PRO-LIFT
Training & Assessment Services

TLILIC0020

Licence to operate a slewing mobile crane (over 100 tonnes)

Student Guide

Contents

Introduction

Welcome to **TLILIC0020 Licence to operate a slewing mobile crane (over 100 tonnes)**

Information provided may help to ensure your safety.

This unit

This unit specifies the skills and knowledge required to safely operate a slewing mobile crane with a Maximum Rated Capacity (MRC) over 100 tonnes in accordance with all relevant legislative responsibilities. Competence in this unit, does not in itself result in a High-Risk Work Licence (HRWL) to operate this plant.

- Slewing mobile crane means a mobile crane incorporating a boom or jib that can be slewed, but does not include:
- a front-end loader, or
- a backhoe, or
- an excavator, or
- other earth moving equipment, when configured for crane operation.

A person performing this work is required to hold a slewing mobile crane with an MRC over 100 tonnes HRWL
This unit requires a person operating a slewing mobile crane with an MRC over 100 tonnes to:

- plan for the work/task
- prepare for the work/task
- perform work/task
- pack up

Licensing/Regulatory Information

Legislative and regulatory requirements are applicable to this unit of competency.

This unit is based on the licensing requirements of Part 4.5 of the Model Work Health and Safety (WHS) regulations and meets Commonwealth, state and territory HRWL requirements.

The National Assessment Instrument (NAI) is the mandated assessment for the HRWL to operate the relevant licensing class as detailed in this unit

This unit

Elements covered in this unit are:

1. Plan work/task
2. Prepare for work/task
3. Perform work/task
4. Pack up

WHS Law

Legislation is law passed by Parliament. It governs many areas, including health and safety at work.

It can be national, or relevant to individual states and territories.

You need to know the WHS legislation that covers your job and workplace.

You are required by law to comply with them.

You need to understand how WHS Acts, regulations, codes and standards affect your work, job and workplace.

Acts & Regulations

Acts - Are law. They describe how to provide health and safety in the workplace

The *Work Health and Safety Act*

2011 QLD / NT / WA / NSW

2004 –Victoria

The Act is the cornerstone of legislative and administrative measures to improve occupational health and safety

Regulations - are made under the Act. They set out the practical steps to follow to comply with the Act

Codes of practice & Australian Standards

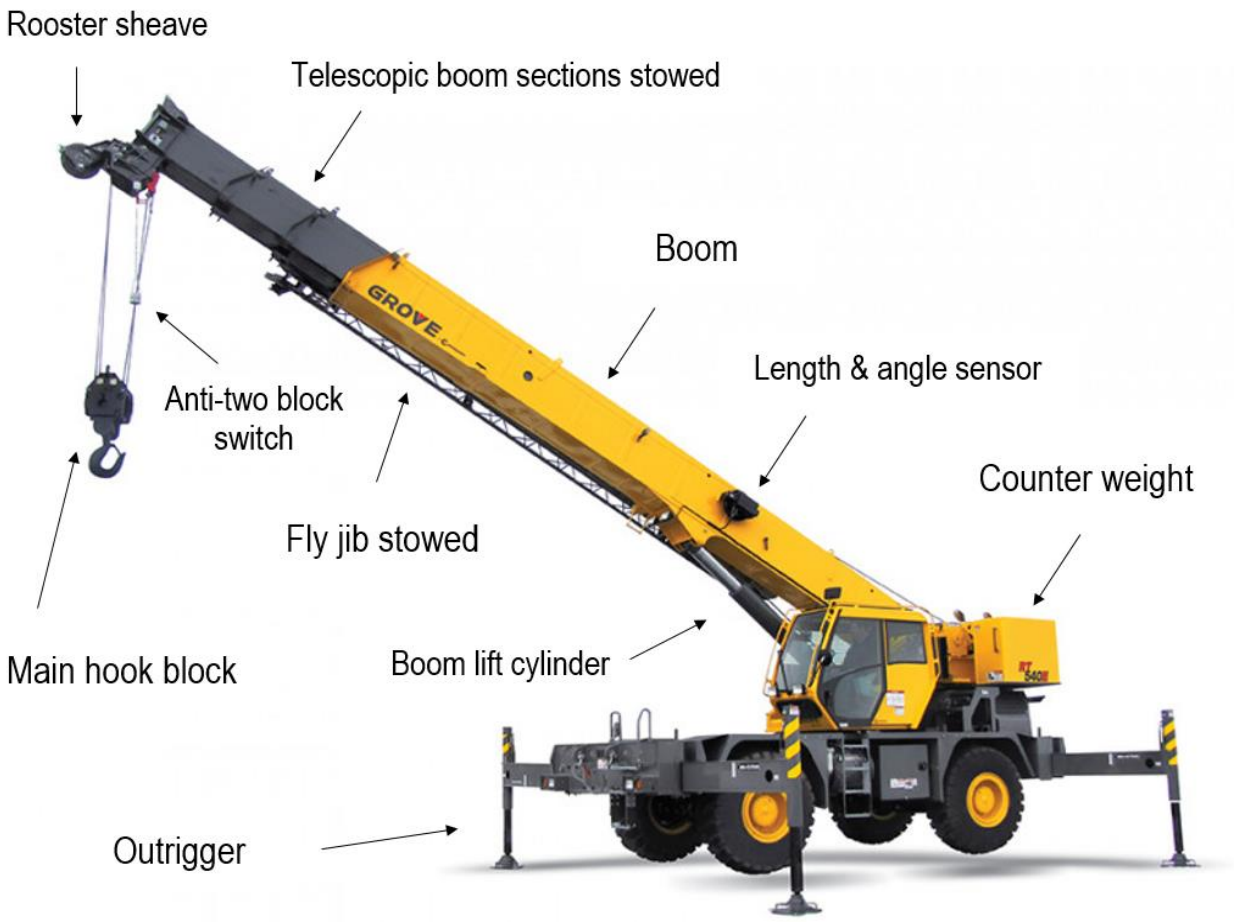
Codes of practice - Give practical guidance on how to legally comply with regulations and Acts

Australian Standards - Developed to provide minimum levels of performance or quality. Cover hazards, work processes and products.

The safest way to carry out the work activity is to read, understand and follow your

- Safe work method statements
- Codes of practice

Mobile slewing crane parts



Identify job task requirements

You can identify job task requirements from.

- Work orders
- Supervisor instructions
- Communications with the site foreman

Planning for lifting operations

When planning lifting operations, you must ensure that

- The lift plan is confirmed with all associated personnel
- A site inspection is conducted according to workplace procedures

Plan and prepare

Other than hazards you should plan for

- Permits and Licences
- Location of task
- Characteristics of load
- Access & Egress
- Communications
- Equipment required and availability

Access workplace safety information

- Legislation and regulations
- Australian Standards
- WHS/OHS policy
- Codes of practice
- Manufacturer instructions
- Safe working or job procedures

Work health and safety regulator

If a high-risk worker is not working safely under a high-risk work licence, the work health & safety regulator can

- Suspend their HRW licence
- Cancel their HRW licence
- Not renew their HRW licence
- Order to undergo re-assessment

New equipment

An employer must provide ***Internal training, supervision, instruction and or information*** before an operator can work with a new type of equipment or crane.

Health and safety

Employers have an obligation to ensure the health and safety of all workers by

- Providing and maintain safe plant and equipment
- Providing and maintaining a work environment without risks to health and safety
- Providing information, training, instruction or supervision for work to be undertaken safely
- Providing and maintaining safe work systems and or procedures

Duty of Care requirements

Ensure you meet duty of care requirements

- Take reasonable care for own health and safety
- Take reasonable care for the health and safety of others who may be affected by your actions
- Comply with anything your employer does to meet WHS/OHS requirements
- Do not interfere or misuse anything provided in a workplace for WHS/OHS

Ground conditions

Most suitable ground conditions to set up a mobile crane.

- Hard rock
- Shale rock
- Sandstone
- Compacted gravel with up to 20% sand

Soil type	Bearing Capacity (approx.) t/m^2
Hard rock	200
Shale rock and sandstone	80
Compacted gravel	40
Compacted sand	20
Asphalt	20
Stiff clay (dry)	20
Soft clay (dry)	10
Loose sand	10
Wet clay	Less than 10

Assess ground conditions

Always ***consult a competent person (Engineer)*** to assess ground conditions including the bearing pressure value of soil.

