night operations, effective illumination should be used. This may mean the positioning of floodlights and/or the use of flashing amber warning lights. Plan ahead to ensure adequate lighting is available.
Dust	Arrange for watering down of the site area.
Shadows from Surrounding Structures	Ensure good radio or whistle communications.
Glare from the Sun	Ensure good radio or whistle communications. Wear tinted safety glasses.
Fog	Do not operate in thick fog.
Rain	Rain combines with dust on windshields. Keep glass areas and windscreen washers/wipers clean.

5.2.9 Hazardous Chemicals

The ChemAlert database system is used for the registration of hazardous chemicals, and for storage and access of Safety Data Sheets (SDS) for chemicals registered on site. Each work area maintains a register of hazardous chemicals utilised in their operations. Transport and handling of hazardous chemicals is strictly controlled by a Standard Operating Procedure.

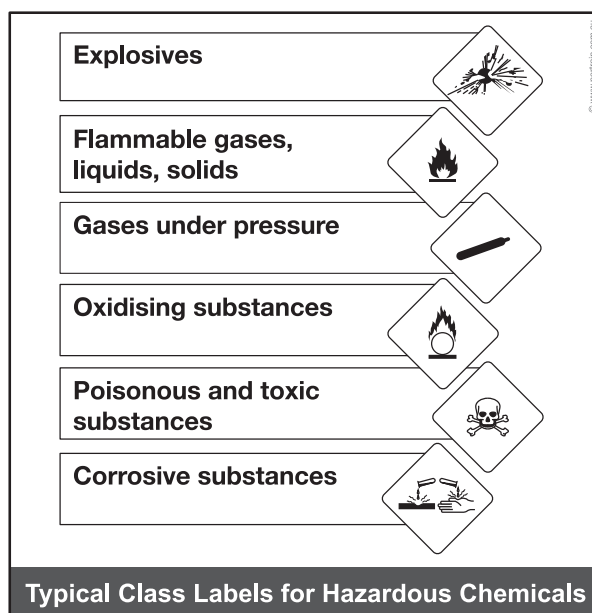
Hazardous chemicals include:

- explosives
- gases
- flammable liquids
- flammable and dangerously combustible solids
- oxidising substances
- poisons and infectious substances
- radioactive materials
- corrosive substances
- miscellaneous hazardous materials.

Classes of Hazardous Chemicals

Hazardous chemicals classification and labelling is standardised and displayed on HazChem signs whenever hazardous chemicals are packaged, transported or stored.

Diamond-shaped class labels are typically used on containers, packaging, vehicles, warning notices and emergency information panels that include information about the hazardous chemical.



Handling Hazardous Chemicals

Refer to the relevant SDS sheet and read any labelling on the load for safe handling information when flammable liquids, toxic chemicals and gases have to be lifted. Lift containers by their designated lifting points and ensure that the load is secure before starting a lift.

Before you enter a hazardous chemical storage area, ensure that you are familiar with the location of breathing apparatus, safety showers and relevant emergency procedures.

Spillage

Hazardous chemicals spills not only pose a danger to personnel, but can also cause serious environmental damage. Spills can destroy flora and fauna as well as pollute the underground water table. It is important that all spills are dealt with as soon as possible to minimise environmental damage.



DANGER

A risk assessment must be conducted before containing or removing hazardous chemicals to minimise the risk to yourself and others.

If a hazardous chemical is spilled, take the following steps.

C	Contain: the spillage by turning off the supply and by constructing a bund or digging a trench to contain the material.
A	Absorb: by covering the substance with sawdust, dirt or other absorbent material.
R	Report: to area supervisor for instructions on the disposal procedures.
D	Dispose: transfer to a suitable container and dispose of the material according to the site Environmental Waste Management Procedure.



NOTE

Report any spills immediately, according to site procedures.

5.3 Treating Uncontrolled Hazards

Uncontrolled hazards need to be controlled to reduce the risk rating. A control is a strategy, mechanism or approach to eliminate a hazard or minimise the risk associated with exposure to the hazard. Risk treatment involves selecting and implementing appropriate controls for dealing with risk. Reducing either the consequences of an event or the likelihood that the event will occur can reduce the risk rating. The 'Hierarchy of Control' method is used to determine the most effective means of control.

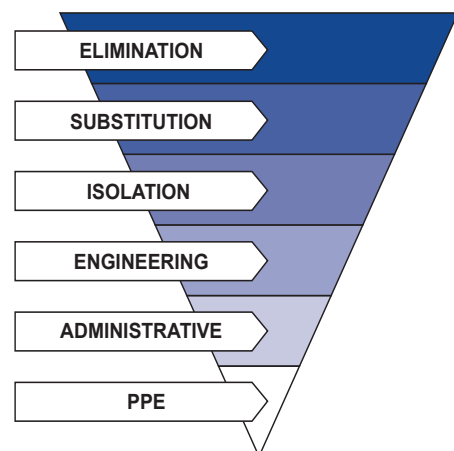
Any hazard with a risk rating above Low must have steps taken to reduce the risk. Refer to your site policies and procedures to determine the site standard for acceptable risks. Risks within the site unacceptable range need to be reported to your supervisor using your site hazard reporting procedures.

5.3.1 Hierarchy of Control

Once you have identified the hazard and determined the level of risk, you must take proactive steps to reduce the risk As Far As Reasonably Practicable (AFARP).

The Hierarchy of Control is the main method of ensuring safety in a workplace. The diagram shows the progression from the most effective control (elimination) to the least effective control (PPE). The highest possible level of control should be used whenever possible.

Lower levels can be used if higher levels are not possible or practical. Lower level controls can also be used in conjunction with higher levels of control for more thorough risk control, as the more controls in place the lower the likelihood and consequences of a hazardous event.





NOTE

Give preference to preventative controls (that stop an incident from occurring) over behavioural and mitigative controls.



NOTE

Hazard control measures must only be removed when the hazard no longer exists.

Elimination

Elimination is the safest and preferred method of control for risks. Eliminate the risk by removing the hazard, or removing the need to complete the task. Elimination is a preventative control that prevents the hazardous event from occurring.

Substitution

Substitution replaces the task or part of the task with a less hazardous one. Examples of control by substitution are automation, mechanical aids and substituting hazardous materials with less hazardous ones. Substitution is a preventative control that prevents the hazardous event from occurring.

Isolation

Isolate or separate the hazard from the person, or the person from the hazard using cut off switches, machine guards and barriers.

Engineering

Engineering is redesigning the workplace, equipment or process so that it can be done safely. Engineering may include installing ventilation, insulation or remote controls. Engineering is a preventative control in that it prevents the hazardous event from occurring.

Administration

Administration uses policies, procedures and training to reduce exposure to the risk. Signs, standard operating procedures and work permits are examples of control by administration. Administration is a behavioural control in that it amends the behaviour of the work force to reduce the likelihood of the hazardous event occurring.

Personal Protective Equipment (PPE)

To be effective PPE must be suitable for the risk and properly maintained. PPE does not prevent an event from occurring, but it can lessen the consequence. Required PPE will be detailed during the shift briefing, in the task procedure and on signs around the workplace.

Mandatory PPE includes:

- safety helmet
- safety footwear, e.g. steel capped boots or gum boots/waders in wet conditions
- protective clothing, including high visibility stripes or vests as required.

In addition to the mandatory items, the minimum PPE requirements for lifting operators to prevent injury are:

- safety gloves
- safety glasses
- other items according to site requirements.

Additional protective equipment, for example hearing protection, dust mask and fall protection equipment must be worn when carrying out some tasks.

Check that the PPE is in good condition before it is used. Clean the PPE you have used on the job after use, and store in the designated area. Tag out damaged PPE, and have consumable PPE stocks, such as dusk masks and ear plugs replenished as necessary.

Safety Belts and Harnesses

Safety belts, harnesses and other personal fall protection equipment must be worn if you are working above ground level, for example on a platform. Personal fall protection equipment must comply with the relevant national standards and be inspected before use.



DANGER

Do not use defective safety belts or harnesses. Your life may depend on it.

When using a belt or harness, adjust the straps to fit comfortably before attaching it to the structure or lifeline.

Lifelines must be flexible steel wire rope no less than 12mm in diameter with a maximum span of 6 metres and a sag of no more than 250mm. The lifeline must not be tight.



SECTION TWO: LIFTING EQUIPMENT

This section introduces the main types of lifting equipment and accessories, including ropes and slings, shackles and eyebolts, as well as other lifting aids such as spreader bars and lifting beams.

Lifting equipment, gear and load supports must be:

- Designed to relevant National, International and Industry Standards
- Registered in a lifting gear register
- Labelled to identify safe Working Load Limit (WLL), identification number and inspection date
- Stored in accordance with manufacturer specifications
- Inspected prior to use by a competent and authorised person and inspected regularly as detailed in the following table.

Pre-operational Inspections	All lifting gear must undergo a pre-operational inspection prior to each use. The pre-operational inspection must be recorded.
Periodic Inspections	All lifting gear must undergo periodical inspection by a competent and authorised person. The minimum time frame would be three monthly, or more regularly as determined by the Responsible Ok Tedi Manager.
Inspection Tags	Only use lifting equipment that has a current inspection tag attached.
Inspection Log	Each site will maintain a Lifting Gear Register.
Removal from Use	All faulty or damaged lifting gear must be immediately withdrawn from service, tagged with an 'Out of Service Tag' and disposed of by rendering the article unusable (i.e. physical cutting of chain, slings etc).

5.3.2 Working Load Limit (WLL)

The Working Load Limit (WLL) (previously known as the Safe Working Load or SWL), is the maximum load that a lifting device, or lifting arrangement can safely lift, suspend or lower. Lifting gear is normally tested to twice the WLL with a minimum safety factor of 4 to 1. The Safety Factor is the ratio between the load at which ultimate failure will occur and the WLL.

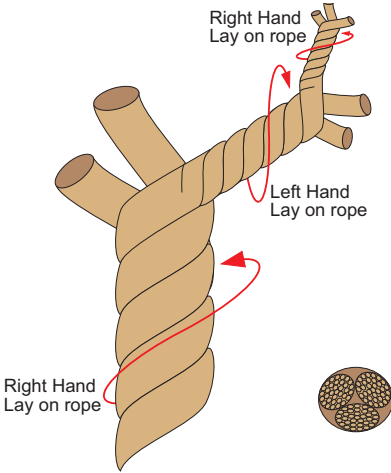
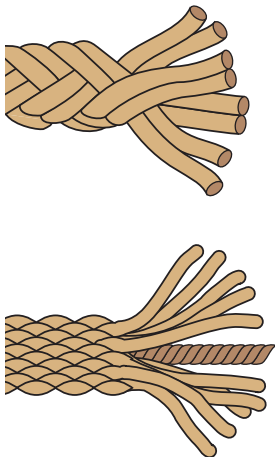
The WLL of a sling is the maximum load, measured in tonnes, which may be lifted after considering the WLL of the sling material, the reeving arrangement and the method of sling termination.

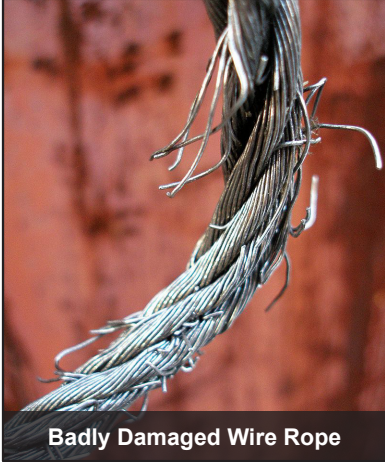
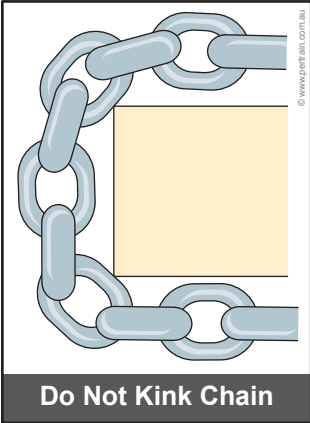
The WLL of a lifting arrangement is determined by the rated WLL of the:


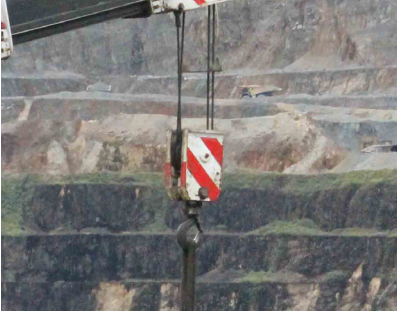

- lifting device (crane, winch, block)
- lifting equipment (spreader bar, hook, shackles)
- slings (chain, natural and synthetic rope, flexible steel wire rope)
- the load radius.

The WLL of a lift arrangement is the lowest rated WLL of all components.

