INTEGRAL SKILLS

SLEW CRANE – UP TO 60T

TLILIC0023 Licence to operate a slewing mobile crane (up to 60 tonnes)

LEARNER GUIDE

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MODIFICATION HISTORY

Version	Date	Nature of Amendment
1	3 Oct 19	Creation
1	30 July 20	Correction Crane and Equipment checks: Drums.
2	29 Mar 22	Updated UOC and changes to Pre-requisites

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INTRODUCTION

This training course is based on the National High Risk Licence Unit of Competence TLILIC0023 Licence to operate a slewing mobile crane (up to 60 tonnes).

This unit specifies the skills and knowledge required to perform slewing mobile crane (up to 60 tonne) activities safely in accordance with all relevant legislative requirements. Competence in this unit, does not in itself result in a High Risk Work Licence (HRWL).

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.

This unit requires a person operating a slewing mobile crane with an MRC up to 60 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 licencing class as detailed in this unit.

HIGH RISK WORK LICENCE REQUIREMENTS

Any person who is undertaking training for a High Risk Work (HRW) licence according to the Work Health & Safety (WHS) Regulations must be currently enrolled in a course of HRW training and being supervised at the workplace by a person with a current HRW licence for the work.

The holder of a HRW licence is responsible for taking reasonable care and not adversely affecting the health and safety of other people while performing the HRW.

Once you pass your assessment you will have 60 days to apply for your licence. You must renew your licence within 12 months of its expiry otherwise:

- Your licence can't be renewed.
- You need to repeat the course and re-apply for your licence.
- You need to enrol in the course again and be supervised by somebody who has a current licence for the same class.

You can still do high risk work without a licence as long as:

- You are enrolled in a high risk course for the class, and
- You are being supervised by a person who has a HRW licence for the same class.

Any licensed worker must take reasonable steps to make sure the way they work does not impact on the safety of themselves or any other worker. This is their legal duty of care. Failing to work safely can result in the health and safety regulator:

- Suspending or cancelling your licence.
- Refusing to renew your licence.
- Ordering that you are reassessed to ensure you are competent.

Your employer might ask you for evidence that you have a high risk licence before you start any high risk work. You can show them:

- Your licence.
- Proof from the training company that you have passed your assessment.
- Proof that you are currently completing a course for high risk work.

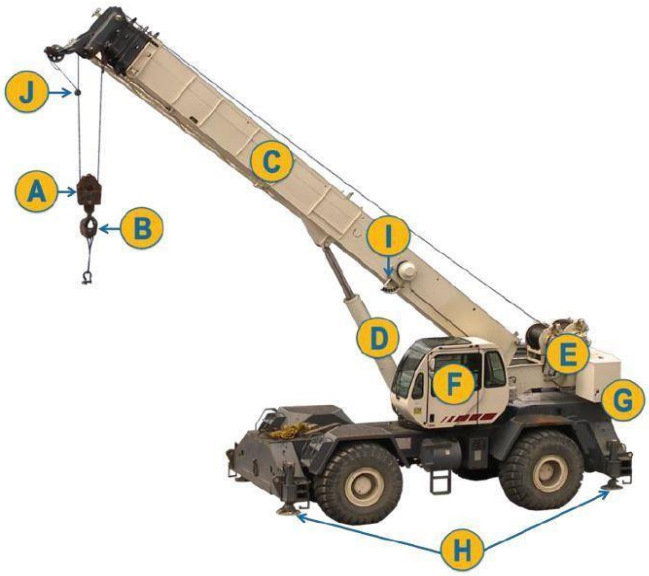
WHAT IS A SLEWING MOBILE CRANE

A slewing mobile crane is a crane with a boom or jib that is capable of being slewed.

Figure 1 – Mobile Slewing Cranes (example)

PARTS OF A SLEWING MOBILE CRANE

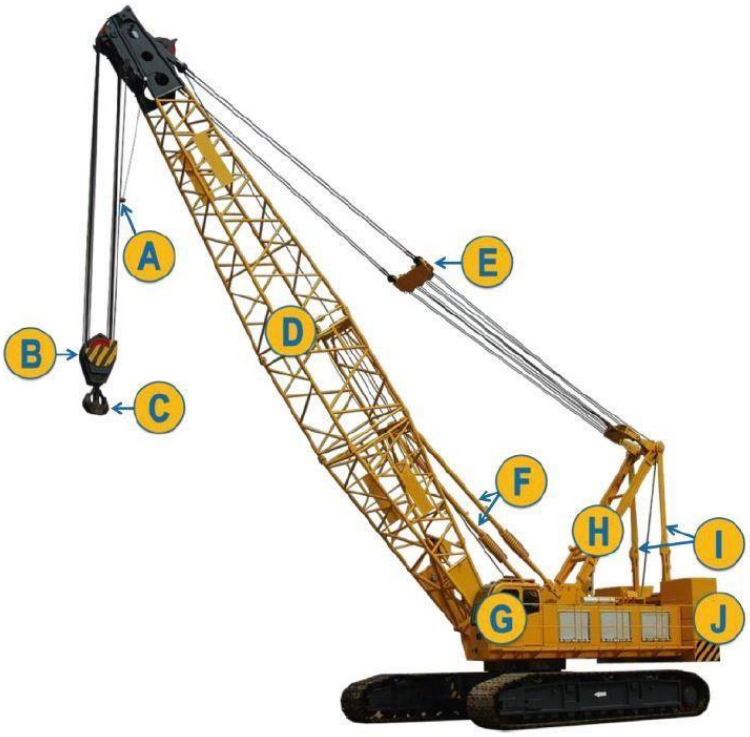
Each slewing mobile crane is different. Always refer to the manufactures information before conducting and crane operations. The following diagram shows the general parts of a slewing mobile crane.