Ground bearing capacity

You need to consider, the ground bearing capacity, for the type of ground you intend to set up on in order to ***ensure crane stability***

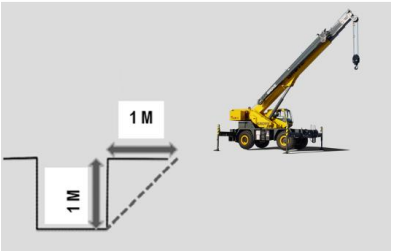
Operating surface suitability

Before setting up a mobile crane on a concrete slab, check to ensure the ***concrete*** *slab* ***is able to support the crane and the load***, this can be done by ***checking with a competent person (engineer) or checking the engineering report***

Trench or excavated ground

It is dangerous to set up any part of a crane including the wheels or outriggers near to a trench or recently excavated ground.
The trench or ground could subside, it could cave in (collapse).

When setting up a crane near a trench excavation- Leave at least a ***horizontal distance equal to the depth of the excavation from any form of support.***



Lifting capacity

For crane lifting / rated capacity, always refer to

- Manufacturer specifications
- Marked labels on crane
- Operators' manual
- Load chart

Crane hook & rated capacity

Identifying the rated capacity of the crane hook

- Stamped on hook
- Marked on hook

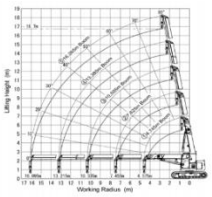
Documented lifting procedures

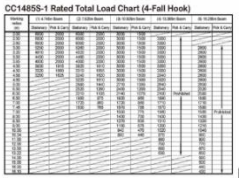
Certain activities will require detailed and documented lifting procedures

- Multiple crane lifts
- Erection of tower cranes
- Tilt-up panel jobs
- Working near live overhead power lines
- Heavy lifts where maximum capacity may be approached
- Lifting large pressure vessels or tanks

Signs, labels and load charts

You must ensure all signs, labels and load charts are in place and can be read easily, this is ***to ensure the operator is aware of the crane capacity and limitations.***

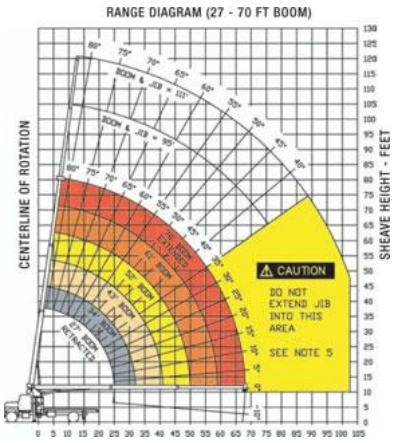




Load chart

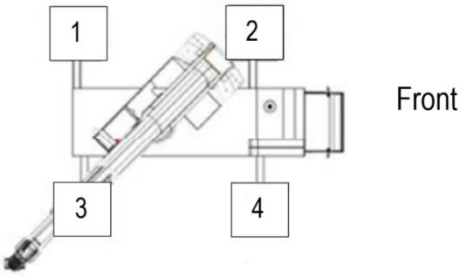
Types of information found in a load chart.

- Hook block weight
- Rated capacity of crane
- Boom angle
- Crane operating radius
- Rubber ratings
- Jib/fly ratings



Crane configuration

The outrigger that has the most load if the crane has no load on the boom although is fitted with a counterweight. ***2 as the highest load is on the outrigger under the counterweight***



Path of movement

Considerations when working out the appropriate path of movement for a crane and load

- Size of Load
- Surface conditions
- Obstructions
- Power lines
- Radius of the boom

Determine appropriate paths

Always assess and determine appropriate paths for operating and moving loads by

- Inspecting and determining at planning stage
- Consulting with other personnel involved in the lift or working in the immediate area
- Following workplace procedures

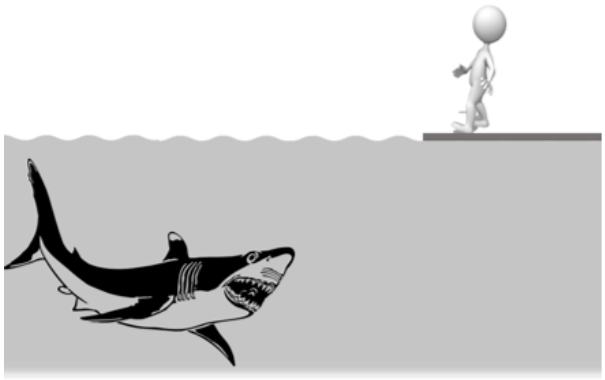
Safe operations

Never raise or lower the boom or a load over people.

It may cause an ***unsafe serious risk, injury or death if load falls.***

Hazard vs Risk

A **Hazard** is *something that has the potential to harm you*



A **Risk** is *the possibility of harm (death, injury or illness) from exposure to a hazard*

Risk and control

Person near a crane boom that is being retracted or extended

Risk

Person may be *struck or crushed by load or crane during movement*

Control

Exclusion zones to ensure personnel are clear of hazardous zones

Risk and the control

Risk and control for personnel near the structure of a crane during operations

Risk

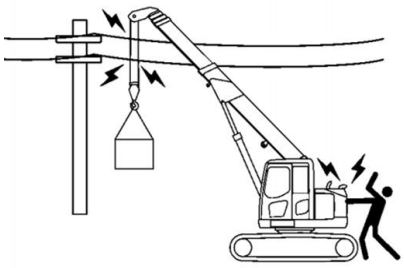
Struck and or crushed by load or crane movement

Control

Exclusion zones to ensure personnel are clear of hazardous zones

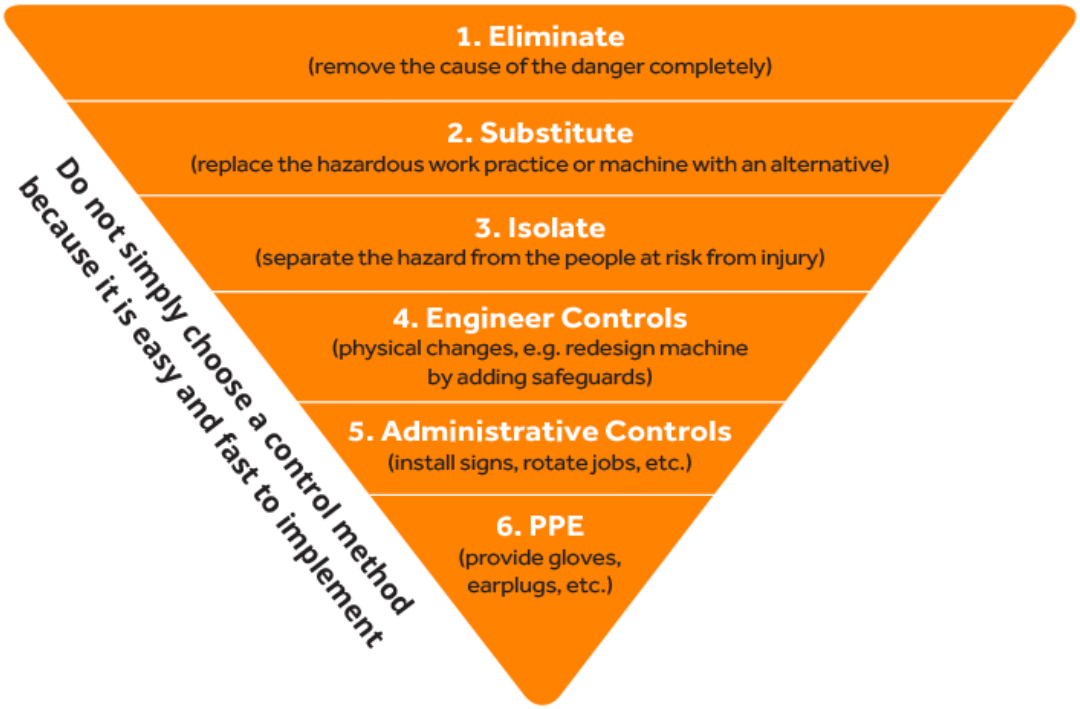
Potential hazards

Potential hazards which could affect crane operations.