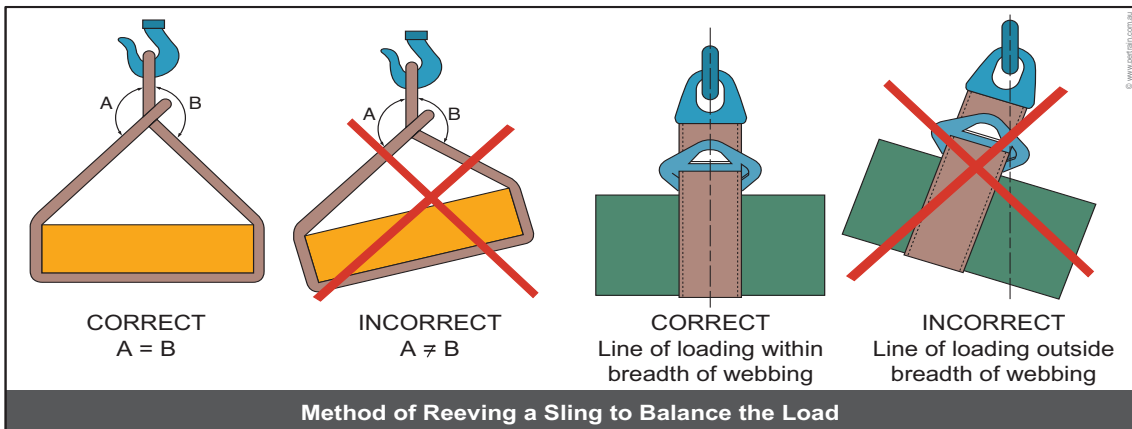
6. LIFTING GEAR

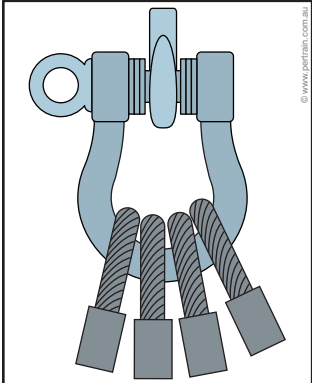
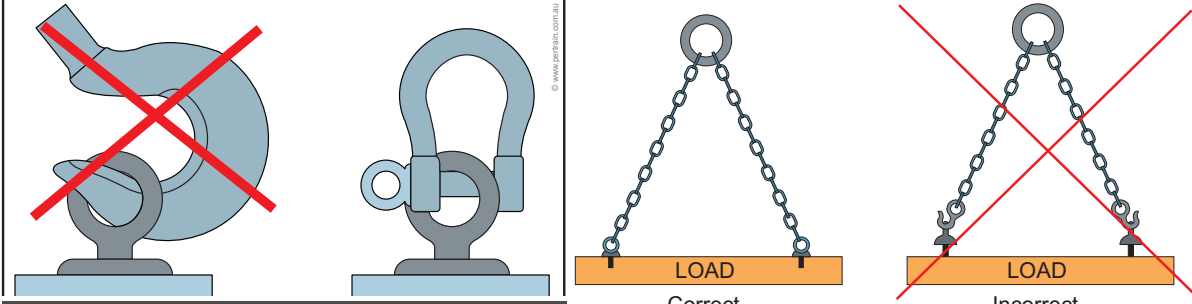
Lifting Gear	Information
<p>Natural Fibre Rope</p> 	<ul style="list-style-type: none"> • Used to restrain load movement, rather than for lifting tasks. • Fibre rope sizes are defined by their diameter in mm. <ul style="list-style-type: none"> - The minimum size fibre rope that can be used as a tagline on loads is 16mm. - For lifting purposes, the smallest diameter rope that can be used is 12mm, if the weight of the load is lower than the Working Load Limit (WLL) of the rope. • Inspect rope before each use. Examine the entire length of the rope at intervals of about 30cm, checking all sides and carefully untwisting the strands slightly. Look for cut or broken fibres, knots, discolouration, sunrot, mildew, signs of over-stretching, including broken yarns and reduced diameter, powdery dust (a sign of internal wear). • Correct storage and care will extend the service life of natural fibre ropes. <ul style="list-style-type: none"> - Always store natural fibre rope in a dry place. - Do not store in closed containers. • Using fibre rope: <ul style="list-style-type: none"> - For good used rope, reduce the WLL of the sling by 1/3 - For sound old rope, reduce the WLL by 1/2 - When a fibre rope sling is reeved around a round load, reduce the WLL of the sling by 1/3 - When a fibre rope sling is reeved around a square load, reduce the WLL of the sling by 1/2 - Do not use a rope sling if included angle between any two legs exceeds 90°.
<p>Synthetic Rope</p> 	<ul style="list-style-type: none"> • Synthetic rope is generally stronger than natural fibre rope and usually more elastic. Making it good for shock load restraint, but not suitable for lifting. More resistant to rot and mildew. • Types include Nylon, Dacron-terylene, Taniklon, Silver Rope (Flat Split Taniklon Fibre), Polypropylene (will float in water and resistant to alkalies and acid unless very concentrated). • Disadvantages - outer surface can be smooth and slippery causing slip and failure of bends, knots and splices. • Store in dry place away from direct sunlight, weather, fire and chemicals. • Do not use a synthetic sling that shows damage, wear or does not have a legible label or tag attached.

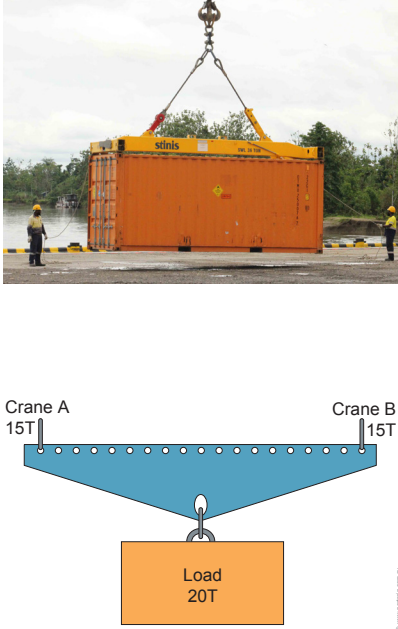
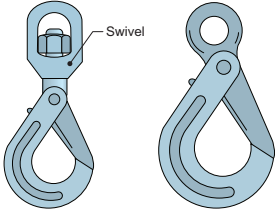
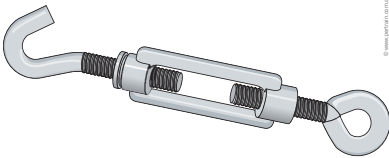

Lifting Gear	Information
<p>Flexible Steel Wire Rope (FSWR)</p>  <p>Badly Damaged Wire Rope</p>	<ul style="list-style-type: none"> • Constructed from a number of wires formed into strands that are laid around a core. • Rope sizes are shown as the diameter in millimetres. • Before using FSWR, inspect the rope for damage. Do not use a wire rope if it shows signs of damage, wear, stretching, kinks or knots, corrosion, 10% of wires are broken over a length of 8 x diameter of the rope, reduction in rope diameter. • Do not kink ropes or expose them to corrosive substances. • Grease or oil ropes to ensure sufficient lubrication. • Feed / roll out ropes without slack and in a straight line from the reel to prevent kinking or disturbance of the lay. • Reeled ropes are to be mounted on a spindle and securely anchored. • Ensure reels are effectively braked. • Do not throw the rope off turns with coil or reel flat on the ground. • Regularly release the torque of new ropes until the rope has settled.
<p>Chains</p>  <p>Do Not Kink Chain</p>	<ul style="list-style-type: none"> • Chain can 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. • Chain is heavier than wire rope for the same application but can handle rougher treatment. • Chain slings must have permanently attached identification tags stating size, grade, rated capacity and reach. If there is no WLL tag attached, look for the grade markings and arrange to have the tag replaced. If there are no marks the chain should not be used for lifting. • Inspect chain regularly for wear, nicks, gouges, stretch, localised bending and shearing. • Loads must be within the safe WLL of the chain. • Do not twist, kink or knot a chain to shorten it. • Do not shorten a chain by using nuts and bolts. • Do not hammer a chain to straighten the links or to force them into position. • Do not put loads down onto chains, or allow vehicles / mobile plant to drive over chains. • Do not drag chains across the ground where they may be worn. • Use protective padding on chains around sharp corners.

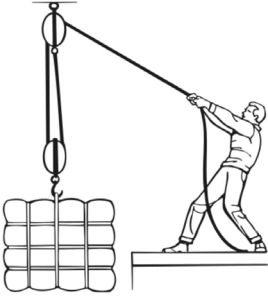

Lifting Gear	Information
<p>Hoist</p> 	<ul style="list-style-type: none"> • The part of a lifting configuration that consists of a drum or lift wheel around which a rope or chain wraps. • The block and hook are attached to the rope or chain. • Can be mechanically, electronically or pneumatically (air) driven. • Use according to manufacturer specifications.
<p>Sheave Blocks</p> 	<ul style="list-style-type: none"> • Periodically overhaul and lubricate blocks. • Use blocks according to manufacturer specifications. • Ensure the grooves of the sheaves are the correct size for the rope. • Do not use if safety latches are deformed, shank is damaged, loose or does not turn freely, side straps are worn or damaged or there are visible signs of damage or wear on any surface. • Do not paint sheaves in such a manner that free movement is impaired or lubrication points or grease holes are choked or reference marks are not visible.
<p>Hooks and Rings</p> 	<ul style="list-style-type: none"> • Hooks must be fitted with a safety catch. • Hooks must have at least the same WLL as the chain sling. • Crane hooks must rotate freely at all times. • Dispose of a chain hook if the opening is stretched more than 5%. • Do not use bent, distorted or stiff hooks. • Do not weld or repair damaged hooks. • Do not weld attachments to hooks. • Rings must be at least the same WLL as the chain, hook and other parts of any sling used. • Dispose of rings that are damaged or stretched more than 5%. • Do not place a ring over a hook unless it can hang freely.

Lifting Gear	Information
<p>Slings</p>	<ul style="list-style-type: none"> • Synthetic-webbing slings should never be used for general lifting applications. • 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. <ul style="list-style-type: none"> - Polyamide, or nylon, is alkaline resistant but is damaged by acids. - Polyester, or terylene/dacron, is resistant to acid but is damaged by alkalis. - Polypropylene is resistant to acid and alkalis but is damaged by organic solvents. • 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. Do not use slings that are not tagged. • Allow wet slings to dry naturally. Do not apply heat to dry. • Protect slings from sharp edges during lifting. • Do not use a sling if it has any sign of cuts, snagging, heat or chemical damage, excessive wear or damaged seams. • Do not tie knots in slings. • Do not use a sling if it is crossed or twisted around the load. • Do not expose slings to excessive temperatures, abrasive surfaces or chemicals. • 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. The maximum WLL depends on the slinging angle.



Lifting Gear	Information
<p>Shackles</p>  <p>Use a Bow Shackle for Multiple Sling Lifts</p>	<ul style="list-style-type: none"> • Shackles connect slinging gear to a load. The two main types of shackle are D (or Dee) and Bow shackles. • Bow shackles are used to support multiple slings. • The WLL of a shackle is marked on the shackle, not the pin. Do not use a shackle if the WLL is missing or is not legible. • Shackles must be at least the same WLL as the chain, hook and other parts of any sling used. • When fixing a shackle to a crane hook, position the shackle so that the pin rests on the crane hook. Pack the shackle pin with washers to centre the hook and carry the load evenly. • Do not use bolts / nuts in place of the proper shackle pin. • Shackles permanently attached to lifting devices must have their pins secured by seizing or mousing. • Dispose of a shackle that is bent, deformed, damaged or worn in the crown or pin by more than 10%. • Avoid applications where movement of the load or rope may unscrew the pin. • Shackle pins are only to be tightened finger tight, then released a quarter turn prior to use to prevent jamming. • Shackles must be large enough to accommodate large slings or multiple rings when lifting loads.
<p>Eyebolts</p>	<ul style="list-style-type: none"> • Install eyebolts on loads to provide coupling points between the load and slinging gear. Use a shackle to couple an eyebolt to a hook or chain. Do NOT insert the point of a hook directly into an eyebolt. • Use collared eyebolts to prevent the eyebolt shaft from bending or breaking if the load is pulled at an angle (lift is not vertical). • One single sling leg should be attached to each eyebolt.
 <p>Always Use a Shackle on an Eyebolt</p>	

Lifting Gear	Information
<p>Spreader Bars and Lifting Beams</p>  <p>The diagram shows a blue lifting beam with a central hook for a 20T load. Two 15T cranes are attached to the ends of the beam. The beam is wider at the ends and tapers towards the center.</p>	<ul style="list-style-type: none"> • Spreader bars are designed to lift large wide loads. Their purpose is to provide two vertical lifting points at a variable distance apart. • A lifting beam performs the same role as a spreader bar but connects directly to the crane or with the use of a short sling (snorter). • A lifting beam is heavier and far more robust than a spreader bar. • Lifting beams can also be used 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. • Design calculations for spreader bars and lifting beams are provided by the manufacturer. • Spreader bars and lifting beams must be: <ul style="list-style-type: none"> - Engineer designed - Operated in accordance with manufacturer's instructions - Designed so that the load remains stable.
<p>Swivels</p>  <p>The diagrams show two types of swivels: one with a hook and a ring, and another with a hook and a D-ring.</p>	<ul style="list-style-type: none"> • A swivel is a rotating sling attachment that allows twisting without spinning the sling, hook or load. • Only use swivels that are approved for lifting.
<p>Turnbuckle</p>  <p>The diagram shows a turnbuckle with two eyelets at the ends and a central adjustment loop.</p>	<ul style="list-style-type: none"> • A turnbuckle, stretching screw or bottlescrew is a device for adjusting the tension or length of ropes, cables and wires. • Adjust the tension by twisting the loop. This causes both eyelets to be screwed in or out simultaneously, without twisting the eyelets or attached cables. • A turnbuckle used for lifting purposes must be stamped with the WLL.
<p>Gin Wheel</p>  <p>The photograph shows a green gin wheel with a metal shaft and a rope passing over it.</p>	<ul style="list-style-type: none"> • A pulley wheel attached to scaffolding. • Used to raise and lower tools and materials.

Lifting Gear	Information
<p>Block and Tackle</p> 	<ul style="list-style-type: none"> • A system of two or more pulleys with a rope, chain or cable threaded between them. • One block is fixed to a structure and the other moves with the load. • The rope, chain or cable is threaded through the pulleys to provide mechanical advantage that increases the force applied to the rope.
<p>Elevating Work Platform</p> 	<ul style="list-style-type: none"> • Used to lift personnel up to work at height. • Various types including scissor lift and cherry picker. • Personnel in the basket must wear appropriate PPE, including fall protection harness attached to an approved anchor point. • Use according to manufacturer guidelines and follow all safety requirements during operations.

SECTION THREE: BASIC RIGGING AND LIFTING METHODS

This section examines the different methods of slinging that you must be able to use as a lifting operator. It also examines the planning and preparation that you must complete before any lifting job, some of the hazards that you will need to consider, and the important rules that you must follow when conducting lifting and slinging operations.

7. LIFT PLANNING

A lift plan must be prepared by a competent person for ALL lifts. The plan should be developed in consultation with relevant site personnel and workplace safety officers to ensure that rules and procedures are followed.

The plan will include the following details.

- Risk assessment to assess the hazards and determine whether a generic lift plan can be used (routine lift) or a specific lift plan needs to be developed (non-routine lift).
- Controls to be implemented, including lifting procedures and checklists.
- Pre-lift inspection, test and checklist requirements.
- Communication methods, language, protocols, pre-lift meetings etc.
- Identification of the lift team member competencies.
- Processes for verifying lift plans and risk assessments particularly for non-routine lifts.
- Management of change procedures.

Some planning considerations for lifting are shown in the following table.

Consideration	Examples
Site Access	<ul style="list-style-type: none"> • confined or cramped pick up or drop off area • near overhead obstructions or buildings • outside in windy/wet/slippery/dusty area • located near underground services or trenches • access and egress
Load Characteristics - Load Weight	<ul style="list-style-type: none"> • heavy • uneven weight distribution
Load Characteristics - Load Shape	<ul style="list-style-type: none"> • dimensions • odd shape • round • long • open top
Load Characteristics - Load Content	<ul style="list-style-type: none"> • fragile • liquid • hot • hazardous substance or material

Consideration	Examples
Site Hazards	<ul style="list-style-type: none"> • ground conditions that may be soft/wet/uneven • grades and slopes • power lines • trees • overhead service lines • bridges • surrounding structures • obstructions • facilities • other equipment • dangerous materials • underground services
Built-up Area	<ul style="list-style-type: none"> • power line clearances • overhead service lines • underground services • traffic and pedestrians • uneven or unstable ground • dangerous materials

Prepare the preliminary lift plan using the following guidelines.

- Confirm the details of the lifting operation with the lift designer and other relevant personnel.
- Check the lifting and slinging requirements and make sure that the lifting operation is feasible.
- Determine the work area access routes and restrictions and inspect the site. Make sure that there is sufficient space for equipment, such as a crane, to access the area and operate safely.
- Identify the load characteristics, e.g. dimensions, content, size and shape.
- Calculate the weight of the load to be lifted and the height to which it must be raised.
- Check the serviceability and availability of the equipment required to complete the lift safely:
 - load must be within the WLL of the crane and lifting equipment
 - additional lighting
 - warning signs and barricades
 - spreader bars and frames
 - oversized loads
 - weight of all items in the load must be included in the calculation.
- Determine the tools and equipment that you will require, e.g., ropes and slings, lifting accessories, spreader bars and frames, and powered lifting equipment.
- Assess the number of people required to complete the lift and confirm the role and responsibilities of each person. All non-essential people must be kept clear of the work area.
- Confirm the method of communication between yourself and others in the team. Make sure that all communication equipment is available, fully charged (if battery operated) and working as required.
- Schedule any other resources or materials required for the lift.
- Ensure that the lifting procedures you intend to use are within the load manufacturer's design parameters. The lifting points may be fabricated on the load, or sling positions may be clearly marked. It is extremely important to sling only at these points.