A. Hook Block
B. Hook
C. Boom
D. Hydraulic Ram
E. Rope Drum
F. Cabin
G. Counterweight
H. Outriggers
I. Boom Angle Indicator
J. Hoist Limit-Safety Devices

Figure 2 – Slewing Cranes Parts (example)

The following diagram shows the general parts of a lattice boom type slewing mobile crane.



A. Hoist Limit-Safety Device
B. Hook Block
C. Hook
D. Boom
E. Equaliser Bridle
F. Boom Stops
G. Cabin
H. A Frame
I. Back Hitch
J. Counterweight

Figure 3 – Slewing Cranes Parts (example)

SLEWING CRANE MOVEMENTS

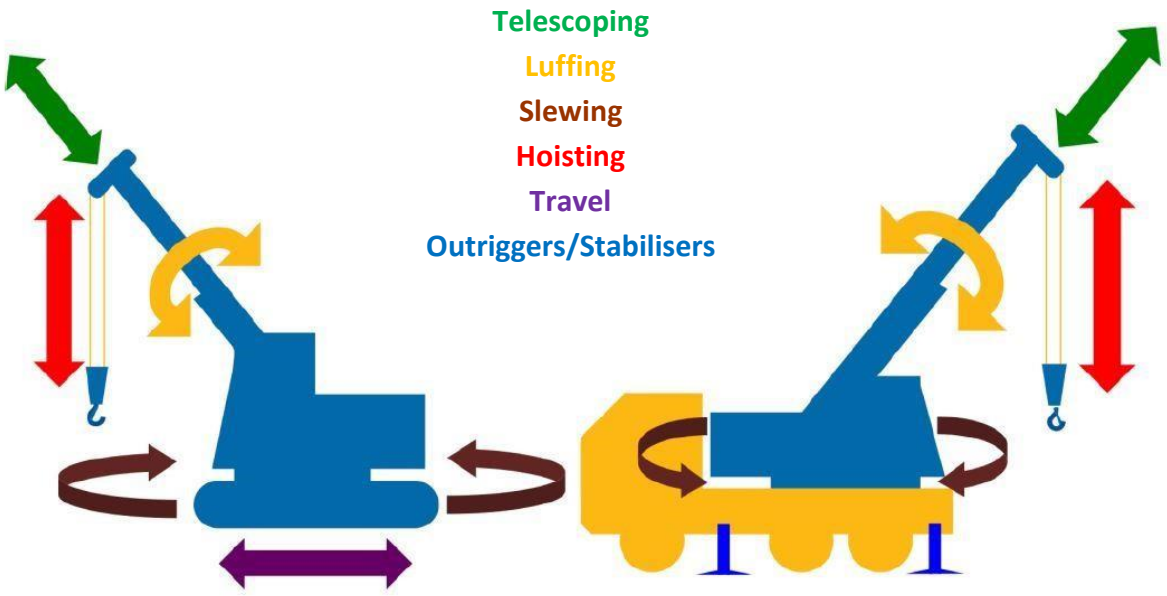


Figure 4 – Mobile Slewing Cranes Movements

- Telescoping – the extension and retraction movement of a hydraulic type boom.
- Luffing – the up and down movement of the boom.
- Hoisting – the raising and lowering of the hook block using the hoist rope.
- Slewing – the circular movement of the boom (usually includes the cabin).
- Travelling – mobiling the crane with a load.
- Outriggers/Stabilises – operated to level and stabilise the crane

WORKING SAFELY

You must follow all safety rules and instructions when performing any work. If you are not sure about what you should do, ask your supervisor. Do not perform any work that you are not qualified and authorised to perform.

COMPLIANCE DOCUMENTATION

Before you begin your task ensure that you access the relevant documentation and plan your work. Part of this is identifying any compliance documentation.