- Power lines
- Trees
- Buildings
- Service pipes
- Weather - wind, rain, lightning
- Traffic (e.g. pedestrians, vehicles, plant), shape & size or type of load to be moved
- Ground stability (e.g. ground condition, recently filled trenches, slopes)
- Load bearing ability (e.g. temporary formwork)
- Site specific hazard or dangerous materials

Hierarchy of Hazard Control



Discuss workplace hazards

Always speak with personnel about workplace hazards prior to starting work.

- Safety officer
- Supervisor
- Engineer
- Health and safety representative
- Other personnel

Speaking with personnel about workplace hazards before working will help you to

- Identify any workplace specific hazards or ground conditions
- Ensure workplace policies and or procedures are followed
- Identify hazards and controls

Location of power lines

Tiger tails, safety warning / danger signs and ***power line marker balls*** are the most effective ways to identify the location of power lines on your worksite.

Controls

Controls to help ensure the safety of personnel

- Exclusion Zones - Pedestrian / Vehicle
- Barriers
- Warning signs

Operating at night

When operating the crane at night you must have ***adequate lighting over the whole work area*** to ensure safety.

Determine powerline voltage

To determine the voltage of powerlines that you are working near, contact the ***authority responsible for the electric lines.***

Power lines

If you need to work closer than the prescribed safe operating distances for power lines

- Contact the relevant authority for an access permit
- Ask to have the power disconnected or appropriately insulated by contacting relevant supply authority
- Use a qualified safety observer (spotter) and observe legislation within your state or territory

Minimum safe operating distances

Minimum safe distances you must maintain when working near electric lines.

QLD

Up to 132,000 volts = **3m**

Between 132,000 and 330,000 volts = **6m**

Above 330,000 volts = **8m**

NSW

Up to 132KV = 3m

132kv to 330kv = 6m

More than 330kv= 8m

NT

50v to 1000v = ...3m

1000v to 33000v = ……3m

33000v to 66000v = ….4m

66000v to 132000v =...5m

VIC

Distribution lines(poles)

- *No closer than* 3m with a qualified/registered spotter
- Without spotter 6.4m

Transmission Lines (Towers)

- *No closer than* 8m with a qualified/registered spotter
- Without spotter 10m

WA

Less than 33KV = 3m

Over 33kv = 6m

Over 133kv = 8m

SA/TAS/ACT

- Distribution lines - 6.4m or 3.0m with a qualified spotter
- Transmission lines - 10m or 8m with a qualified spotter

If your crane touches overhead electric lines

- Warn others to stay away
- Attempt to break contact
- Stop the crane
- Stay in the crane if safe. If not safe, jump clear and shuffle at least 8m away with both feet together
- Call for help
- Secure area
- Report power authority and safety regulator
- Have crane checked before next use

Signage requirements & positioning

The ***traffic control plan*** will provide guidance on signage and isolation requirements for pedestrian and vehicles.

Local authorities

Always check with local authorities before setting up a slewing mobile crane in an active street

- For any Permits
- If there are any exclusion zones
- Traffic control

Communication methods

Always decide the best communication methods for the task ***at the pre-start meeting or planning stage with lifting personnel.***

Check communication equipment

Always check your communication equipment is operational before the task.

Crane workbox

When using a crane workbox, the person dogging the load should be positioned ***in the workbox where they are able to safely observe and direct crane movements***.

Fall prevention & fall arrest equipment

Fall prevention and fall arrest equipment is required at ***2m or higher.***

Requirements or procedures

Always ensure requirements or procedures for a specific work area are met by

- Confirming task requirements
- Working in accordance to the lift plan and workplace procedures
- Following safe work method statements

Details on the safe use of slings

Information that will supply details on the safe use and care sof lings

- Australian standards
- Manufacturer specifications

Communication methods

Communication methods a dogger/rigger uses to direct the crane operator

- Hand signals
- Whistle or buzzer signals
- Two-way radio

Hand signals when crane operator is in direct view of the dogger

Whistle signal when the load is in sight of the dogger or out of sight of the crane operator

Two-way radio – When the dogger is not always in view of the crane operator.

When whistle signals cannot be heard or confused with other signals (multiple cranes operating)

When more efficient to use.

Maintain communications

Maintaining communications with workplace personnel will help to

- To ensure the lift plan is understood clearly
- To ensure the lift plan meets the site requirements and workplace procedures

Check your risk controls

Always check your risk controls for identified hazards ***before you commence any work, or as soon as a hazard is identified.***

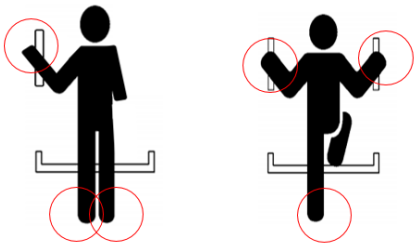
Out of service, danger or safety tags

Tags may be removed ***when the crane is deemed safe to use by a competent person and only when they remove the tag.***

3 points of contact

Use 3 points of contact when climbing on and off the crane, this means having two hands and one foot or two feet and one hand in contact with the crane at all times.

Always access a crane according to manufacturer requirements and safe work procedures.



Pre-start checks

Pre-start checks before operating a slewing mobile crane.

- Structural damage to boom or jib
- Wire ropes and anchorage
- Winch drums
- Inspect outrigger and packing
- Fluid leaks
- Track or tyre condition
- No danger tags in place
- Log book in place and correct

Load moment indicator

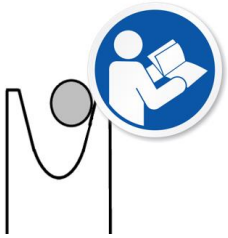
A load moment indicator must tested for accuracy by ***picking up a known weight according to the manufacturer specifications***

Operating on tyres

Where a manufacturer specifies that a crane can be operated on tyres, the tyre pressure must be checked ***to ensure the cranes stability is not affected.***

FSWR

Refer to the ***Manufacturer specifications*** when establishing how much wire rope should sit in the base of the sheave groove.



Sheave groove

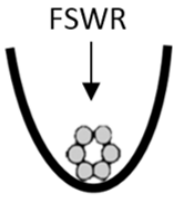
Refer to the ***Manufactures specifications*** to establish the correct depth of the sheave groove in regards to the diameter of the wire rope being used.

Winding rope around the drum

When a hook or block is positioned as low as possible, you must keep ***at least three full turns*** of wire rope on the winch drum ***or as specified by manufacturer.***

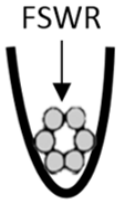
Sheave groove too large

If the sheave groove is too large for the wire rope diameter, then *a* ***wire rope will flatten or deform causing failure.***



Sheave groove too small

If the sheave groove is too small for the wire rope diameter, then *a* ***wire rope will pinch and abrade causing failure.***



Crane boom or structure defects

Visual clues may indicate boom or structure defects

- Cracks in the boom, structure or welds
- Bends or twists in the boom or structure
- Rust from welds or joints
- Loose or missing bolts
- Flaking paint

Sheave defects

Inspect the sheave for defects

- Worn sheaves pins, hinge pin wear
- Excessive wear in the groove of a sheave
- Cracks
- Deformed or out of shape
- Twisted
- Damaged

Procedure for reporting any faults

Reporting any faults during a pre-start check

- Stop
- Do not use
- Tag out of service
- Report to supervisor
- Record in maintenance log

Lifting equipment defect

10% wear and tear or more on lifting equipment including shackles deems them not safe to use.

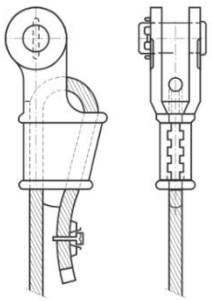
Dead end of a rope

The tail projection of the dead end of a rope used with a wedge socket is fitted with

- Clamp and bolts

or

- Bulldog grip or Bulldog clamp

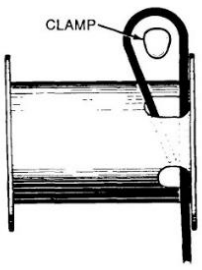


This is to ***visually indicate rope slip*** through the wedge socket.