- Determine the best method of rigging the load, including if a crane is to travel with a suspended load.
- Identify the hazards and determine the required controls to minimise or eliminate risks.
- Perform the required preparation for the set down area.



NOTE

Perform all lifting calculations, select the correct lifting equipment, plan the lift and slinging arrangement, and inspect equipment before going to the lift site. This will ensure that the correct, serviceable equipment is available for the lift.

7.1 Determine the Weight of the Load

Before starting lifting operations, you must determine the weight of the load you are lifting and the height to which it will be raised and confirm that the weight of the load is within the Working Load Limit (WLL) of the equipment.

Determine the weight of the load from the relevant documentation or lift plan. The weight should appear on documents such as the delivery docket or weighbridge certificate, or it may be marked on the load.

If the weight of the load is not known you will need to calculate it by establishing the weight of each component and adding them together. Check with your supervisor or other relevant personnel for information on how to perform the required calculations. Always round numbers up to provide an extra safety margin. A quick conversion and calculation reference guide is included in the Appendix at the end of this manual.



NOTE

Remember to add the weight of all the lifting equipment to the material load weight to obtain the total load weight.

Calculate the weight of common materials using the table shown in this section.

Weight/Load Table			
Material	Mass	Material	Mass
25 bags of cement	1.0 tonne	1 cubic metre of clay	1.9 tonnes
1000 bricks	4.0 tonnes	1 cubic metre of coal	0.846 tonne
200 litre (44 gal) drum, full	200 kg	1 cubic metre of concrete	2.4 tonnes
1 cubic metre of aluminium	2.7 tonnes	1 cubic metre of earth	1.9 tonnes
1 cubic metre of blue metal	2.0 tonnes	1 cubic metre of sand (dry)	1.3 tonnes
1 cubic metre of cast iron	7.2 tonnes	1 cubic metre of sand (wet)	1.5 tonnes
1 cubic metre of cast steel	7850 kg / 7.85 tonnes	1 cubic metre of water	1.0 tonne
		1 litre of water	1 kg
1 cubic metre of hardwood	1.1 tonnes	1 cubic metre of softwood	0.75 tonne

If you are calculating the weight of multiple items, adjust the values accordingly. For example:

- 1 cubic metre of concrete weighs 2.4 tonnes. Therefore 2 cubic metres of concrete would weigh 4.8 tonnes ($2 \times 2.4 = 4.8$ tonnes)
- 1000 bricks weighs 4.0 tonnes. Therefore 100 bricks would weigh 0.4 tonne ($4.0 \div 1000 = 0.004$ per brick, 0.004×100 bricks = 0.4 tonne).
- 1 cubic metre of water weighs 1 tonne (or 1000 kg). Therefore 200 litres (l) of water would weigh 200 kg ($1000 \div 200 = 5$ and 1 tonne $\div 5 = 200$ kg).
- 10 timber beams, each 5 metres long, where a one meter timber beam has a mass of 7kg, The entire load of 10 beams will weigh $10 \times 5 \times 7 = 350$ kg,



NOTE

If you are required to work in kgs, rather than tonnes, the conversion rate is 1 tonne = 1000 kgs. For example, 1.9 tonnes = 1900 kg and 0.846 tonnes = 846 kgs.

A quick conversion and calculation reference guide is included in the Appendix at the end of this manual.



CAUTION

Use caution when using a weight from a delivery docket. Materials can absorb large amounts of water. For example, timber can be up to 50 per cent heavier when wet. Tanks, pipes and drums may contain fluids, other materials, rubbish or sludge.

Always conduct a trial lift when lifting a load for the first time and watch the lifting equipment carefully for signs of strain to confirm that the weight has not been understated. Overstressed lifting equipment may not be obvious and may fail without warning.

7.2 Confirm the Safe Working Load

Confirm the safe working load requirements by checking the Working Load Limit (WLL) of the lifting equipment and accessories. Apply the lowest WLL of all equipment to the lifting operation.

Use equipment load charts, sling tags or charts to determine the WLL.

- Consult a WLL chart for the appropriate size natural and synthetic rope, chains and flexible steel wire rope.
- Check the identification tag or grade markings on chain and chain slings. Use a minimum of Grade 80 (Grade T) chain for lifting.
- Check the tag, label or identification plate attached to slings.
- Check the WLL marked on lifting accessories such as shackles, turnbuckles, spreader bars and lifting beams.
- Consult the manufacturer specifications to determine the WLL of eyebolts, swivels and other equipment.

Ensure that the weight of the load is less than the WLL. Include the required safety factor and allow for a safety margin. Confirm with a competent person that the lifting equipment will move the load safely.

7.3 Site Inspection and Hazard Identification

Carry out a site inspection to identify hazards before starting operations. Check the area even if you have only recently checked it, because conditions may have changed. Monitor the area constantly during operations for moving vehicles and personnel. When working with mobile cranes, check for:

- potholes and soft or rough ground
- personnel working in or entering the area
- overhead obstructions
- blind corners and traffic flow
- power lines
- underground services.



Check grassy surfaces for potholes hidden by long grass. Walk over the area before guiding a crane across. Do not direct the driver to slew unless the surface is firm and level. The crane will be less stable if the boom is slewed. This may cause the crane to tip over if the ground is uneven or unstable. Ensure the spring lockouts (where fitted) are set before moving a load.

If work is to be conducted near power lines you may need an Authority to Work (ATW). Check with your supervisor, or the person in charge of the lifting operation and arrange for all required authorisations to be in place before work begins.

Establish an exclusion zone around the lift, travel and set-down sites to keep unauthorised personnel and equipment away and protect them from being struck or crushed by the crane or load.

8. LOAD ATTACHMENT AND MANAGEMENT

The following are some general load attachment and management precautions.

- Before lifting a load, make sure that the boom tip is directly over the load's centre of gravity and the hoist rope is vertical.
- Raise and lower the load under power.
- Secure the load to prevent load swing during travel. Control the load with a static line / tag line if possible.
- Carry loads as close to the ground as the conditions allow.
- Except in the case of an emergency, a crane operator must not leave the cabin of the crane while a load is suspended from the crane hook.
- No person is permitted to:
 - ride upon the hook block or load being lifted by a crane
 - have a load or part of a load pass over them.

8.1 Basic Rules for Lifting and Slings

Obey the following rules when slinging loads.

Do

- 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.
- 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 trial 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.
- If a crane workbox is used to hoist a worker, the person dogging the load must be in the workbox with the worker.





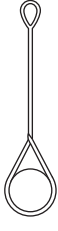
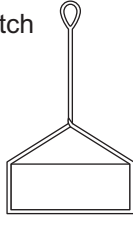

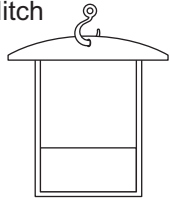

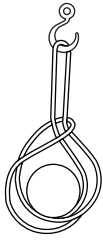
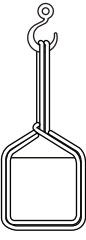
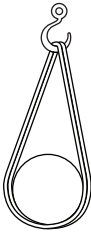

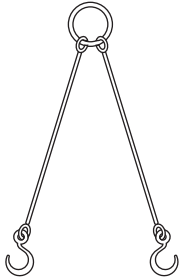
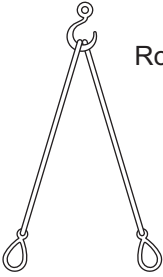
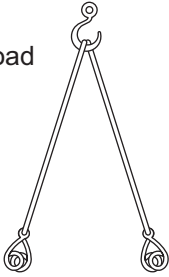
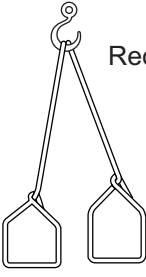
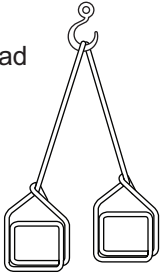
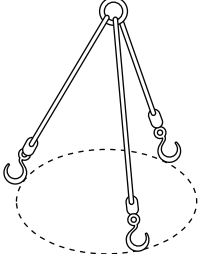
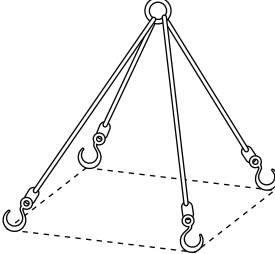
Corner Pad

Do Not

- Do Not use worn or broken gear.
- Do Not leave unused sling legs or hooks dangling when the crane is travelling.
- Do Not trail slings along the ground, or pull slings from beneath loads with a crane.
- Do Not use bricks, concrete blocks, or other crushable objects when packing under loads or between stacks.
- Do Not leave the pins out of shackles when not in use.
- Do Not use bolts when the pins are lost.
- Do Not knot wire rope and chains, or join chains with nuts and bolts.
- Do Not cross, twist, or kink any chain.
- Do Not drop a chain from a height.
- Do Not roll loads over a chain.
- Do Not place a sling, shackle or eyebolt on a crane hook unless it hangs freely over the bow of the hook.
- Do Not place several slings on the same hook without a safety latch or mousing.
- Do Not leave wire rope slings attached to the load and crane during welding. Earthing through a shop crane may damage both the wire rope slings and the crane.
- Do Not guess at the weight of loads or the capacities of cranes, or of any lifting gear. Refer to manufacturer documentation.
- Do Not overload hooks or lift loads on the point of hooks.
- Do Not reeve slings on wide heavy loads.
- Do Not impose angular pull on the ferrule of a mechanical splice.
- Do Not 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.

8.3 Using Slings on a Load

Slings used for lifting can be rope, webbing slings or chains. The following calculations and rules are the same regardless of the type of sling used to conduct the lift. There are several factors that determine the lifting equipment required to carry out a lift.

Single-part, Single-leg Slings					
					
Direct Load	Round Load	Choke Hitch	Rectangular Load	Round Load	Rectangular Load
Double-part, Single-leg Slings					
					
Direct Load	Round Load	Choke Hitch	Rectangular Load	Round Load	Rectangular Load
Two-Leg Slings					
					
Direct Load	Single Wrap	Double Wrap	Single Wrap	Double Wrap	
Three-Leg and Four-Leg Slings					
					
Three-Leg Assembly			Four-Leg Assembly		
Common Sling Arrangement					

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As a reminder, some factors that determine the type of sling to be used are:

- load weight
- load shape
- single or multiple slings
- the sling angle, if multiple slings are used:
 - the WLL of a multiple leg sling decreases as the angle between the legs increases
 - with three or four leg slings, two of the legs must be capable of taking the whole load
 - the lifting ring must be able to safely support the combined WLL of all of the legs.

Take special precautions and use a larger size chain or sling if:

- the exact load is in doubt
- there is a possibility of shock loads
- the conditions are abnormal or severe
- there is exceptional hazard to personnel.

8.3.1 Load Factors and Tension on Slings

The WLL of a sling is affected by factors such as the slinging arrangement, the number of slings used and the angles of the slings. You must choose an appropriate sling to lift the load safely. To determine a suitable sling, load factor calculations must be applied to the WLL to find out how the slinging arrangement will alter the WLL of the sling.

The slinging arrangement will affect the tension placed on a sling, and therefore the WLL of the sling in that configuration. The factors that affect the WLL of a sling are:

- the number of sling legs used
- the sling angle
- the slinging method used.

The number of slings and the sling angles will affect the WLL of slings in a multiple sling lift. To calculate the WLL of multiple sling legs, calculate the tension applied by the load on each sling leg individually.

When lifting with three or four legged slings, use the same formula as a two legged lift, as only two legs will hold the load. The other legs balance the load.

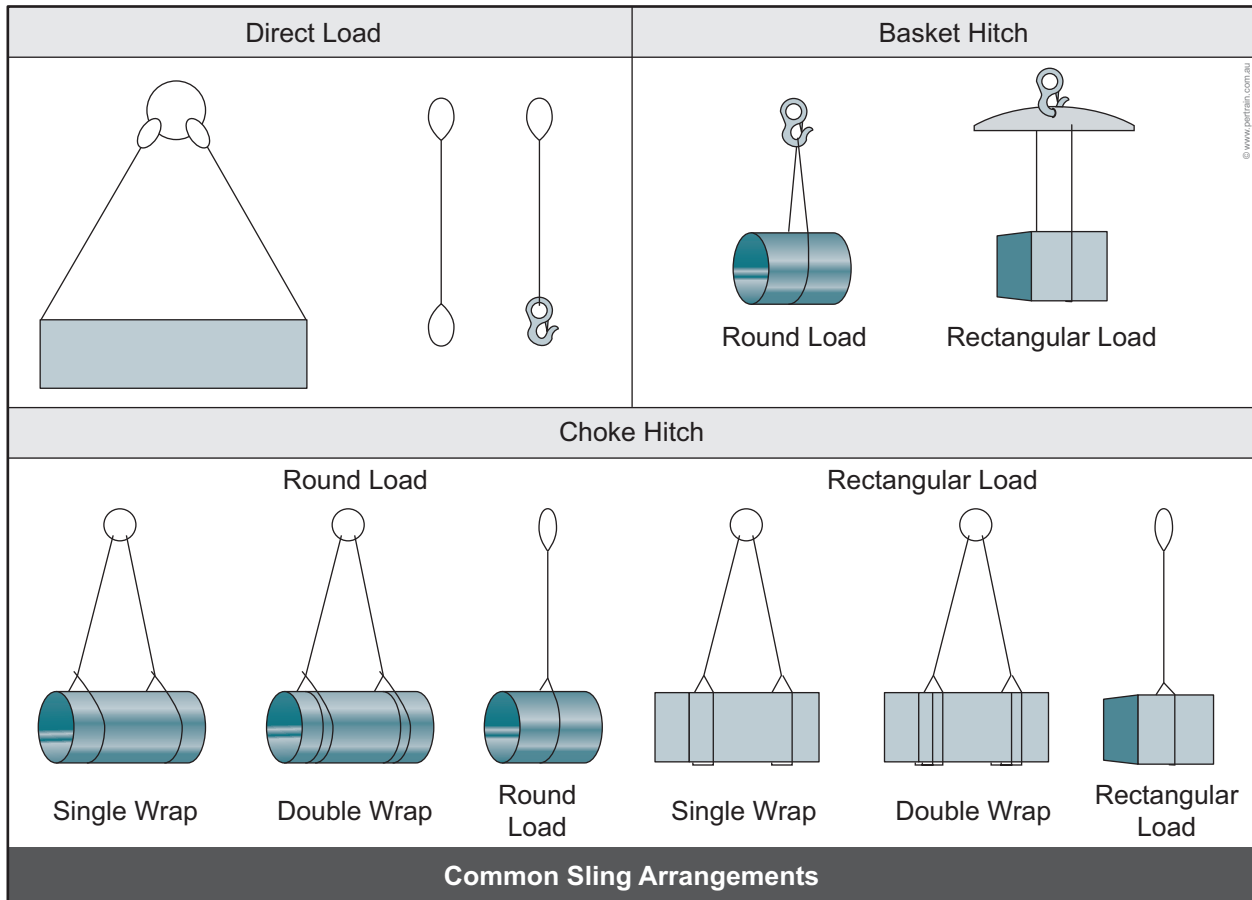
There are three main slinging attachment methods to attach the sling to the load. These are:

- direct slinging method – the sling is attached directly to the load, usually by eyebolts or lifting lugs
- basket hitch method – the sling is wrapped around the load (either single wrapped or double wrapped) and then both ends are attached to the hook or lifting beam
- choke hitch method – the sling is wrapped around the load (either single wrapped or double wrapped) and then reeved through the sling eye.