Compliance documentation is essential to all aspects of operations on every worksite.
From work instructions through to quality and environmental requirements, compliance documentation sets out the what, when, how and who of everything that needs to be done in the safest, most effective way.

Interpretation of compliance documentation will allow you to make the right decisions for each situation or task. Interpretation means understanding what is required of you and how you are expected to perform the tasks.

Applying documentation involves following all instructions given by these documents at all times – they are designed to keep you safe.

Statements containing the words “must”, “shall” or “will” are often used within these documents to indicate that there are mandatory (legally must be applied) requirements. Each project site will have different compliance documentation that must be referred to.

This may include:

- Legislative, organisation and site requirements and procedures.
- Occupational Health and Safety (OHS)/ Workplace Health and Safety (WHS) legislation, codes of practice and guidance material.
- Manufacturers’ guidelines and specifications.
- Australian Standards.
- Codes of Practice.
- Equal Employment Opportunity and Disability Discrimination legislation.
- Licence and certification requirements.
- Internal permit control systems.
- Mechanical and electrical isolation processes.
- Company policy and permit control systems.

Compliance documentation may be provided by:

- WHS authorities and ASCC/NWHSC.
- Environment Protection Authority (EPA).
- Employment and workplace relations legislation.

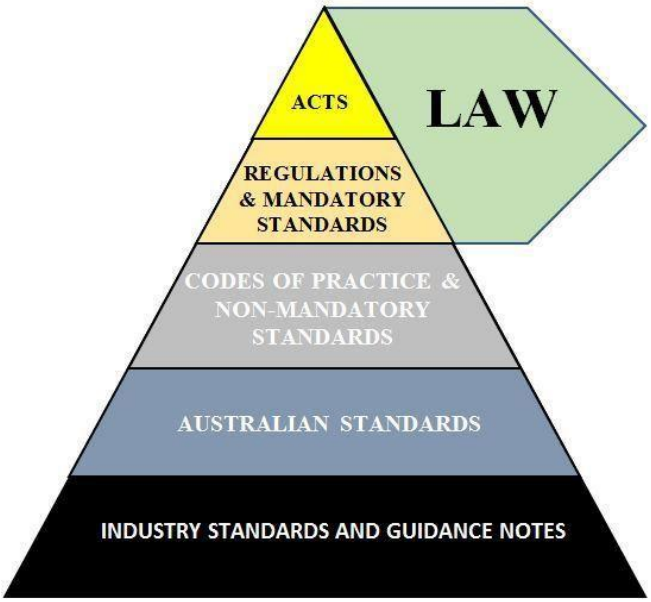


Figure 5 – Legislation Hierarchy

WHS LEGISLATION AND REGULATIONS

Workplace Health and Safety (WHS) are laws and guidelines to help keep your workplace safe.

These can be broken down into four main types:

- Acts
- Regulations.
- Codes of Practice.
- Australian Standards.

Legislation/Acts	Acts of Parliament and laws to protect the health, safety and welfare of people at work. For example the Work Health and Safety Act (the WHS Act) 2011.
Regulations	More details or information on particular parts of the Act.
Codes of Practice/Compliance Codes	Practical instructions on how to meet the terms of the law. For example the Code of Practice "Managing the Risk of Falls in Workplaces".
Australian Standards	The minimum levels of performance or quality for a hazard, work process or product. For example AS/NZS 1891

Table 1 – Legislation Descriptions

HARMONISATION OF WORKPLACE HEALTH & SAFETY LEGISLATION

In 2011, Safe Work Australia developed a single set of WHS laws to be implemented across Australia. These are known as 'model' laws. For the model WHS laws to become legally binding, the Commonwealth, states and territories must separately implement them as their own laws.

The model WHS laws include:

- The model WHS Act.
- The model WHS Regulations.
- Model Codes of Practice.

These elements are supported by the National compliance and enforcement policy, which sets out principles of how WHS regulators monitor and enforce compliance with their jurisdictions' WHS laws. WHS regulators in the Commonwealth and in each state and territory are responsible for regulating and enforcing the laws in their jurisdictions.

The model WHS laws have been implemented in the Australian Capital Territory, New South Wales, the Northern Territory, Queensland, South Australia, Tasmania and the Commonwealth. Some jurisdictions have made minor variations to make sure the legislation is consistent with their relevant drafting protocols and other laws and processes.

MODEL WHS ACT

The Model WHS Act forms the basis of the WHS Acts that have been implemented in most jurisdictions across Australia.

The main object of the Act is to provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces. It does this by:

- Protecting workers and other persons from harm by requiring duty holders to eliminate or minimise risk.
- Providing for fair and effective representation, consultation and cooperation.
- Encouraging unions and employer organisations to take a constructive role in promoting improvements in WHS practices.
- Promoting the provision of advice, information, education and training for WHS.
- Securing compliance with the Act through effective and appropriate compliance and enforcement measures.
- Ensuring appropriate scrutiny and review of actions taken by persons with powers or functions under the Act.
- Providing a framework for continuous improvement.
- Maintaining and strengthening national harmonisation of WHS laws and facilitating a consistent national approach to WHS.