Fasten hoist rope to winch drum

Secure / fix the tail of the hoist rope to the winch drum

- Clamp and bolts
- Socket and wedge



Prepare for on road travel

Prepare and check the slewing mobile crane for on road travel.

- Check tyre pressure
- Secure outriggers
- Retract and lower the boom
- Unlock suspension for road travel
- Disengage drives to hydraulic pumps booms and outriggers and putting the controls in the off position

Check crane and equipment

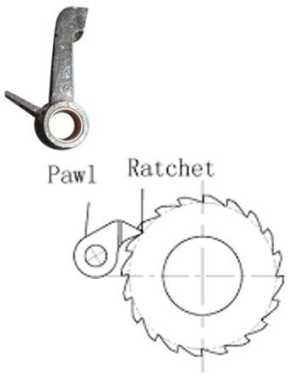
Always check a crane and related equipment before use to ensure crane and equipment are safe to use.

Boom pawl engaged the ratchet

If the boom pawl has engaged the ratchet, the boom brakes may be creeping due to moisture, brake condition or mechanical failure

Luff pawl

When the luff pawl is engaged you should luff down carefully to prevent breakage or the pawl being bent by the impact as it engages the ratchet



Crawler crane

The track pressure changes when a crawler crane has a load on the hook with the jib luffing down as

- It moves towards the load

  OR
- Applies pressure on the front of the track

Checks after positioning a crane

Checks should be done after positioning a crane and before levelling and packing

- Safe working radius
- Access and egress
- Engineer report
- Clearance from obstacles or hazards
- Crane can reach tasks

Operations on rubber tyres

Where a manufacturer permits a crane to operate on rubber tyres, always ***check the load chart and manufacturer specifications*** to find information regarding the most stable side to lift over.

Level indicator

A ***level indicator*** is the tool used to ensure crane is set up level.

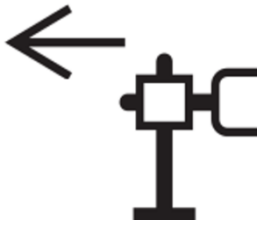
Maintain stability

When pigstying with hardwood packing, the second layer is placed at ***90 degrees*** to the first layer.

Minimum area of packing needed

You must work out the minimum area of packing needed under each outrigger to ***ensure the stability of the crane and load***

Partially extended outriggers



A mobile crane can be operated with partially extended outriggers, only ***when manufacturer specifications or instructions permit.***

Stability

If one or more of the outriggers start to sink

- Stop operations and reassess
- Stop operations and relocate the crane to more stable position

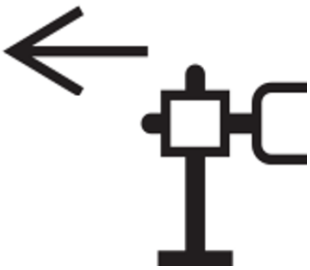
Maintain stability

Elements must be considered to ensure stability throughout crane operations

- Ensure correct setup of crane as per manufacturer guidelines
- Operating the crane below rated wind speed
- Operating crane below max rated capacity
- Monitor crane computer for any changes
- Eliminate potential shock loading

Extend outriggers

A crane can ***tip over or become unstable during lifting operations*** if outriggers are not fully extended.



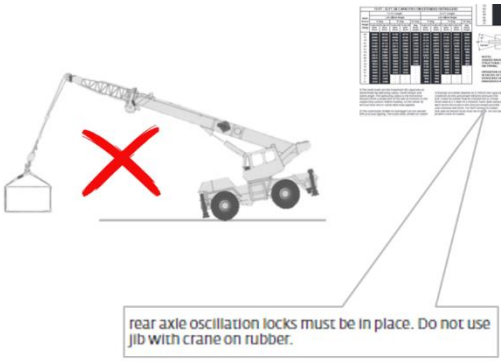
Counterweight requirements

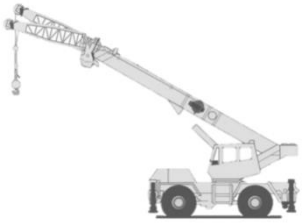
Refer to the *manufacturer's specifications* when setting up and securing counterweights

Crane specifications

To establish if a crane can be travelled with a load on the fly jib always refer to

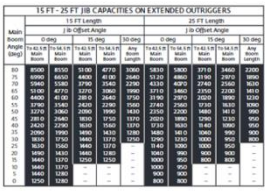
- Manufacturer's specifications
- Load chart





Offset fly jib

When a fly jib is offset at 15 degrees it has a ***lower rated*** load capacity than at 0 degrees.



15 FT - 25 FT JIB CAPACITIES ON EXTENDED OUTRIGGERS

Main Boom Angle (deg)	15 FT Length						25 FT Length					
	Jib Offset Angle						Jib Offset Angle					
	0 deg		15 deg		30 deg		0 deg		15 deg		30 deg	
	To 42.5 ft Main Boom	To 54.5 ft Main Boom	To 42.5 ft Main Boom	To 54.5 ft Main Boom	Any Length		To 42.5 ft Main Boom	To 54.5 ft Main Boom	To 42.5 ft Main Boom	To 54.5 ft Main Boom	Any Length	
80	8500	8550	5100	4770	3060		5830	5800	3710	3460	2200	
75	6990	6650	4400	4130	2640		5320	4860	3190	2970	1890	
70	5940	5580	3790	3540	2290		4530	4070	2740	2560	1630	
65	5100	4770	3270	3060	1990		3710	3460	2350	2200	1410	
60	4400	4100	2810	2640	1710		3190	2970	2020	1890	1210	
55	3790	3540	2420	2290	1560		2740	2560	1710	1630	1080	
50	3270	3060	2090	1990	1410		2350	2200	1480	1410	990	
45	2810	2640	1810	1710	1370		2020	1890	1290	1230	950	
40	2420	2290	1610	1560	1370		1710	1630	1140	1090	950	
35	2090	1990	1480	1410	1280		1480	1410	1060	990	900	
30	1810	1710	1440	1370	1250		1290	1230	1000	950	800	
25	1610	1560	1440	1370	-		1140	1090	1000	950	-	
20	1490	1410	1440	1280	-		1060	990	900	900	-	
15	1440	1370	1250	1250	-		1000	950	800	800	-	
10	1440	1370	-	-	-		1000	950	-	-	-	
5	1440	1280	-	-	-		900	900	-	-	-	
0	1250	1280	-	-	-		800	800	-	-	-	

Crane operational start-up checks

- Check brakes
- Check warning lights work
- Check communications equipment work
- Check slew radius
- Check travel limits
- Check steering

Crawler under body checks

Conduct underbody checks before operating a crawler crane

Example

- Check idlers/rollers
- Check drivers free from leaks
- Tracks complete and undamaged
- Tracks drive sprockets

Crane interference

Report to your ***supervisor*** if you find any faults or indication that someone has interfered with the crane.

Check crane and equipment

Always check the crane and equipment and test it to its full range of operations before commencing work this will ***ensure it is safe to use and functioning correctly.***

Motion limiting device

A motion limiting device is used to prevent physical damage to the crane or part of the crane due to movement of the crane or part of the crane past its designed range of motion

Log book

Make checks of a crane log book

Examples

- The logbook applies to the crane
- Crane repairs & defect rectification signed off
- Daily safety checks have been carried out and signed off

Weather

It will be potentially hazardous to operate a crane rated to a safe wind speed of 39km/h on Monday and Saturday due to lightning, rain and strong wind.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
17°/13°	17°/13°	18°/12°	18°/12°	20°/8°	15°/8°
Wind South at 42km/h	Wind North at 15km/h	Wind North at 15km/h	Wind North at 25km/h	Wind North at 30km/h	Wind South at 41km/h

High UV exposure

Control the risk associated with high UV exposure

- Wear appropriate sun protection & clothing including a hat
- Drink plenty of water
- Take breaks
- Plan to work in lower UV rated times or days if possible

Risks of operating a crane in windy conditions

- Load swing
- Load spin
- Damage to crane
- Crane instability

Maximum wind velocity

You can locate the maximum wind velocity for the slewing mobile crane.