CAUTION

Basket hitches should not be used where people may be located near a lifted load, unless the sling is positively restrained from sliding along the load.



There are also two load factor calculations for each slinging attachment method. These are:

- the reeve factor, which is applied to all slings attached using the choke hitch method
- the angle factor, which is applied to all slings with two or more sling legs.

Multiple leg slings that are attached with a choke hitch must have both the reeve factor and the angle factor applied to the WLL of the sling.



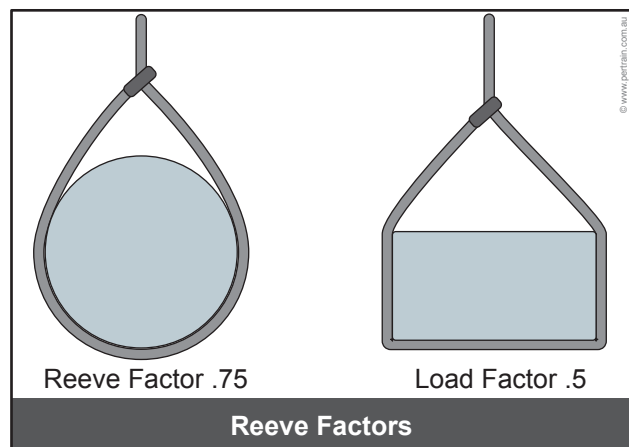
NOTE

Load factor calculations reduce the sling capability (WLL) in a particular configuration.

8.3.2 Reeve Factor

When a sling is reeved (choke hitch) around a load the WLL of the sling is reduced. Reeving creates sharper angles in the sling and places stress on the sling at the nip point.

This reduces the safe load that a sling can lift. When a sling is reeved, the manufacturers WLL (MWLL) should be multiplied by the reeve factor (R), to determine the actual WLL (WLL) of the reeved sling.



8.3.3 Angle Factor

The angle of the slings has an effect on the safe WLL of a sling. An increase in the sling angle will decrease the WLL of the slings.



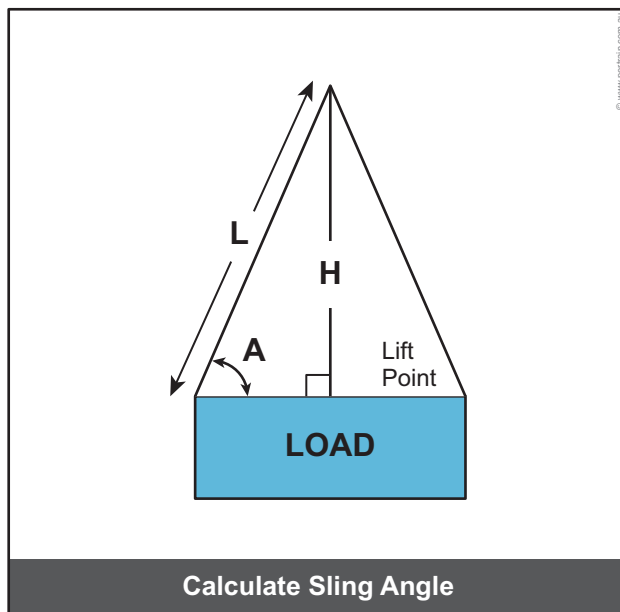
CAUTION

The included angle should be no more than 60° for efficient lifting.

The included sling angle refers to the angle between the two sling legs. To calculate the sling angle (A), divide the height from the load (H) by the length of the sling leg (L).

$$A = H \div L$$

The table below shows Angle Factor the various Sling Angles.

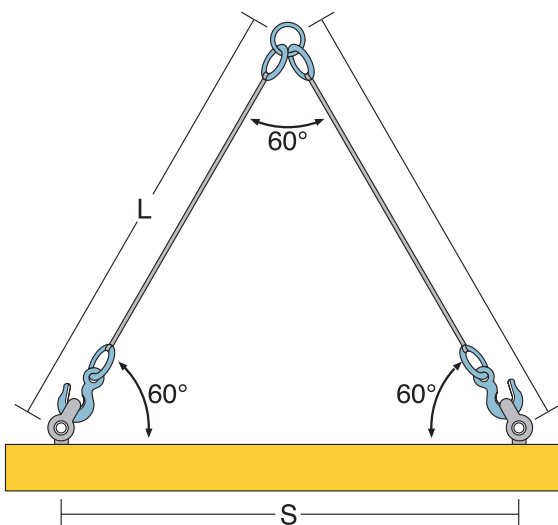


Sling Angle 30° Load Factor 1.93	Sling Angle 45° Load Factor 1.85	Sling Angle 60° Load Factor 1.73	Sling Angle 90° Load Factor 1.41	Sling Angle 120° Load Factor 1
30°	45°	60°	90°	120°
Angle Factors				

There is an easy method for determining if the included angle is less than 60°.

- If the distance between the lifting points (S) is the same as the length of the sling leg (L), the angle is 60°.
- If the distance between the lifting points is less than the length of the sling leg, the included angle is less than 60°.

A simple rule of thumb for a good safe working angle is if L is greater than S, the angle is OK. This will ensure the angle between the two slings of the sling does not exceed 60°.



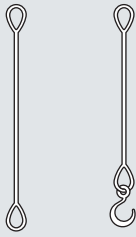
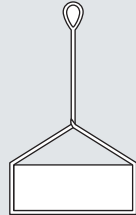

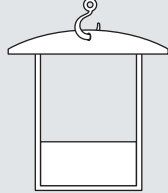
Safe Working Angle

8.3.4 Single Sling Loading

The three slinging attachment methods discussed in the previous section can be applied to two types of single leg slings. The direct slinging attachment method is not reeved and has no angle, so it has no reeve factor and no angle factor applied. The tension on the sling remains the same as the weight of the load.

Reeve and angle factors must be applied to the other slinging configurations to calculate the extra load or tension in the sling. The rule of thumb formula for calculating the actual WLL is to multiply the manufacturer WLL by the angle factor (A) and the reeve factor (R) to determine the maximum load that can be lifted by the sling configuration. Always use a sling that has a WLL greater than the tension that will be applied to the sling by the load.

The reeve factor of various sling configurations is shown in the table.

Sling Method	A direct vertical lift	Reeved around a Square Load	Reeved Around a Round Load	Basket Hitch – Slings Parallel
				
Reeve Factor	1	0.5	0.75	2

If the load is reeved, by using a choke hitch, the reeve factor must be applied to the manufacturers WLL to find the safe WLL of the sling while reeved.



NOTE

A reeve factor of 0.5 is applied to a square load and a reeve factor of 0.75 is applied to a round load.

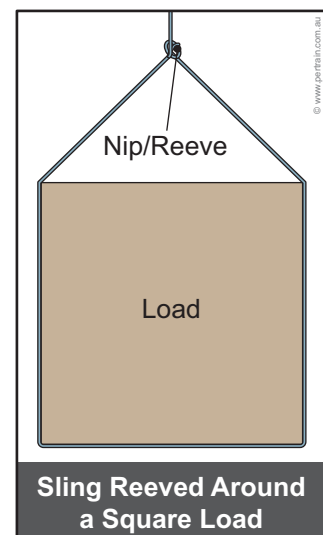
Example: MWLL of the sling is 3000 kg.

The sling is reeved around a square load.

$$MWLL \times R = WLL$$

$$3000 \times 0.5 = 1500 \text{ kg WLL}$$

A sling with a WLL of 3000 kg can only safely lift 1500 kg if it is reeved around a square load.



When a load is carried in a basket hitch, the load is shared between the two sling legs. In a vertical lift each leg can lift the full WLL of the sling. For example, when the sling legs are parallel, a sling with a WLL of 500 kg can lift 500 kg in each sling leg, or 1000 kg in total. If the sling legs are not vertical then an angle factor must be applied.

8.3.5 Two Sling Loading



CAUTION

Always use identical slings. Do not mix slings or use slings with a different WLL.

Using two slings to lift a load shares the load if the maximum angles are not exceeded. There are three main factors that affect the length and capacity of the slings that are required for a lift.

These factors are:

- the mass of the load
- the included angle between the slings
- the method of slinging the load (direct loading, reeved or basket hitched).



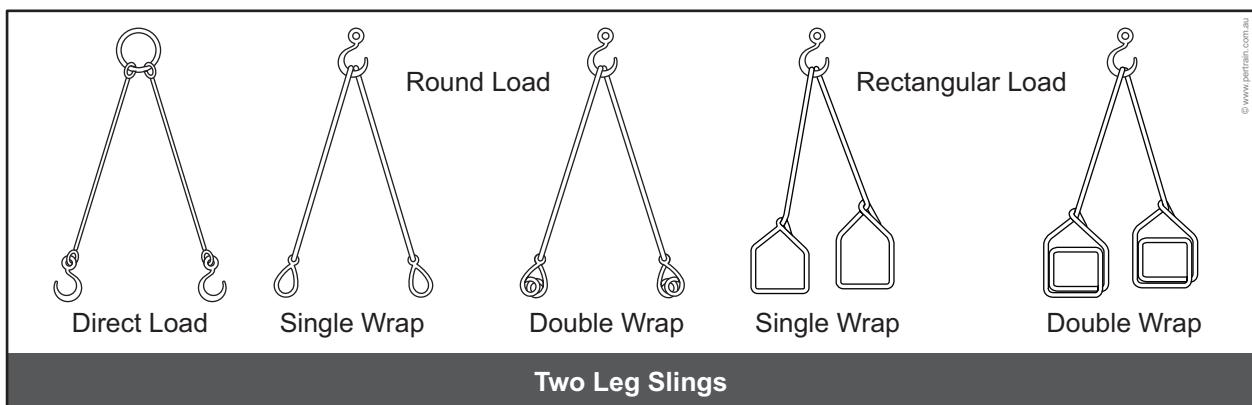
NOTE

The larger the included angle between the legs, the more load is applied to the legs. The angle between two legs of a sling should not exceed the recommended angle of 60°.

A sling may be capable of lifting a load if that load is supported vertically, but when acting together with a similar sling, may be overloaded if the angle between the two slings is too great.

You must be careful when lifting flexible irregular shaped objects because it is possible that only one leg of the sling is taking the whole load. If in doubt, use slings capable of holding the entire load.

The larger the angle from the vertical made by slings on a hook the more likely it is that the sling eye will slip off the point of the bill. To eliminate this risk use a hook with a safety latch or mouse the hook.



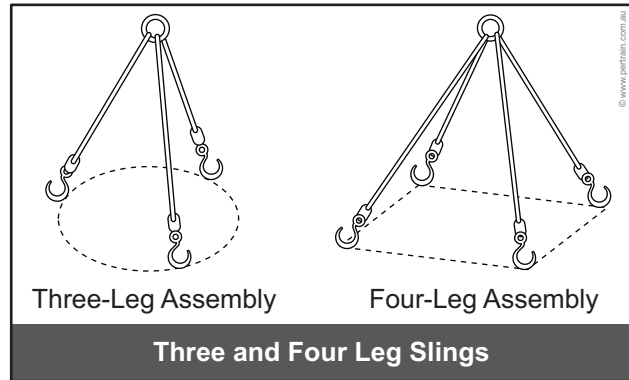
8.3.6 Multiple Sling Loading

When multiple slings are used:

- the WLL of a multiple leg sling decreases as the angle between the legs increases
- the included angle is measured between diagonally opposite sling legs
- two legs must be capable of taking the whole load even with three or four leg slings
- the lifting ring must be able to safely support the weight of the load, including lifting gear.

When slinging a rigid object with a multi-legged sling, assume that only two of the sling legs are taking the load. Additional legs do not increase the WLL of the sling assembly. When two or more slings are attached to a load and a lifting hook, the included angle between the legs determines the load or tension on the individual legs.

- The maximum angle of a four-legged sling is determined by measuring the greatest angle between any of the two opposite diagonal legs of the sling.
- The angle should not exceed 60°.
- Determine the WLL on the diagonally opposite legs and ensure that each leg takes an even share of the load.



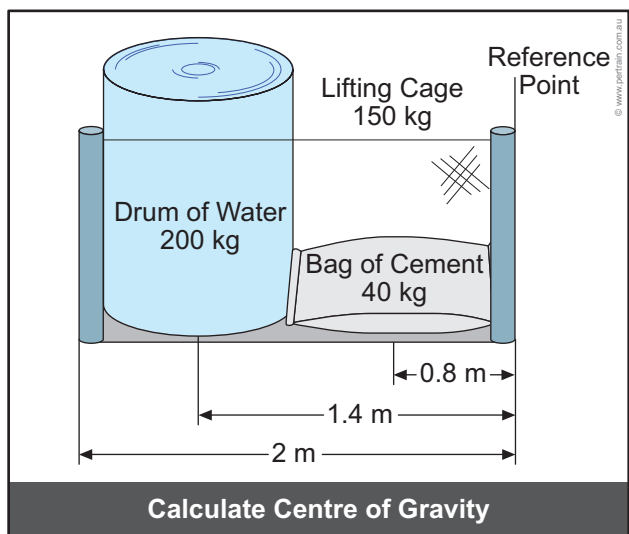
The larger the angle from the vertical made by slings on a hook the more likely it is that the sling eye will slip off the point of the bill. To eliminate this risk thread the eyes into a 'bow' shackle large enough to prevent jamming. Ensure that the shackle pin is resting on the hook and is packed with washers to prevent movement.

8.3.7 Determining the Centre of Gravity

Some loads may be heavier at one end than the other. Loads like this will tilt to one side when lifted if this is not taken in to account. This may cause the load to slip out of the slings or can overstress slings causing the sling to break. It is important to determine the centre of gravity (CoG) of the load so that the load can be lifted evenly.

- The COG is the point in which the weight of the object is equally balanced in each axis.
- Some loads will be marked with the COG by the manufacturer.
- If the load is not marked, you will need to determine the CoG, particularly if the load consists of several items.

The CoG for solid even loads, such as a steel beam or a plasterboard pack, will be at the centre point on each axis.



NOTE

You can determine the CoG using a trial lift. If the load is unbalanced, lower the load and re-arrange the slings to ensure that the load is stable and even.

8.4 Attach a Tagline

Taglines stop load rotation and help guide the load into place.

- Use a 16mm dry natural fibre rope as a tagline. Natural fibre rope is non-conductive.
- Never use wet taglines near power lines or electrical conductors.
- Attach the tagline as you are attaching the slings.
- Ensure that the tagline does not interfere with the slings.

9. LOAD HANDLING

Loads with lifting lugs fitted must have the WLL of the lifting lug clearly marked. Before using lifting lugs you must:

- identify the correct lifting lugs/points
- visually inspect/check the lugs for serviceability, ensuring that there is no evidence or obvious signs of welds:
 - splitting
 - cracking
 - damage
 - separating
 - stretching
- check for WLL rating
- check lugs for positioning, considering the centre of gravity of the load (the lugs may not meet the lifting needs)
- attach the lifting equipment to the load, using the correct lifting/sliding points.