- Manufacturer specifications
- On the Crane
- Load chart
- Operator manual

Wind load

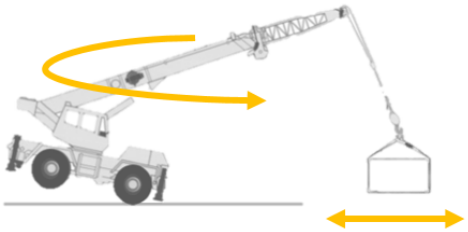
Positioning the boom or jib into wind could be hazardous, the *boom can be pushed back onto crane causing crane damage or overturn the crane*

Wind load

Wind load results from wind acting on the crane and the load being lifted.

Dynamic force

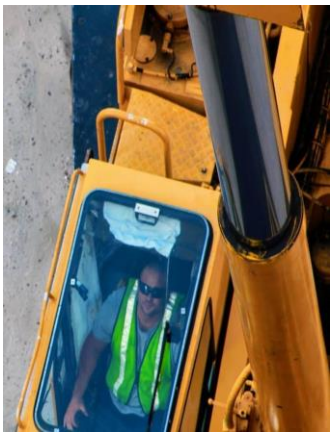
A dynamic force is caused by movements of the crane and on the load being lifted.



Consideration-Set up in restricted space

- Access (will the crane fit safely)
- The need for a spotter
- Can outriggers be fully extended
- Can crane be operated in accordance with manufacturer specifications?
- Can boom be slewed safely?
- Can the load be accessed, slung and landed safely?
- Counterweight swing zone

Setting up in close proximity to buildings



Considerations

- Boom set up to slew away from building
- Building protection
- Screens for building windows or facade
- Wind load increase next to buildings
- Counterweight swing zone
- Slew brake
- Travel brake (wheels)
- Ground conditions

Hazardous operation

If an outrigger pad sinks during a crane task

- Lower load if safe and appropriate to do so
- Stop operations
- Assess the situation and seek assistance
- Report to appropriate person

Load is affected by wind

If the load is affected by wind and deemed unsafe, take action and ***lower the load to the ground***

Approximate weight

Load Material	Approximate Weight per m^3	Load Material	Approximate Weight per m^3
Aluminium	2700kg / m^3	Granite	2600kg / m^3
Bricks	4000kg / 1000	Gypsum	2300kg / m^3
Bronze	8500kg / m^3	Iron, ore	5400kg / m^3
Cast Iron	7200kg / m^3	Lead	11200kg / m^3
Cement (25 bags)	1000kg	Steel	7850kg / m^3
Clay	1900kg / m^3	Poly Pipe	1100kg / m^3
Coal	864kg / m^3	Timber (hardwood)	1100kg / m^3
Concrete	2400kg / m^3	Timber (soft)	600kg / m^3
Copper	9000kg / m^3	Water	1000kg / m^3 1L = 1kg
Earth	1900kg / m^3		

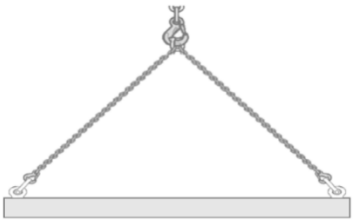
Determine load weight

Methods to determine load weight

- Weighbridge notes
- Weigh the load
- Estimate by calculation
- Delivery docket

Load factors

1.41 is the load factor for an included sling angle of 90°



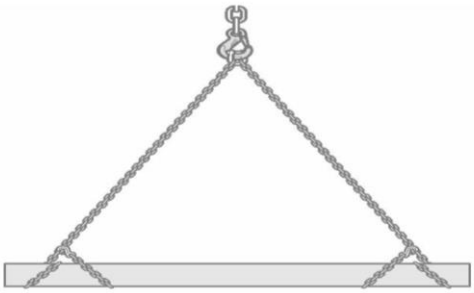
Calculate the load factor

Calculate the load factor for an included sling angle of 60°

Note: remember to account for choke factor

1·73 x 0·75

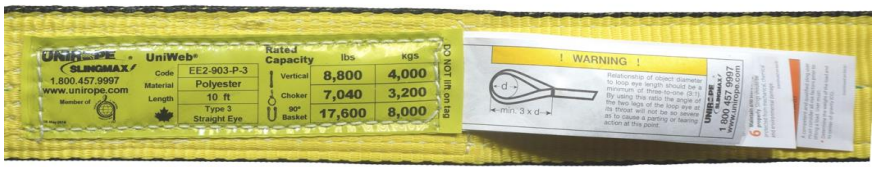
= 1·29



Synthetic sling tag information

Types of information displayed on a synthetic sling tag

- Working load limit (WLL)
- Reeve factors
- Angle factors
- Manufacturer
- Conditions of use



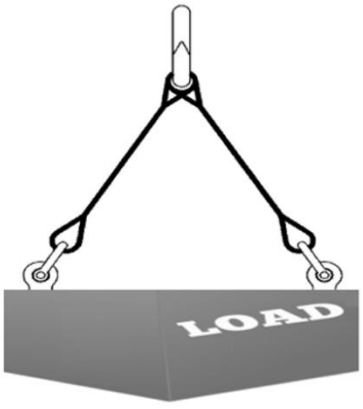
Calculate derated (reduced capacity)

Information that will help you to calculate the derated (reduced capacity) of lifting equipment

- Slinging techniques
- Sling tags
- Angle factor

Using eyebolts with a two-legged sling

Correct method of use when using eyebolts with a two-legged sling.



Lifting equipment

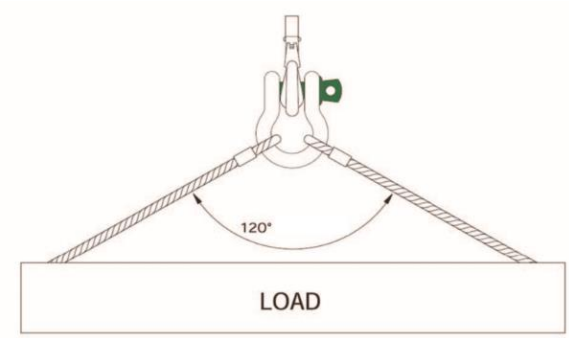
A ***brick or block cage*** is used to lift a pallet of bricks.

Plate or lifting clamps are used to lift steel plates.

To lift a gas bottle, use a ***bottle cage fitted with restraints***.

Maximum allowable angle

120 degrees is the maximum allowable angle between two legs of a straight sling lift.



Pre-lift considerations

Considerations prior to using two slings to lift a load

- Weight of load
- Slinging method
- Reeve factors
- Angle factors
- Size or length of the load

Bow shackle

A ***Bow shackle*** can be used to lift a load using multiple slings.

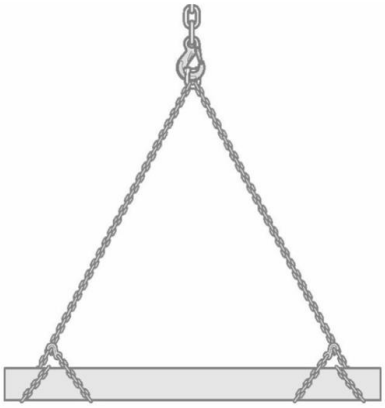
Chain grades

Meaning of letters stamped on chain slings

- **T =** Grade 80
- **V =** Grade 100

Ensure the reeves will not slip

Double wrap the reeve or choke to ensure the reeves will not slip, when choking a chain sling around a steel beam at an angle of 60°.



Chain shortener

WARNING

Shortening clutches MUST be used correctly with the load bearing chain always leading out from the bottom of the clutch.