Loads such as long pre-cast concrete beams have the lifting points marked to the manufacturer or engineer's specifications. When selecting suitable lifting/sliding points consider the:

- centre of load distribution and balance
- security of slings
- reeve and angle factors
- weight of load
- possible damage to the load.

Before a load is lifted, you must obtain the manufacturer's specifications and information to determine:

- the load's weight
- the load's centre of gravity
- the load's lifting points
- any factors that will affect the capacity of the crane or will impact on the crane being able to move the load.

All loads that may be hazardous must be strapped or wrapped.

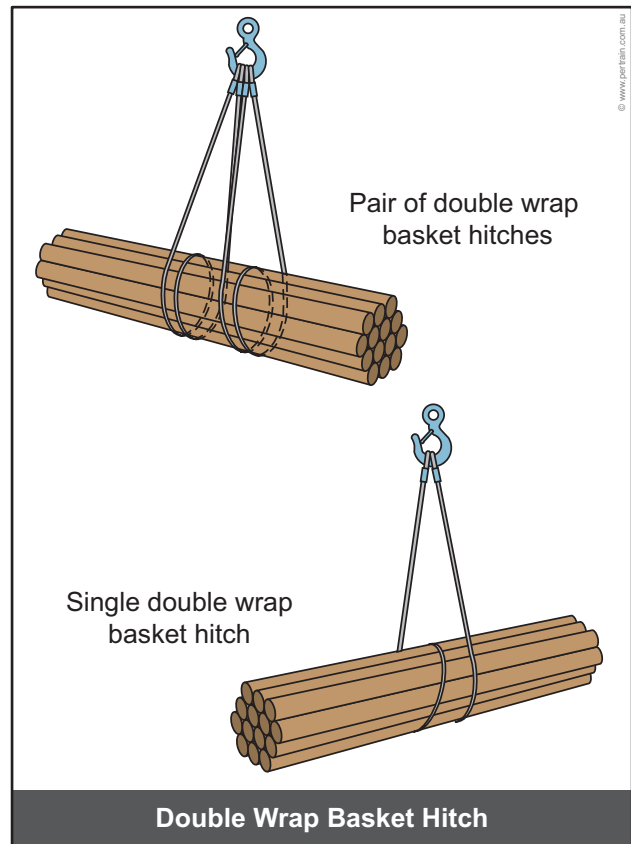
- Plywood sheets should be wrapped to prevent the wind catching individual sheets. Do not use strapping on plywood sheets as it can damage the sheets.
- Loads of pipe, metal or timber should be strapped before lifting.
- Take care when removing strapping or load binding chains as they may release suddenly and whip back or the load may move.
- Spreaders are recommended for lifting individual lengths and wrapped bundles of timber, pipe or steel.

9.1 Loose Bundles

Safe methods for slinging and lifting loose pipes or a loose bundle of steel include:

- use two slings
- double wrap the slings using a basket hitch to compress the load and prevent slipping
- 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)
- use suitable stillage, pallets or slings.

Always chock or block round loads before releasing them to prevent them from rolling away.



9.2 Loose Items

Loose items such as scaffold clips or single gas bottles 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:

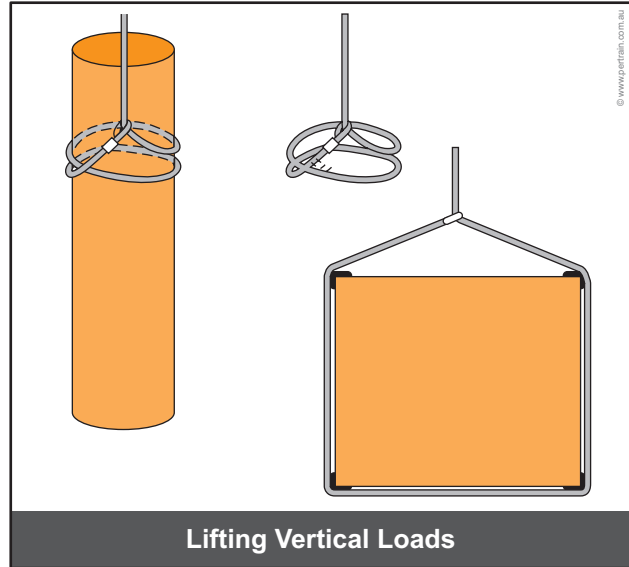
- there is no rated lifting capacity
- you cannot reliably know the condition of the base of the drum (drums are usually discarded because they are unfit to hold liquid)
- holes cut into the sides for the sling or hooks are likely to pull through under the load weight
- sharp edges on the holes are likely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



9.3 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 from damaging the load.



9.4 Structural Steel

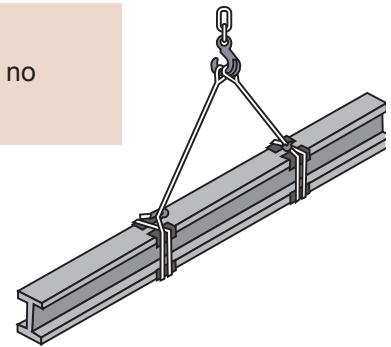
Structural steel can be very dangerous. When a load arrives on site, walk around the truck and check that the load has not shifted. Serious injury or death can occur if steel beams fall when the restraining chains are removed. Trucks must have restraining spikes, or a frame, fitted when carrying steel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



DANGER

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

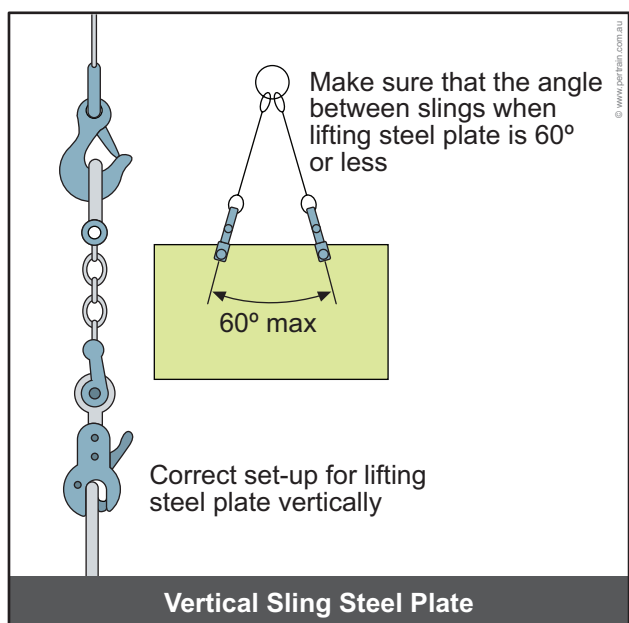
- Deep beams are unstable and can topple because they are narrower in width than height.
- Keep bundles of steel straight and level when lifting.
- Use double wrapped reeves around the beam or bundle.
- Do not lift the bundles vertically or at an angle as slings do not give sufficient hold to prevent 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.



9.5 Steel Plate

Steel plates are usually thin and many are long and wide. The plates tend to sag and buckle during a lift. 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.



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.

Plate clamps can also be used if a sling cannot be used and there is no lifting holes or lugs.

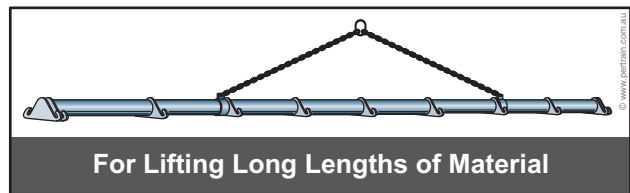


DANGER

Plate clamps may lose grip if worn. NEVER lift loads over people or equipment.

9.5.1 Using a Spreader Beam

Use a spreader beam when lifting long thin plates horizontally to prevent flapping, sagging and vibration. Also use a spreader beam if the angle between the legs of a sling is likely to be more than 60°. To lift a long bundle of roofing iron a spreader beam or long leg slings can be used. To lift steel plate, slings are positioned equally around the load and then attached to the spreader bar. Place the slings so that the plate will not bend during the lift. Protect the slings by placing padding between the plate and slings.



9.6 Timber Trusses

The recommended lifting equipment for timber trusses is a lifting beam and/or long sling or wire.

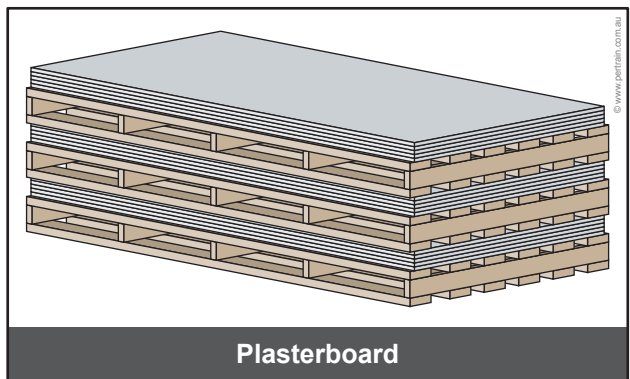
9.7 Pre-cast Concrete Panels

The recommended lifting equipment for pre-cast concrete panels is lifting clutches.

9.8 Plasterboard

Sheets of plasterboard are usually delivered on site in plasterboard packs.

- Lift plasterboard packs in a specifically designed lifting cage.
- If an approved 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.

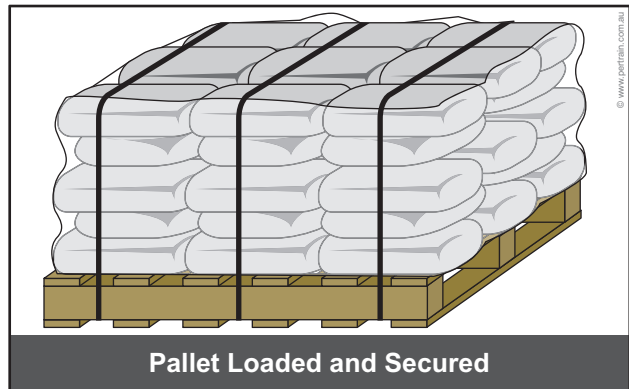


9.9 Pallets

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

- pallet is in good condition
- load is secured so 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
- lower the load
- 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-palletted.

9.10 Specialised Lifting Equipment

Specialised lifting equipment is manufactured for lifting different loads, including:

- brick cages
- personnel cages
- rescue cages
- rubbish bins
- cylinder cage
- concrete kibbles.

Equipment must be designed in accordance with Australian Standards. As a general rule, check the WLL of the equipment before using it to hoist or move a load. Ensure that the device and all lifting equipment are suitably rated for the combined weight of lifting gear, tools, pallet, materials and/or personnel being lifted.

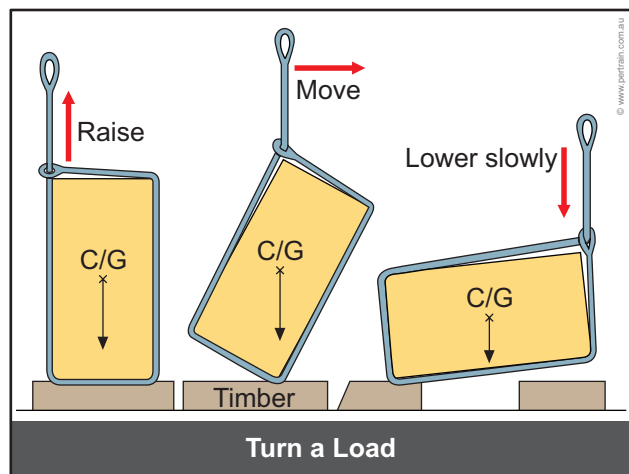
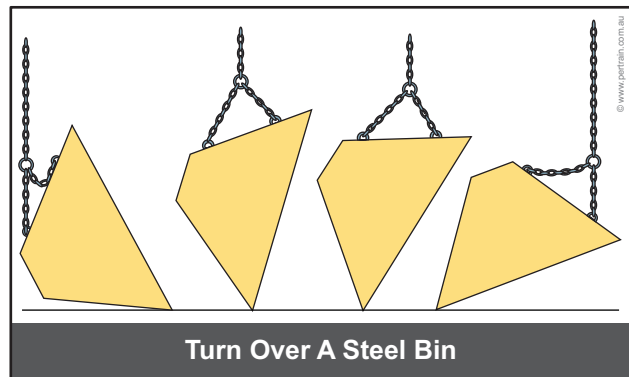


- Safety harnesses must be worn by personnel being lifted.
- Use the lifting lugs or attachment points provided on the equipment.
- Personnel must not stand below any lifting equipment.
- Objects in the lifting cage must be secured and remain stable during the lift.

9.11 Turning Loads Over

When turning over a load, such as a steel beam, box or bin, the sling must be attached to the hook on the side of the load that is to be lifted. This ensures that the load is raised on a diagonal through the centre of gravity. When the load's centre of gravity crosses over the balance point, lower the load in a safe and controlled manner.

Sling the load so that when the load is lowered, the nip will pull against the eye. A long narrow load such as a steel beam standing on its flange has a narrow base and a high centre of gravity. If you nip the sling incorrectly the load may topple over and break the slings.



9.12 Stacking

Stack all materials safely and in a location where the stack will not interfere with other operations. Stacks of materials must be arranged so that:

- the stack is even and will not fall
- there is adequate clearance from moving machinery
- there is access for people and equipment, such as a forklift
- the sling can be removed as each unit is placed on the stack. Do not use the crane to remove the sling as it can topple the stack. Remove the sling by hand
- there is access to fire extinguishers and other emergency services.



NOTE

Always remove a sling by hand as a crane may topple the stack.

Before stacking ensure that the ground is stable, level and not prone to flooding. If there is heavy rain, ensure that the stack is raised off the ground and check for signs that the ground may give way. Check the stack level if the ground is sloping.

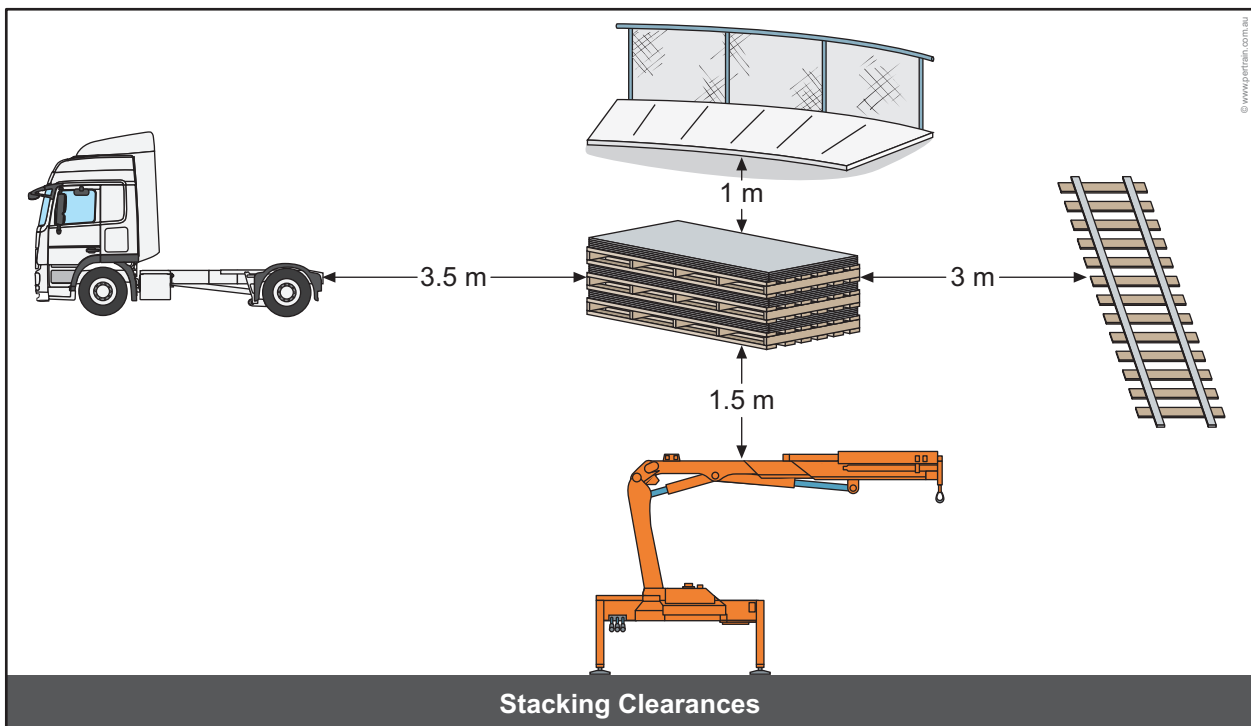
When a stack is removed, check for ground stability before placing another stack in the same location. Stack materials in a safe location away from operations and personnel.

Conduct Lifting Operations

There are clearance zones around operational areas where materials must not be stacked. The minimum clearance that must be kept between stacked loads and the following structures are:

- 3 metres from railway tracks
- 3.5 metres around the stack for truck access
- 1 metre for walkways
- 1.5 metres for access for an overhead travelling crane operator.

There must be enough access around the stack for normal work and for stretcher access in the case of emergency.

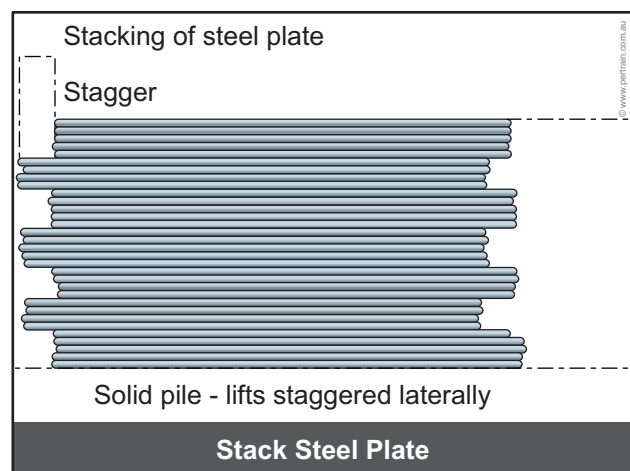


9.12.1 Stacking Steel Plate

Steel plate can be stored in racks or in piles. Plates wider than 0.75 metres can be stacked horizontally by staggering groups of plates to make a suitable amount to lift. Plates of different sizes can be stacked with the largest at the bottom so that the markings are visible.

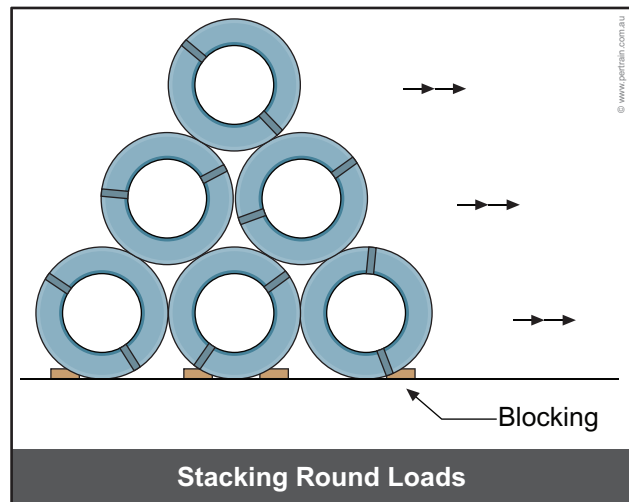
Take care moving plate when it is stored vertically in a rack. When steel plate is stacked upright in racks the plate can easily swing and crush someone when the crane takes the weight of the plate.

Never lift a plate from a rack if someone is inside the rack. Use plate clamps and adequate packing to avoid standing inside a rack. To avoid high, horizontal stacks of steel plate becoming unstable, tie together with strapping.



9.12.2 Stacking Rolled Steel, Coils and Other Round Loads

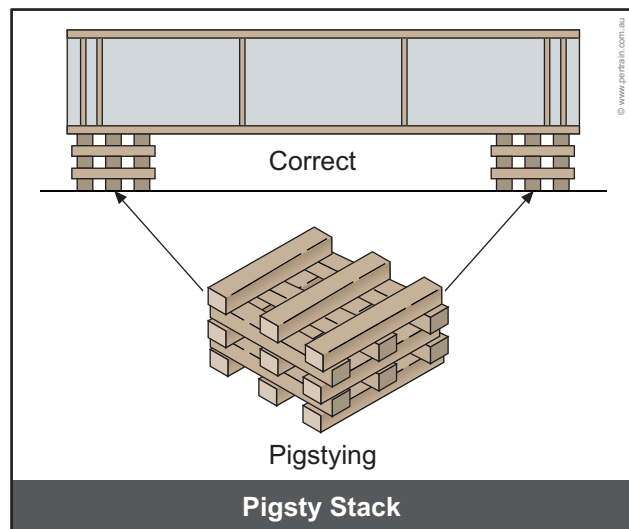
All round loads must be blocked or chocked at the bottom to prevent them rolling or moving. Each layer of the stack must be one unit less than the layer below. The stack will then resemble a pyramid.



9.12.3 Stacking Timber

When stacking shorter lengths of timber, place alternate layers at right angles. This is called pigstying.

- Bundles of timber must be strapped and have dunnage under and between the bundles.
- Keep stacks straight and set on a level surface.
- Check for ground movement after rain.
- Ladders must be provided for access to the top of high stacks.
- Tie high stacks together with interlocking packing to avoid the stack becoming unstable.



SECTION FOUR: WORKING WITH CRANES

There are various types of cranes that can be used for lifting operations, including:

- tower cranes
- portal boom cranes
- mobile slewing cranes
- non-slewing mobile cranes
- bridge and gantry cranes
- vehicle loading cranes
- container side lifter.

All cranes have characteristics that make them more or less suitable for a particular lifting task.

For example:

A vehicle loading crane is mounted on a vehicle, such as a truck, for the purpose of loading and unloading directly from the vehicle.

A container side lifter is designed to pick up and move shipping containers onto a truck for transport to another location.

Bridge, overhead and gantry cranes consist of a hoist that travels along parallel runways attached to a structure. These cranes are used to move heavy items within that structure, e.g. workshop.

Liaise with the crane operator to determine the most suitable crane for the lift.

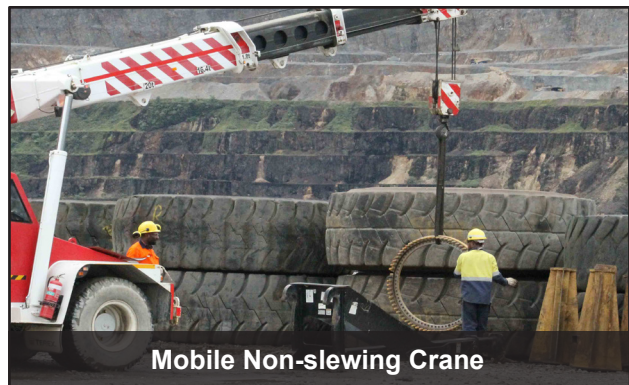


CAUTION

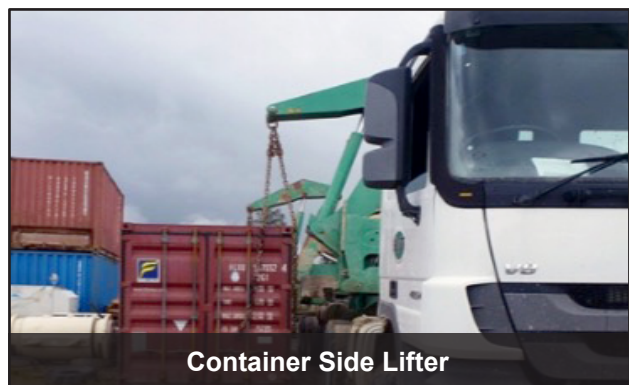
Do not overload the crane. Overloading can cause overturning, structural damage or instability.



Vehicle Loading Crane



Mobile Non-slewing Crane



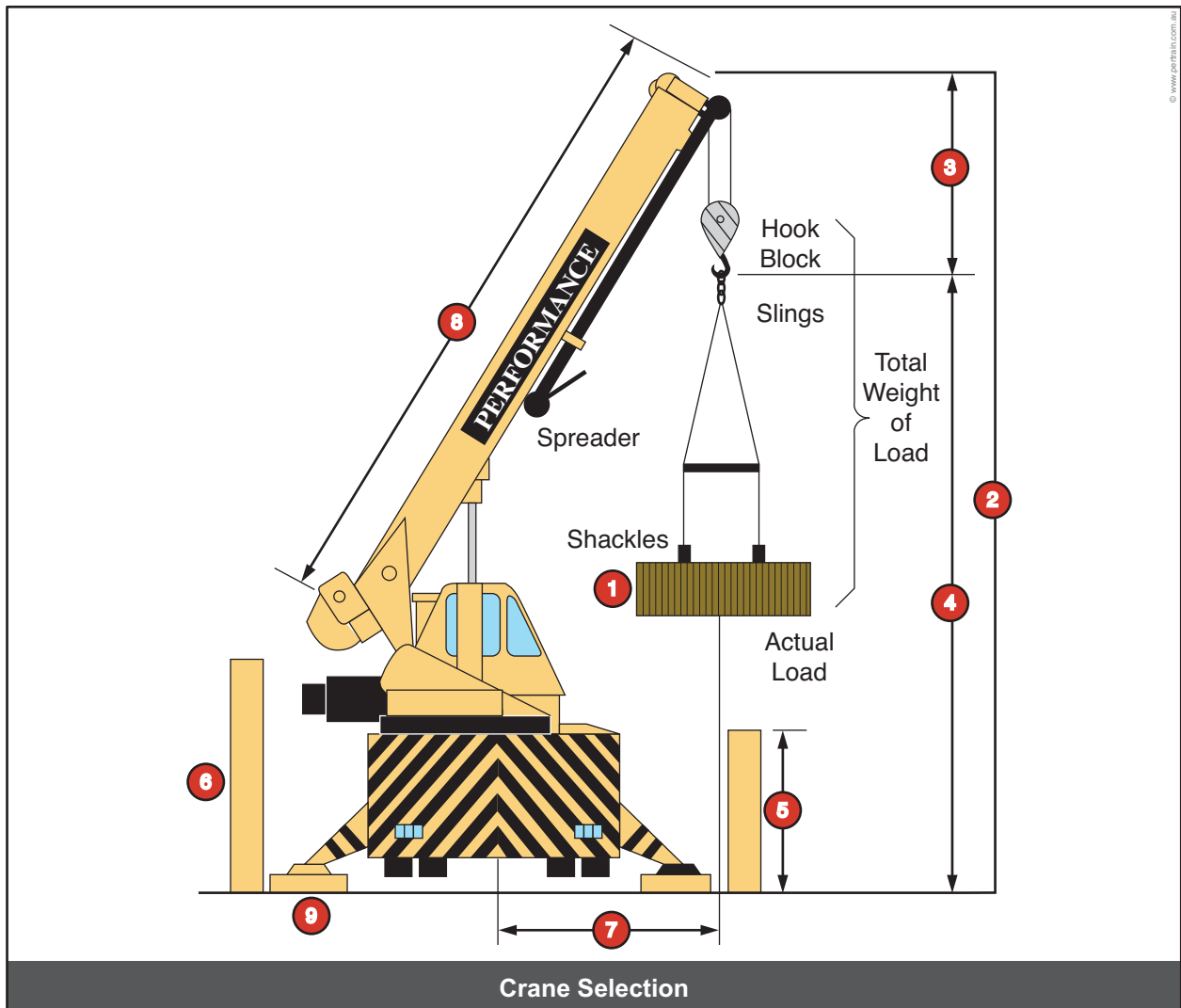
Container Side Lifter



Overhead /Bridge / Gantry Crane

There are nine key considerations when selecting a suitable crane for the task.

1. The weight of the load. Include all lifting equipment. The total lift weight must not exceed any load capacity listed in the crane rating chart.
2. The overhead clearance height.
3. The distance from the jib head to the hook.
4. The height of the hook from the ground.
5. The height of any obstructions between the crane and the load.
6. Any obstructions that may hinder the counterweight when slewing.
7. Any obstructions and their distance from centre of rotation.
8. The boom length.
9. Make sure the ground is firm and check for power/telephone lines and other services.



NOTE

Obtain the total weight of the load by adding the actual load weight to the weight of the crane hook block, slings, spreaders, shackles and any other lifting attachment.

10. RATED LIFTING CAPACITY AND WLL

The capability of the crane to lift a load is called its rated lifting capacity. The rated lifting capacity is the total suspended load that can be safely lifted under ideal conditions at a given boom length, articulation angle and load radius. The total suspended load includes the weight of the load being lifted plus the weight of the hooks, blocks, slings and other lifting devices.

Use the manufacturer guidelines to assess rated lifting capacity. Remember the load chart ratings only apply when the load is picked up directly under the boom tip. At any other position the boom strength is reduced.

The working load limit (WLL) of a crane is the maximum load, under specified conditions, for which that crane can be used. Working load limits, as specified on crane rating charts, are based on standards of crane design and take into account appropriate safety factors. Load chart capacities are based on ideal conditions, which are seldom achieved under actual working conditions.

CRANE LOAD CHART Showing rated lifting capacity (in tonnes) on fully extended outriggers.						
Radius	10.1m Boom		18.1m Boom		26.0m Boom	
(m)	Over Rear	Over Side	Over Rear	Over Side	Over Rear	Over Side
3.0	25.0	25.0	14.00	14.00		
3.5	21.70	21.70	13.40	13.40		
4.0	18.50	18.50	12.75	12.75		
4.5	15.50	15.50	12.15	12.15		
5.0	12.80	12.80	11.60	11.60	7.40	7.40
5.5	10.50	10.50	10.00	10.00	7.10	7.10
6.0	8.80	8.80	8.70	8.70	6.65	6.65
6.5	7.70	7.55	7.70	7.70	6.40	6.40
7.0	6.85	6.60	6.85	6.60	6.10	6.10
7.5	6.20	5.70	6.20	5.70	5.75	5.75
8.0	5.60	4.95	5.60	4.95	5.40	5.40
8.5	5.05	4.36	5.05	4.35	5.00	4.80
9.0			4.60	3.85	4.60	4.35
10.0			3.90	3.10	3.90	3.50
11.0			3.30	2.65	3.30	2.95
12.0			2.80	2.25	2.80	2.50
13.0			2.40	1.95	2.40	2.15
14.0			2.10	1.55	2.10	1.80
15.0					1.55	1.30
16.0					1.20	0.95
18.0					0.90	0.60
20.0					0.70	0.40
22.0					0.55	0.25
24.0						

Example of a Lifting Capacity Chart



NOTE

You must know how to determine the WLL capacity from a chart and recognise factors that can reduce the capacity of the crane you are working with.