Inspect lifting equipment

Inspecting lifting equipment prior to commencing tasks will help ***to ensure all equipment is safe to use and suitable for the task.***

Shackle markings

Information must be clearly and permanently marked on a shackle body

Examples include

- WLL
- Manufacturer's identification
- Quality Grade, as M or 4, or S or 6
- Identification marking to correlate the shackle to the test certificate

Check shackles

Checks should be made to shackles before any lifting use occurs

Examples include

- WLL markings are legible
- The pin is the correct type
- The threads of the pin and body are undamaged
- The body and or pin are not distorted

Landing pipe

Appropriate chocks on either side should be placed against concrete pipe at the landing area to prevent it from rolling away

Check the load landing area

Checks should be made to the load landing area

- Stability of the surface
- Capacity of the surface to bear the load weight
- Safe access
- Exclusion zones (isolation of pedestrian and or traffic)

Pre-lift considerations

Considerations before performing lifts

- Weight and size of loads
- Access and egress
- Obstructions
- Working radius
- Capacity of the crane

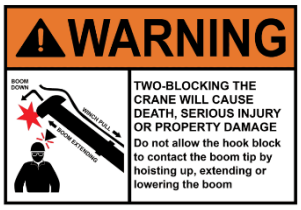
Load weight & responsibility

As the crane operator you have a responsibility ***to ensure the load is within the capacity of the crane.***

Hoist limit

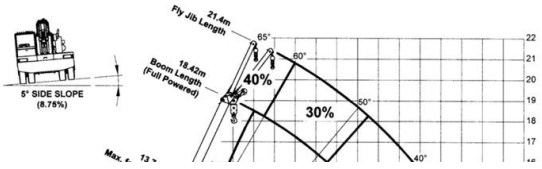
The hoist limit not be exceeded

- The hook/block assembly can be dragged into the head sheaves causing damage
- Two blocking
- Damaged rope causing loss of hook and load

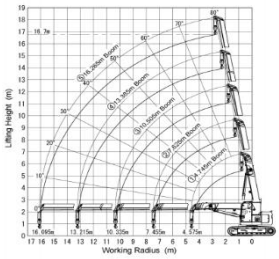


Side slope deration

Side slope deration should be applied where *any deviation from firm level ground will require rated capacity to be reduced as per manufacturer specifications.*



Longer operating radius



Always ***use the longer operating radius*** in the event a load chart fails to show the exact working radius. This is because ***the increased operating radius reduces the rated capacity.***

Before lifting a load, ensure you will remain within the cranes operating radius, be aware of

- Weight of the load
- Load chart specifications
- Boom/jib deflection
- Lifting attachments

Position the lifting hook

Follow direction from the dogman to position a lifting hook over the loads centre of gravity

This will avoid

- Load swing
- Dragging or snigging the load
- Instability of load and crane

Test lift

To ensure a load with a strange centre of gravity has been slung correctly, conduct a ***test lift.***

Safe use of lifting gear

- Always ensure the load weight does not exceed limitations of lifting gear
- Connect lifting gear to the load according to the lifting plan
- Follow safe work procedures and equipment manufacturer specifications

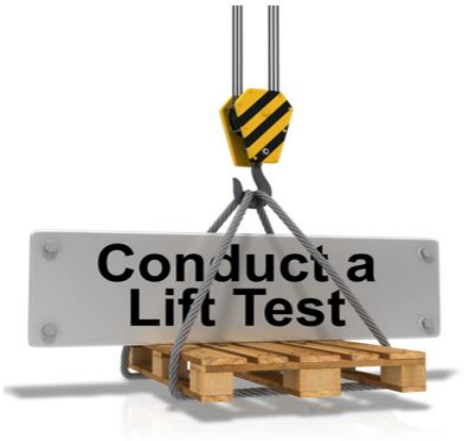
Mobiling a load

Always refer to ***manufacturer instructions*** and the ***load chart*** to establish how the crane should be configured to mobile a load.

Test lift

The purpose of a test lift is to ensure

- Stability of the load
- Security of the load
- Check stability of crane
- To confirm load weight
- All crane equipment is functioning properly



Test lift Issues

Issues doing a test lift

- Stop & Lower the load
- Correct the problem
- Test lift again
- Do not proceed until rectified

Tagline

A tagline is used to ***assist safe landing and control of a load.***

A ***dry non-conductive rope*** or ***dry natural rope*** tagline must be used when working near overhead powerline.

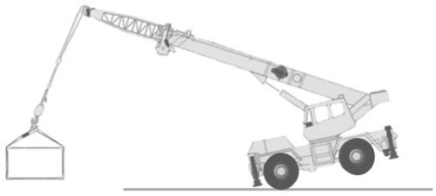
16mm is the smallest diameter tagline that may be used when working near overhead powerlines.

Temporary rope connections

Temporary rope connections when connecting a tagline to a load.

- Clove hitch
- Rolling hitch
- Single sheet bend
- Bowline

Transfer loads



Fast or jerky movements will affect the crane while shifting loads, especially when operating close to maximum capacity

- The load will swing, increasing the operating radius to a dangerous length
- Could result in carrier instability or structural damage to the crane

Drag or snig

Never drag or snig a load, as it could

- Over load the crane
- Damage the lifting gear
- Damage the load
- Affect crane stability

Constantly monitor

You must constantly monitor movement of the load ***to identify any new hazards and implement controls as new risks arise***.

Travelling up a slope

Considerations before travelling up a slope with a suspended load

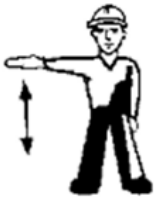
- Load swing
- Rated capacity
- Have the load face up the incline/uphill
- Ground conditions
- Keep the load as close to the ground as safely possible
- Keep boom to minimum radius and angle
- Travel at minimum speed of travel
- Operating according to crane load chart
- Operate according to manufacturer instruction regarding slope angle and direction of travel

Slewing the boom

Slewing boom from front to back of the vehicle will considerably vary the ***crane capacity***.

Always refer to the ***load chart*** prior to operations to ensure you understand these effects.

Hand signals

	Stop	1 short
	Hoist up	2-short
	Boom up	3-short
	Boom down	4-short
	Hoist down	1 long
	Slew left	1 long 1 short
	Slew right	1 long 2-short
	Telescope out	1 long 3-short
	Telescope in	1 long 4-short

Signals

When a signal is unclear during crane operations

- Stop all crane movements
- Ask for clarification of the last signal

Reduce upward boom/jib movement

Reduce upward boom/jib movement after landing a heavy load from the hook.

Release the load slowly and smoothly and, as load is released, lower the boom / jib slightly to compensate for the upward movement.

Packing or dunnage

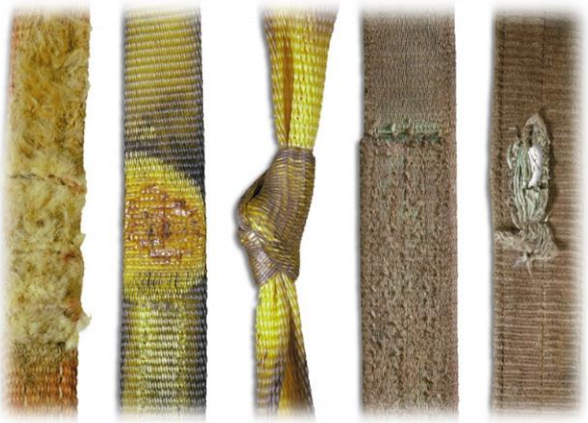
Use packing or dunnage when landing loads

- To protect the load
- To allow safe removal of lifting gear
- To prevent damage to lifting gear
- Stabilise load

Synthetic slings defects

Inspecting synthetic slings for defects

- Damage to stitching
- Damage to sleeve
- Chemical damage
- Cuts or tears
- No label
- Wear and tear
- Burns



Flexible steel-wire rope defects

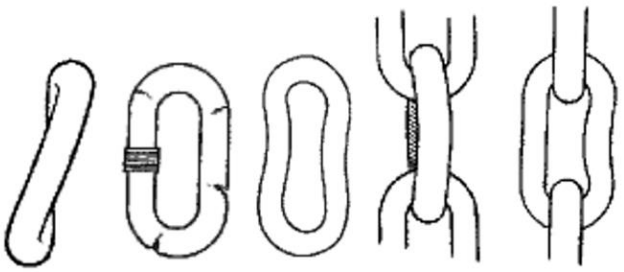
- Kinks
- Stretching
- Abrasion
- Crushed
- Knotting
- Corrosion
- Damage to eye

Shackle defects

- Cracked
- Stretch
- Bent or distorted
- Wrong pin or damaged pin

Chain defects

- Twisted
- Cracked
- Stretch
- Kinked
- Knotted
- No rated capacity tags
- Gouged or cut more than 10% of original diameter



Defects to lifting equipment or gear

- Isolate defective equipment
- Tag out
- Report and record

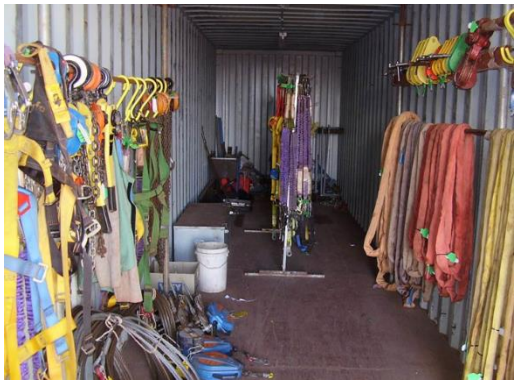
Stowing or securing

When stowing or securing the boom / jib or any lifting equipment

- Secure correctly according to manufacturer requirements
- Locking pins as required

Store synthetic lifting equipment

- Away from direct sunlight
- Away from chemicals
- Away from machinery
- Clean
- Dry
- Well ventilated
- According to manufacturer specifications



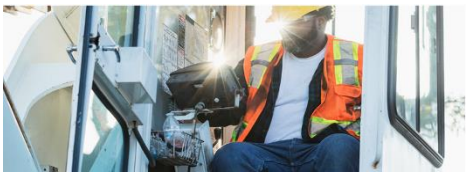
Store and secure

Where a fly jib or counterweight is removed for storage

- Securing according to manufacturer requirements
- Exclusion zones and barricading to prevent any damage occurring when stored on site at ground level

Shutdown

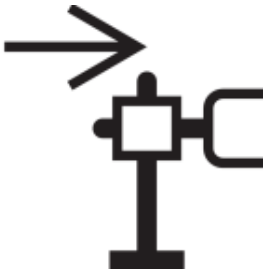
Motion locks and brakes used when shutting down or leaving the crane unattended, according to manufacturer and workplace requirements.



Stow outriggers

Stow outriggers when shutting down a crane

- Retract all outriggers
- Lock them in with the correct pins
- According to manufacturer / workplace requirements



Leaving a crane unattended

Take required steps when leaving a crane unattended

Example

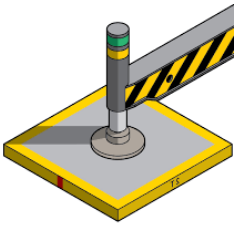
- Ensure no load is left on the hook
- Raise hook to safe height
- Retract boom (if applicable)
- Crane secured
- Access to crane restricted

Shutdown

Never leave a load hanging on a hook after shutdown, ***it may lower, swing or fall.***

Stow plates or packing

Plates or packing should be *cleaned, secured and stored on the carrier or in a designated storage area*.



Shutdown checks

Conduct checks when shutting down & packing up a crane

Example

- Check exclusion is in place
- Check hook raised and clear of obstructions
- Boom retracted and lowered
- Check hoist brake applied
- Relevant controls set to neutral
- Lock and secure access to cabin
- Isolator switch off and secure
- Log book

Conduct the following calculations using the **Grove GMK 5130-2** and **Kobelco CKE2500** crane Load charts provided separately

Calculation questions

Q1. Using the information provided, **find the maximum ground pressure applied to the ground when lifting directly above an outrigger**. The answer is to be rounded up to the nearest 0.1m²

- A **Grove GMK 5130-2** will be setup on a civil construction site in an area which has undergone earthworks
- The standard crane mass is **60 t** when configured with **8.5 t counterweight**, 11/18 m bi-fold swing-away and **20 t** hook block
- The crane will lift a **50t tonne** load and will be reconfigured with **23.5 t** counterweight and **75 t** hook block
- Each outrigger has timbers **1.8 m** X **1.8 m**

Standard CM = 60 t including 8·5 tonne C/W and 20 t (325kg) hook block

Reconfigured crane

CW = 23·5 t

85 t hook block = 850kg

CM = 60 t – 8·5 + 23·5 – 0·325 t + 0·850 = 75·525 tonnes

Load to lift (L) = 50 tonnes

Timber in contact with ground = 1·8 x 1·8 = 3·24 m^2

Pressure applied (complete in tonnes and meters)

0·65 x (CM+L) ÷ area (L x W) = Round up

(L x W) = 1·8 x 1·8

0·65 x (75·525 + 50) ÷ 3·24m^2 = Round up

0·65 x 125·525 ÷ 3·24m^2 = Round up

81·591 ÷ 3·24 m^2 = 25·182 Round up

Answer = 25·2 tonnes/m^2

Calculation questions

Q2. The Grove crane used in question 1 will now be relocated to an area of the site where it will be setup on loose sand.

What is the minimum outrigger pad area to prevent the crane sinking in the loose sand when using the same crane and outrigger configuration in question 1?

Note: student to (round up 0.1m)

Ground type	Max permissible ground pressure, Pmax (Tonnes per $m^{2)}$
Hard rock	200
Shale rock and sandstone	80
Compacted gravel (with up to 20% sand)	40
Asphalt	20
Compacted sand	20
Stiff clay (dry)	20
Soft clay (dry)	10
Loose sand	10
Wet clay	Less than 10

Complete in tonnes and meters

0·65 x (CM+L) ÷ BP = √ Round up

0·65 x (75·525 + 50) ÷ 10 = √ Round up

0·65 x 125·525 T ÷ 10 = √ Round up

81·591 ÷ 10 = √ Round up

= √ 8·159 = 2·856 Round up

L x W = 2·9 x 2·9m

Calculation questions

Q3. You need to setup the **Grove GMK 5130-2** crane on a new site

- The crane will be configured with **23.5t** counterweight, **3 parts of line** and 20t hook block
- You will extend the boom **50.71m**

a) What is the counterweight configuration required to achieve counterweight of 23.5tonnes?

Quantity	Counterweight	Weight (T)
1	1	2·5
1	2	2·5
3	3	5 x 3
1	6	2·5
1	11	1
	Total	23·5

b) What is the maximum and minimum working radius in this boom configuration?

Minimum 7 m

Maximum 46 m

c) What is the maximum speed the hook block can be raised in the above boom configuration?

120 m/min (Load chart) ÷ 3 parts of line = 40m/min

Answer 40m/min

Calculation questions

Q4. Use the crane configuration from the **previous question (3)**

- A new site rule requires that the load chart is derated to 80%
- You are required to lift a **5-tonne** load at a **7m radius** and slew 120 degrees and lower the load at a **14m radius**
- **65 kg** rigging will be used

a) When you consider the new site requirement, what percentage of the site's allowable capacity will the crane operate at when the load is lifted to the 7m radius?

Note: Complete in tonnes, answer to be rounded up to 2 decimal places

Total Load

Load = 5 T

+ Hook = 0·325 T

+ Rig = 0·065 T

= 5·39 T

(Total load ÷ Reduced capacity) x 100 = round up

Reduced capacity = (SWL -20%) = 16-20%

(5·39 ÷ 12·8 T) x 100 = round up

0·421 X 100 = round up

= 42·1%

b) What percentage of the site's allowable capacity is the crane at when the load is lifted to the 14m radius?

Note: Answer to be rounded up to 2 decimal places

Total Load

Load = 5 T

+ Hook = 0·325 T

+ Rig = 0·065 T

= 5·39 T

(Total load ÷ Reduced capacity) x 100 = round up

Reduced capacity = (SWL -20%) = 15·8-20%

(5·39 ÷ 12·64 T) x 100 = round up

0·426 X 100 = round up

= 42·6%

Calculation questions

Q5. You will use a **Kobelco CKE2500** crawler crane

- The crane has been configured in **luffing jib configuration**
- **Boom** length **27.4m**
- **Jib** length **33.5m**

a) What are the most flexible configurations for the boom and jib arrangements?

Boom arrangements (Lengths)					
7·6	3·0	6·1	6·1	3·6	1·0

Jib arrangements (Lengths)					
9·1	3·0	3·0	3·0	6·1	9·1

b) What is the total counterweight required for the configuration?

Total counterweight = Counterweight + Carbody

Weight = 90 + 24 = 114 tonnes

c) How many falls of rope should be on the hook block?

4

Calculation questions

Q6: Use the **Kobelco** crawler crane configuration from the **previous question (5)**

- You are required to pick up a 5-tonne load (including rigging) at a **24m radius** and place it at a **45m radius**

a) What main boom angle is required to pick up the load vertically? *88°*

b) Can you complete the operation in one single lift?