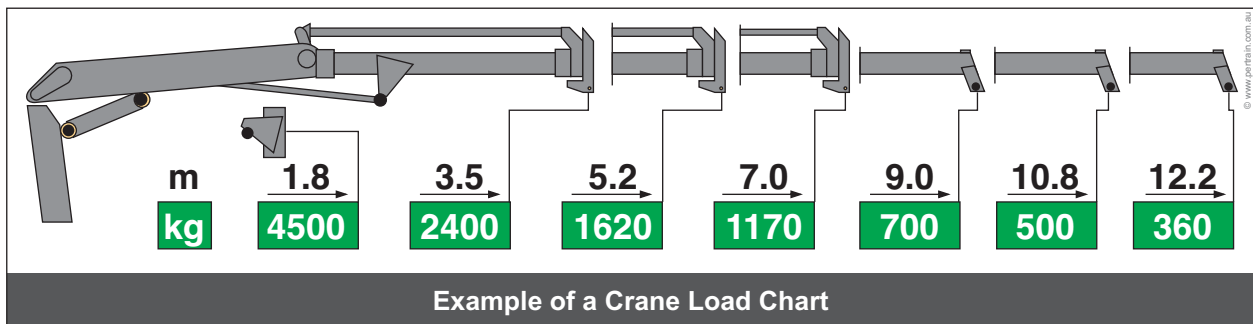
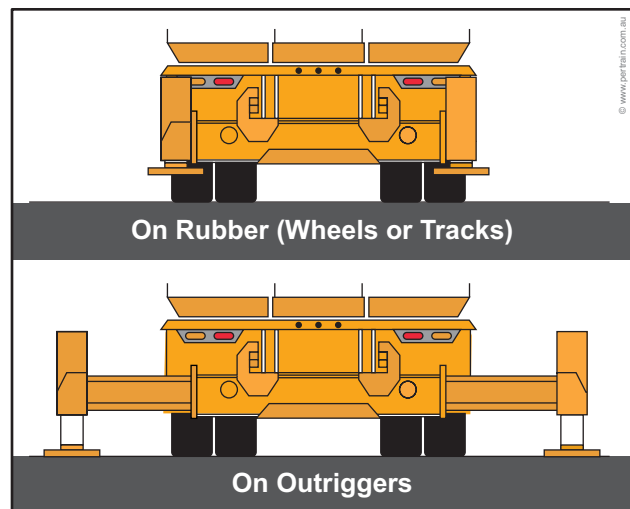
10.1 Crane Load Charts

Each crane must have a load chart that is normally located in the crane cabin. Crane load charts specify the maximum rated capacity of the crane under all configurations. The load chart also specifies the machine's operational limitations and the conditions necessary for safe operation. There are three basic types of crane load charts:

- crane load or ratings charts (provide details of weights and given distances)
- crane radius range diagrams (provide details of distance and heights)
- crane special conditions (outline the provisions for the use of load charts and the crane in general).

Consult the crane load charts and load radius indicators to determine the maximum load that a crane can lift when the crane is:

- free, supported only on its wheels or tracks
- packed using outriggers.



10.2 Crane Safety

Observe the following safety precautions when working around or near cranes.

- Ensure that the weight of the load and all lifting equipment is within the machine WLL.
- Reassess the crane lifting capacity if conditions are less than ideal or if conditions change.
- Locate the crane in the safest location that is consistent with efficient operations.
- On soft ground, place suitable packing under the crane's outriggers to keep the crane level.
- Use extreme care when directing a crane onto sloping ground.
- Establish suitable controls, such as hoarding, a gantry or scaffolding, if lifting over a pedestrian footpath.

- Personnel should not work under or walk beneath a crane boom or suspended load.
- The load should be carried as close to the ground as conditions permit.
- Crane travel should only be as fast as conditions permit. Fast operation on rough or uneven footing can cause machine damage or personal injury.
- Derating of the crane capacity will be required when performing certain lifts, for example in windy conditions or on soft and uneven footing.
- The load ratings are the maximum WLL for a machine levelled to within 1% grade.
- Ensure that no danger to personnel or bystanders exists when operating a crane. Keep all nonessential personnel away from the operating area.
- Do not raise or lower the boom, or pass a load over personnel or other equipment as any load slip or equipment failure can cause a serious injury or fatality.
- Do not walk under or work on a raised load.
- Do not ride the load or on the crane hook.
- Exercise caution when conducting operations in wet or slippery conditions.
- Exercise extreme caution when conducting crane operations on grades.
- Do not overload a crane.
- Do not use the boom of a crane and lifting equipment for anything other than the intended purpose.

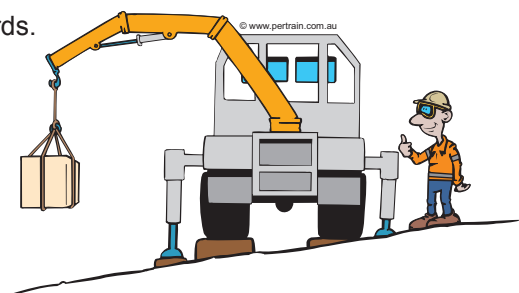
11. LIFT AND SET DOWN SITES

Prepare the work area or arrange for the area to be prepared if necessary. Use the hierarchy of controls to control or reduce all hazards to as low as reasonably possible.

11.1 Positioning a Crane

If you are using a crane to perform the lift, undertake these guidelines when positioning the crane at the lift or set down site.

- Conduct a thorough site inspection to identify hazards.
- Check overhead clearances.
- Maintain the correct distance from power lines and other services.
- Check the ground conditions for stability and load bearing capacity.
- Ensure that there is enough room to manoeuvre the crane and load.
- Position the crane close to the load.
- Keep clear of trenches and excavations.
- Place pigsty packing under the outriggers and extend the outriggers fully.
- Set up an exclusion zone to prevent unauthorised access.
- Set up traffic and pedestrian control, if necessary.
- Provide a spotter, if necessary.



11.2 Inspect the Lift and Set Down Sites

Before starting lifting operations, inspect the lift and set down sites to determine the:

- access to the site
- layout and physical condition of the site
- location and condition of structures
- obstructions
- weather conditions
- equipment requirements
- emergency egress route and access for emergency vehicles
- hazards that may pose risks to equipment or personnel.

Use a checklist like the one below to inspect the work site and identify hazards.

Location	Check List
Site	<ul style="list-style-type: none"> • Layout and condition of the site • Personnel close to the work • Proximity of other structures and equipment • Power, telephone and water lines • Service drains • Boundary and other markers
Surfaces	<ul style="list-style-type: none"> • Stability and slope • Slipping and tripping hazards • Strength to support personnel and equipment
Structures	<ul style="list-style-type: none"> • Location and condition • Stability, strength and security
Ground	<ul style="list-style-type: none"> • Level and even • Firm • Rough, soft or subsided sections
Working Area	<ul style="list-style-type: none"> • Sufficient space • Tidiness and clutter • Openings that may allow falls • Lighting • Traffic, both vehicular and pedestrian
Equipment	<ul style="list-style-type: none"> • Requirements • Suitability for the task • Serviceability • Correct use • Correct set up and dismantling, for example scaffolding
Edges	<ul style="list-style-type: none"> • Protection for equipment and personnel
Below Work Area	<ul style="list-style-type: none"> • Objects, for example star pickets, poles and reinforcing bars • Openings or holes requiring protection • Unguarded excavations • Traffic, both vehicular and pedestrian

Location	Check List
Access	<ul style="list-style-type: none"> • Obstructions • Overhead clearances including overhead power lines • Other equipment • Emergency egress route • Emergency vehicle access
Weather	<ul style="list-style-type: none"> • Rain, wind, sun

11.3 Set Up an Exclusion Zone

Before starting work, signpost and barricade the area around the lift and set down sites. The exclusion zone restricts or prevents unauthorised access into the lifting area. Erect warning signage, barricades, cones and/or lights as required by your site procedures and traffic management plan, if applicable.

Place an exclusion zone sign at all access points or use other approved methods to warn other personnel and visitors entering the work site. If the work area is on a roadway, install traffic control measures to ensure the safety of workers and vehicles.



CAUTION

Persons not directly involved in the lifting job should be kept clear of the lifting zone. You are responsible for ensuring unauthorised personnel do not enter the lift area

11.3.1 Barricades

Barricades can be of either a warning or protective type. They indicate restricted access into lifting areas and areas in which a danger from falling objects is present.



DANGER

Do not enter a barricaded area without authorisation and knowledge of the area.

Warning Barricades

Warning barricades call attention to a hazard but offer no physical protection. They consist of barrier tape and stands or posts. Witches hats and barrier tape warn personnel to keep away from an area, but may not be as effective as more secure barricades.

Protective Barricades

Protective barricades call attention to a hazard and provide physical protection. This type of barricade consists of posts and rails or chains, or other physical barrier to entry. Protective barricades must be erected before the work is commenced. Where flashing lights are part of a barricade, they should be operational in poor light conditions.

An entrance, opening or gate should be placed where practical to allow access to and from the barricaded area.

11.3.2 Traffic Management

Traffic management is essential if lifts are conducted near roadways. Traffic management may include signs, barricades or traffic control personnel (flag person). The site traffic management plan and local regulations contain information on work area signage requirements. Organise for appropriately trained traffic control personnel to control traffic if any part of the roadway is to be blocked by the lifting operation.

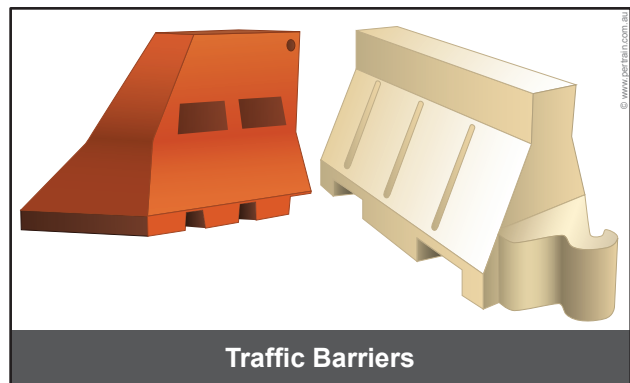
Before starting work, follow these steps to control traffic hazards.

- Identify the requirements for equipment and signage from the project traffic management plan or local regulations.
- Identify the need for traffic or pedestrian control personnel.
- Obtain the equipment required, including:
 - signage
 - cones
 - barricades.

Coordinate traffic management with all personnel involved and ensure that all personnel understand their responsibilities.

Implement the traffic management plan in the work area.

- Erect signage and barricades to warn all personnel.
- Establish an exclusion zone to prevent unauthorised access.
- Arrange for a flag person, if required.
- Arrange for pedestrian management, if required.
- Ensure a safe working area.
- Maintain suitable vision at night including:
 - work lights
 - access lighting.



12. PREPARING TO LIFT THE LOAD

Complete preparations to lift the load by connecting the load to the lifting device, coordinate activities with the personnel involved and conduct a trial lift.

12.1 Connect the Load to the Lifting Device

When the equipment has been assembled, connect the load to the lifting device using appropriate lifting gear. The objective is to ensure that the load is as safe and secure when suspended as it was on the ground.

- Use certified lifting equipment to connect the load to the lifting device.
- Ensure that the attachment methods to connect the sling to the load and the sling to the lifting device are secure.
- Attach slings to the load firmly, for example to purpose-designed lifting points, eyebolts or similar, or by suitable slinging methods.
- Check that the slings are not twisted, knotted or kinked.
- Do not exceed the rated included angle of 120° when using multiple slings.
- Do not overload the slings or other equipment.
- Ensure that the load is secure and cannot fall from the sling when suspended.
- Arrange the slings and other rigging so that the load will be balanced and stable when lifted.
- Ensure that the slings and other rigging cannot damage the load.
- Secure loose parts of the load.
- Hook back and secure loose ends and unused legs of multi-leg slings.
- Attach a 16mm tagline to control load movement. More than one tagline may be required.
- Visually inspect the load, slings and other connecting attachments, and the movement device before lifting to ensure safety and security.
- A competent rigger/dogger should certify that the load is ready to be lifted.

12.2 Direct the Lift

Before lifting, make sure that everyone involved understands the agreed signals to be used.

- Only the designated person should direct the lift and communicate with the crane operator (if using a crane).
- Use the standard hand signals.
- Any person may give the emergency stop signal and this signal must always be acted upon immediately.
- Use radio communication where the load is not readily visible to the crane operator and/or dogger, or where hand signals are obscured.
- Communication should be on a continuous talk basis so that all personnel involved are aware of the lift progress throughout the operation.
- Crane operators should normally take instructions from only one person.



12.3 Conduct a Trial Lift

Before moving the object, conduct a trial lift to check the machine stability and ability to lift and transport the load. Conduct a trial lift using the following method.

1. Ensure the stability of the load and lifting equipment.
2. Check for clearances and ensure there are no obstructions.
3. Inspect the load and lifting equipment and make sure that all slings are tightly secured.
4. Coordinate the trial lift with the required personnel.
5. Lift the load until the load just clears the surface.
6. Check the stability of the load.



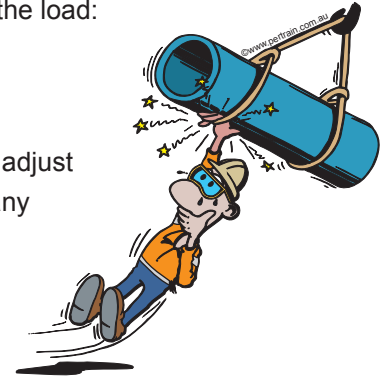
DANGER

During a trial lift, lift the load until it just clears the surface. Do not lift any higher than necessary.

If the load appears unstable or there is weight shift to one side, lower the load:

- apply temporary bracing and/or load support
- re-sling before continuing.

If a load measuring device is fitted, confirm the weight of the load and adjust operations as required if your calculations were incorrect. Check for any deviation in the load radius.



13. LIFT AND CARRY THE LOAD

If the trial lift is successful and all preparations are completed, carry out the lift and carry operation in accordance with the lift plan.

1. Coordinate the lift operation with the required personnel.
2. Ensure all personnel are clear of the work area during lifting operations.
3. Lift the load vertically whenever possible.
4. Direct the load movement using the standard signals.
5. Keep the load as low as practicable.
6. If required, move the machine slowly to carry the load to the destination.
7. Avoid sudden movements or jerking which may cause the load to swing.
8. Carefully swing the boom or carry the load to the required destination.
9. With the assistance of support personnel, lower the load using site procedures.
10. Secure the load according to specifications as detailed in the lift plan and work instructions.



DANGER

Ensure that no personnel are under the load or crane boom while it is being moved as there is a risk of serious injury or death should the crane fail or the load shift.



NOTE

Follow the equipment manufacturer's specifications and your site procedure when lifting, moving and securing the load.

13.1 Carrying/Moving Loads

If you are using a mobile crane, observe the following general rules for carrying/moving loads.