Yes, set boom angle to 88° to allow operator to reach a radius of 24m to pick the load up

Luff the main boom down to a main boom angle of 63°

Luff down the fly jib to place the load at a radius of 45m

Calculation questions

Q7: A drum must be lifted using two vertical flexible steel wire ropes (FSWR) connected to a spreader bar

- The weight of the load is 1500kg evenly distributed between the lifting points

What is the minimum Working Load Limit necessary for each directly loaded sling leg?

Show all your calculations

1500kg ÷ 2 = 750kg

Working Load Limit for each sling is 750kg or 0·75 tonne

Using the load chart provided, what is the minimum diameter sling required when the slings are directly loaded?

Working Load Limit for each sling is 750kg or 0·75 tonne

Closest tonne 0·85 tonne

The minimum diameter sling needed is 10mm

WIRE ROPE DIA. mm	DIRECT LOAD	CHOKE HITCH		DIRECT LOAD			CHOKE HITCH				BASKET HITCH							
		ROUND LOAD	RECTANGULAR LOAD				ROUND LOAD		OTHER THAN ROUND LOAD		ROUND LOAD				OTHER THAN ROUND LOAD			
							SINGLE WRAP	DOUBLE WRAP	SINGLE WRAP	DOUBLE WRAP								
				0°- 60°	90°	120°	0° - 45°	0° - 60°	0° - 45°	0° - 60°	0°	60°	90°	120°	0°	60°	90°	120°
MAXIMUM WORKING LOAD LIMITS IN TONNES OF 1000kg for **1570 GRADE FIBRE CORE** - GALVANISED																		
8	0.55	0.41	0.27	0.94	0.77	0.55	0.71	0.48	1.09	0.94	0.77	0.55	0.55	0.48	0.39	0.27		
9	0.69	0.52	0.34	1.19	0.97	0.69	0.90	0.60	1.38	1.19	0.97	0.69	0.69	0.60	0.49	0.34		
10	0.85	0.64	0.43	1.47	1.20	0.85	1.11	0.74	1.70	1.47	1.20	0.85	0.85	0.74	0.61	0.43		
11	1.03	0.77	0.52	1.78	1.45	1.03	1.34	0.90	2.1	1.78	1.45	1.03	1.03	0.90	0.73	0.52		
12	1.23	0.92	0.61	2.1	1.73	1.23	1.59	1.07	2.5	2.1	1.73	1.23	1.23	1.07	0.87	0.61		
13	1.44	1.08	0.72	2.5	2.0	1.44	1.87	1.25	2.9	2.5	2.0	1.44	1.44	1.25	1.02	0.72		
14	1.67	1.25	0.83	2.9	2.4	1.67	2.2	1.45	3.3	2.9	2.4	1.67	1.67	1.45	1.19	0.83		
16	2.2	1.64	1.09	3.8	3.1	2.2	2.8	1.90	4.4	3.8	3.1	2.2	2.2	1.90	1.55	1.09		
18	2.8	2.1	1.38	4.8	3.9	2.8	3.6	2.4	5.5	4.8	3.9	2.8	2.8	2.4	1.97	1.38		
20	3.4	2.6	1.70	5.9	4.8	3.4	4.4	3.0	6.8	5.9	4.8	3.4	3.4	3.0	2.4	1.70		
22	4.1	3.1	2.1	7.1	5.8	4.1	5.4	3.6	8.3	7.1	5.8	4.1	4.1	3.6	2.9	2.1		
24	4.9	3.7	2.5	8.5	6.9	4.9	6.4	4.3	9.8	8.5	6.9	4.9	4.9	4.3	3.5	2.5		
26	5.8	4.3	2.9	10.0	8.1	5.8	7.5	5.0	11.5	10.0	8.1	5.8	5.8	5.0	4.1	2.9		
28	6.7	5.0	3.3	11.6	9.4	6.7	8.7	5.8	13.4	11.6	9.4	6.7	6.7	5.8	4.7	3.3		
32	8.7	6.5	4.4	15.1	12.3	8.7	11.3	7.6	17.4	15.1	12.3	8.7	8.7	7.6	6.2	4.4		

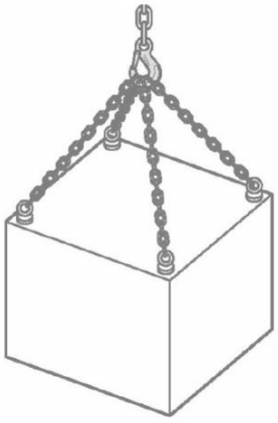
Calculation questions

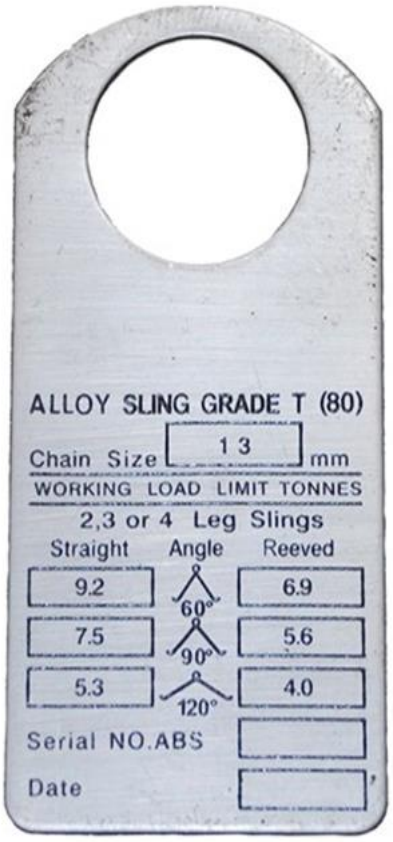
Q8: The task requires a container with lifting lugs to be relocated

- The angle between diagonally opposite sling legs is 60 degrees
- Grade T (80) chain slings will be used
- The chain diameter is 13mm

Using the sling tag provided, what is the maximum load weight that can be lifted?

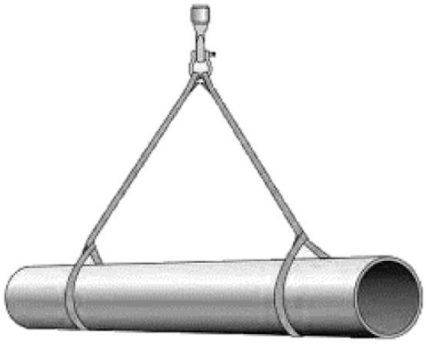
9·2t or 9200kg





Calculation questions

Q9: The task requires a cast iron pipe to be lifted



- Two synthetic slings are used to lift cast iron pipe
- The angle between slings is 60 degrees
- Pipe weight is 104kg per lineal metre
- The pipe length is 6.5m

What is the total pipe weight?

6·5 X 104kg = 676kg or 0·676tonne

Using the pipe weight, what sling is the minimum required?

Choked at 60 degrees

Pipe weight of 676kg or 0·676tonne

Closest tonne 1·3 tonne

The minimum sling size needed is 1 tonne

For educational purposes only

L = LOAD FACTOR		L = 1.0	L = 0.8	L = 2.0	L = 1.7	L = 1.4	L = 1.0	L = 1.7	L = 1.38
Colour	W.L.L Tonnes	VERTICAL W.L.L Tonnes	CHOKE W.L.L Tonnes	BASKET W.L.L Tonnes	60° W.L.L Tonnes	90° W.L.L Tonnes	120° W.L.L Tonnes	60° W.L.L Tonnes	60° CHOKE W.L.L Tonnes
Violet	1.0	1.0	0.8	2.0	1.7	1.4	1.0	1.7	1.3
Green	2.0	2.0	1.6	4.0	3.4	2.8	2.0	3.4	2.7
Yellow	3.0	3.0	2.4	6.0	5.1	4.2	3.0	5.1	4.1
Grey	4.0	4.0	3.2	8.0	6.9	5.6	4.0	6.9	5.5
Red	5.0	5.0	4.0	10.0	8.6	7.0	5.0	8.6	6.9
Brown	6.0	6.0	4.8	12.0	10.3	8.4	6.0	10.3	8.2
Blue	8.0	8.0	6.4	16.0	13.8	11.2	8.0	13.8	11.0
Orange	10.0	10.0	8.0	20.0	17.3	14.1	10.0	17.3	13.8

THE END.