- Warn everyone in the area of your intentions before moving the load. A person can be easily knocked from a structure or crushed by a moving load.
- Warning lights (where fitted) must be turned on when the crane is moving.
- All mobile cranes with wire rope luffing gear must have a luffing overwinding limit device.
- Make sure spring lockouts (where fitted) are set before travelling a load.
- Secure the load fore and aft unless the load is too long. Secure long loads in a diagonal position with the boom fore and aft.
- If you are directing the crane operator, take the slope and angle of the boom into account when moving up or down a slope.
- Do not direct the crane to travel across a slope with a load.
- Travel the crane slowly at creep speed to reduce load swing.
- Bridle the load back to the crane to prevent it swinging.
- Observe traffic rules, watch intersections and avoid pedestrians. Instruct the driver to use the warning horn or whistle when approaching pedestrians or workers.

Do not travel the crane:

- over potholes, objects, dunnage wood, depressions or soft ground
- across a slope
- on road cambers or shoulders.

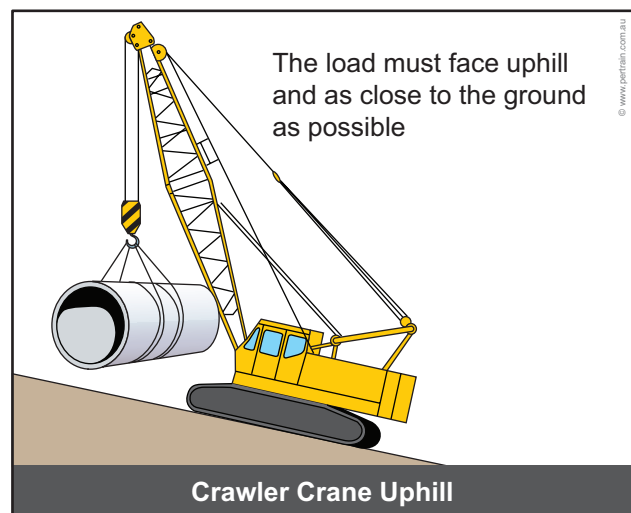
Any of these situations could destabilise the crane or load.

Often there is a need to direct a crane off the road onto unprepared ground. Some mobile cranes are better suited than others to travel over rough surfaces. Rough terrain cranes are full slewing mobile cranes that are suited to carrying a load across an unprepared surface. Cranes are more likely to overturn when they are operated 'off-road' or on rough ground at a construction site. Always check the load chart and the manufacturer's recommendations before travelling.

Before leaving the road check for:

- potholes and soft or rough ground
- overhead obstructions
- power lines
- personnel working in the area
- traffic flow
- underground services
- pedestrians.

Always check grassy surfaces for potholes hidden by long grass. Walk over the whole area before guiding a crane across.



14. LOAD DESTINATIONS

Before lifting a load, inspect and if necessary prepare the set down area. Check that the load destination is capable of supporting the load.

Follow these guidelines to prepare the lift area correctly.

- Obtain any permits that may be required, for example Working at Heights, Enter Confined Space permits.
- Clear the set down area of debris.
- Ensure that the surface at the set down area is firm, stable and level.
- Place packing material on the ground if necessary.
- Erect signage and barricade tape around the lift and set down areas.
- Place a spotter at the set down area.
- Check the route of travel for any obstructions that may prevent movement of the load.
- Clear the lift and set down areas of slip and trip hazards.

14.1 Placing the Load on the Ground

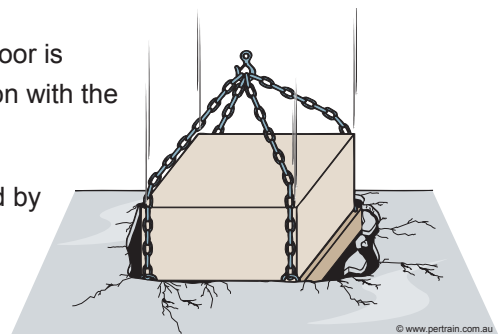
When placing the load on the ground, check that the surface is firm, level and not prone to flooding. Raise the load off the ground to prevent moisture build-up and avoid the load becoming flooded in the event of rain. Place padding or packaging under the load to raise the load off the ground, if necessary. Ensure that there is adequate safe clearance around the load for vehicular and pedestrian access.



14.2 Placing the Load on Concrete or Suspended Floors

When placing the load on a concrete or suspended floor, or temporary formwork and falsework, always check that the floor is capable of safely supporting the load. Check site information with the engineers or other authorised personnel.

Be aware of loads where the weight of the load is supported by a single point. The load may need to be placed on a pallet or packing to spread the weight of the load over a wider area. Check the age of the floor and obtain an engineer compliance documentation if in doubt.



14.3 Placing the Load on a Vehicle

The first priority with any load is to keep within the legal axle load requirements and within the permissible dimensional requirements.

Ensure that the trailer is clean before loading and that the vehicle is braked and chocked. Where possible, place the cargo against the headboard, front rack, or bulkhead of the vehicle. In this way, it cannot move forward during braking and can be more easily secured.

Where it is not possible to do this, you should place the load hard against a large baulking object, for example, a piece of strong timber, of at least 100 mm x 100 mm square cross section. This object must be fitted across the vehicle platform and firmly fixed to a metal frame member of the vehicle chassis.

Blocks, wedges and chocks may also be used to prevent cargo movement. Blocks, wedges and chocks must be of adequate size and strength and must be properly secured to the trailer.

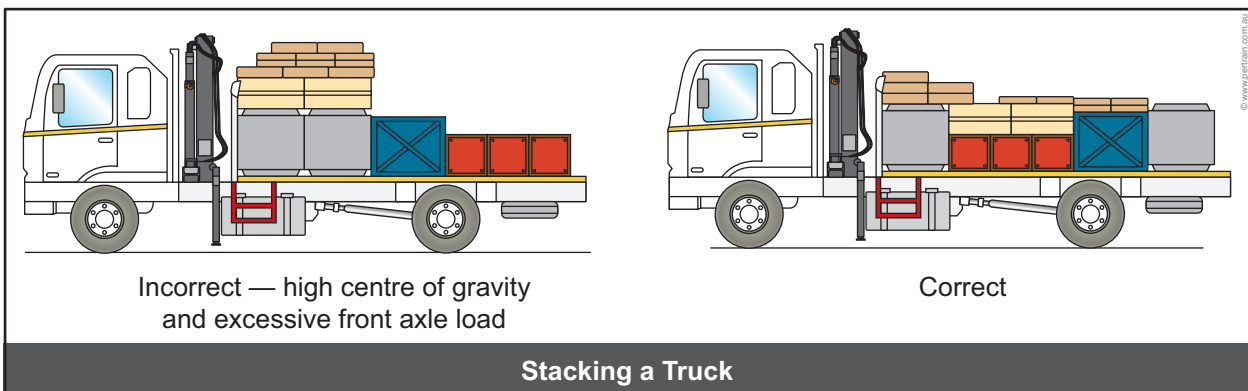
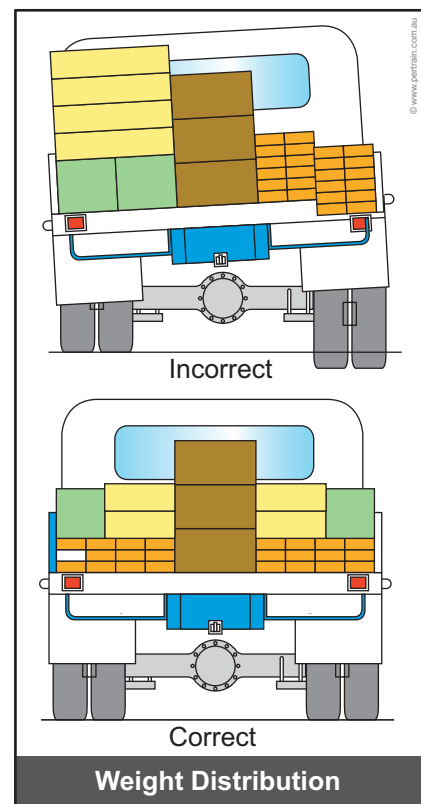
Spread the load to keep the centre of gravity as low as possible. Where the load is stacked, larger and heavier items should be placed at the bottom. If possible, load the vehicle to give an even weight distribution over its floor. Where possible place part loads or heavy items over the axles.

In order to maintain lateral stability, the centre of gravity of the load should be on or as near as possible to the centre line of the vehicle. It is better for heavier items to be carried on the centre line of the vehicle than at the sides. Heavy solid items should, where possible, be placed in front of light crushable items.

A high load will seriously affect the stability of the vehicle and may cause it to overturn when cornering. High loads should be carried on vehicles with a low platform.

Check the overall height of a loaded vehicle to ensure that there is adequate clearance under bridges or other obstructions.

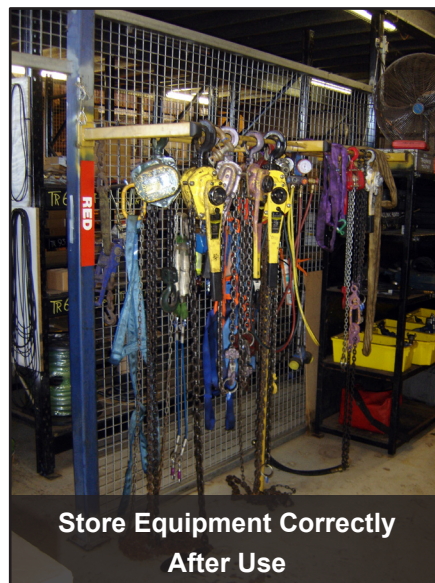
Rear overhang loads must not exceed the road regulations. Attach a red flag or other suitable device to long loads to provide a visual warning. Arrange loads incorporating any dangerous projection to minimise risk to the driver and other road users.



15. COMPLETING THE TASK

Carry out the following tasks to complete the lift procedure.

- Secure the load safely according to the lift plan. This may include raising the load above potential flooding or covering the load to protect from weather.
- Remove or disconnect lifting equipment from the load and the crane (if applicable).
- Inspect all equipment and prepare it for the next task or for storage.
- Perform authorised maintenance in accordance with site procedures.
- Remove worn or damaged equipment from service. Tag items 'Out of Service' for repair or discard as necessary. Complete the required defect or maintenance report and submit it according to site procedures.
- Return slings and other lifting equipment to the designated storage area ready for the next use.
- Store lifting equipment according to manufacturer instructions in an undercover area that is:
 - clean, dry and well ventilated
 - out of direct sunlight, ultraviolet light and fluorescent lighting
 - away from chemicals, oils and other hazardous substances
 - away from sand, dirt, grit and other abrasive substances
 - vermin free.
- Clean up the work site and remove debris and waste.
- Recycle or reuse materials if possible and dispose of waste according to your site procedures and Environmental Management Plan.
- Remove and store barriers and other hazard control measures, as required.
- If a hazard still exists, leave control measures in place and report the hazards to the appropriate personnel.
- Complete and submit the lift report and any other documentation required according to site procedures.



**Store Equipment Correctly
After Use**

16. COMPLETING YOUR TRAINING PROGRAM

Congratulations! By now you should be familiar with lifting operations, and the site safety and work requirements. In order for your training to be recognised you will need to work in different conditions over a period of time and complete a formal assessment.



NOTE

You are responsible for increasing your skills, knowledge and understanding so that you can attempt the assessment.

16.1 Formal Assessment Process

The final step in the training program is for you to complete the formal assessment. The assessment is conducted in a production environment.

Your assessor will observe you to ensure that you have learned the skills to perform lifting operations safely and efficiently.

Your assessor will request that you conduct specific activities, ask the occasional question and refer to your shift reports and site records to assess your competency.

If you have worked through the training program correctly, you should only need to conduct operations as you would on a regular shift. When you have successfully completed the assessment, you will be recognised as trained lifting operator.

17. SUMMARY

This resource has provided information on your obligations when performing lifting operations. It has described the safety procedures you must follow and the techniques you can use to lift and move a load.

APPENDIX

18. TERMS AND ACRONYMS

If you hear a term or acronym that you are unfamiliar with, ask your supervisor or co-workers what it means and add it to this list.

Term	Meaning
Dogging	Dogging is the application of slinging techniques for lifting a load, including selecting the method of lifting and inspecting lifting gear. It also covers directing the operator of a crane or hoist in the movement of a load when the load is out of the crane operator's view.
Rigging	An integrated arrangement of (usually) high strength, flexible lifting equipment, that may include slings and usually ends with an end ring, hook and shackle assembly.
Sling	A rigid device used to lift objects directly, such as hooks and webbing

19. CONVERSION AND CALCULATION REFERENCE

Conversions

- 1 m = 100 cm = 1000 mm
- 1 tonne = 1000 kg

Calculations - Objects

- Width (W)
- Length (L)
- Height (H)
- Base Area (B)
- Diameter (D)
- Radius (r)
- Pi (π) = 3.14

AREA Measured in square metres (m ²)	
Square, Rectangle	W x L
Circle - Option 1	πr^2
Circle - Option 2	D ² x 0.79

VOLUME Measured in cubic metres (m ³)	
Cube, Box	H x W x L
Pyramid	B x 1/3 H
Cylinder	B x 1/3 H
Sphere, Ball	H x W x L x 0.53

WEIGHT Measured in tonnes	
Plate	H x W x L x weight of 1 m ³ of the material it is made from
Pipe	Volume of outside - Volume of inside x weight of 1 m ³ of the material it is made from

WEIGHT Measured in kilograms (kg)	
Plate	H x W x L x weight of 1 m ³ of the material it is made from x 1000
Pipe	Volume of outside - Volume of inside x weight of 1 m ³ of the material it is made from x 1000

Calculations

Calculations work like two sides of a mirror.

What is seen on one side of the = sign (the mirror) is reversed on the other side of the = sign.

- + becomes -
- x becomes ÷
- Squaring (²) becomes the square root (√).

Examples: x is an unknown quantity

$$x + 1 = 10, \text{ so } x = 10 - 1, \text{ therefore } x = 9$$

$$2 \times x = 4 \text{ so } x = 4 \div 2, \text{ therefore } x = 2$$

$$x^2 = 9, \text{ so } x = \sqrt{9}, \text{ therefore } x = 3$$

Calculations - Slings

- Safety Factor (SF)
- Angle Factor (A)
- Diameter (D)
- Reeve Factor (R)
- Chain Grade (CG)
- Weight of Load / Working Load Limit (WLL)

FSWR	If Multiple Slings	If Reeved
$WLL = D^2 \times SF$	$WLL = D^2 \times SF \times A$	$WLL = D^2 \times SF \times A \times R$
$D = \sqrt{WLL \div SF}$	$D = \sqrt{WLL \div SF \div A}$	$D = \sqrt{WLL \div SF \div A \div R}$

CHAIN	If Multiple Slings	If Reeved
$WLL = D^2 \times CG \times SF$	$WLL = D^2 \times CG \times SF \times A$	$WLL = D^2 \times CG \times SF \times A \times R$
$D = \sqrt{WLL \div CG \div SF}$	$D = \sqrt{WLL \div CG \div SF \div A}$	$D = \sqrt{WLL \div CG \div SF \div A \div R}$

NOTES TO REMEMBER:

- Safety Factor for FSWR = 8
- Safety Factor for 80 grade chain = 0.4
- Reeve Factor for circular load = 0.75
- Reeve Factor for square load = 0.5