CODES OF PRACTICE AND AUSTRALIAN STANDARDS

Model Codes of Practice are practical guides to achieving the standards of health and safety required under the model WHS Act and Regulations.

To have legal effect in a jurisdiction, a model Code of Practice must be approved as a code of practice there. To determine if a model Code of Practice has been approved in a particular jurisdiction, check with your local WHS regulator.

An approved code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in a jurisdiction's WHS Act and Regulations. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks that may arise. Health and safety duties require you to consider all risks associated with work, not only those risk that regulation and codes of practice exist for.

While approved codes of practice are not law, they are admissible in court proceedings. Courts may regard an approved code of practice as evidence of what is known about a hazard, risk or control and may rely on the relevant code to determine what is reasonably practicable in the circumstances.

DUTY OF CARE

Employers/PCBUs, self-employed persons, persons in control of the workplace, Supervisors, Designers, Manufacturers, Suppliers, Workers and Inspectors, have a legal responsibility under duty of care to do everything reasonably practicable to protect others from harm by complying with safe work practices. This includes activities that require licences, tickets or certificates of competency or any other relevant state and territory OHS/WHS requirements.

ORGANISATIONAL AND SITE REQUIREMENTS

During your site induction your employer will tell you where to find the compliance documentation relevant to your site and duties.

All work needs to be conducted in accordance with organisational policies and procedures and site requirements.

Procedures exist to ensure that all work is completed in a way that is safe and achieves the required outcomes efficiently without causing harm.

MANUFACTURES GUIDELINES AND SPECIFICATIONS

These requirements will be documented in operator's manuals, equipment specifications and work instructions.

Designers and manufacturers have a responsibility to ensure that structures, plant and equipment meet strict criteria for the safe operation and protection of workers while also meeting relevant environmental standards.

ENVIRONMENTAL PROTECTION REQUIREMENTS

When performing dogging operations, you should always aim to reduce environmental risk and waste.

To do this you need to:

- Identify the environmental management plans, requirements and constraints.
- Confirm any aspect of the environmental protection requirements that may be unclear.
- Apply and comply with the project environmental protection requirements of all tasks undertaken in and around the worksite.

Some environmental requirements are:

- Organisational/project environmental management plans – These outline the steps and processes required to prevent or minimise harm to the environment due to work operations.
- Waste/clean-up management – This covers the disposal of site waste materials and rubbish as well as the recycling and re-use of waste materials.
- Water quality protection – This can include methods for directing run-off away from the stormwater system or other waterways. Spills of chemicals or other materials and the use of spill kits are included.
- Noise, vibration and dust management – These plans aim to limit or avoid creating noise pollution and vibration for people in and around the worksite. Dust management includes the use of screens, tarpaulins and other dust suppression methods.

The NSW Environmental Protection Authority (EPA) can investigate and issue fines for sites that do not meet the state and federal environmental protection arrangements that are in place.

If you have concerns, questions or queries about the exact requirements you must meet, you should speak to your supervisor, the site environmental officer or contact the NSW EPA for more information.

PLAN THE JOB

It is important that you are aware of all the requirements relating to your work, before you start. Therefore to work safely we need to plan the job by taking into consideration:

- Any compliance documentation.
- Job or task requirements.
- Priorities or sequencing.
- Site rules.
- Permits and procedures.
- Inspecting the work area (Layout, structures, equipment & environmental).
- Selection of appropriate equipment as per operational requirements.
- Identifying hazards/risks.
- Implementing hazard/risk treatments.
- Working in accordance with:
    - Procedures (site and equipment)
    - Regulations ○ Codes of practice ○ Australian Standards

Other areas that you should consider when planning dogging tasks should include:

- Communications are safe and adequate.
- Access and egress to and from the work area.
- Location and specifics of the task.
- Permits or licences required to carry out the work.
- Equipment required for the task.
- Availability of equipment for the task.
- Type, capacity and capability of the crane.
- Safe work procedures that need to be followed.
- The type, condition, size and configuration of the load that is being moved.
- Identification and description of the work site (e.g. site details).
- Assessment of conditions and hazards (e.g. hazard report).
- Identifying equipment defects (e.g. fault reports or isolation systems).
- Accessing diagrams or plans.
- Safety Data Sheets.
- Consignment notes (items and weights).

If unsure about your work/task requirements you may need to consult with:

- Supervisor.
- Site Safety Officer.
- Manufacture to ascertain limitations/specifications.

REVIEW TECHNICAL INFORMATION BEFORE YOU START

Before starting you need to make sure you obtain all the relevant technical information appropriate for your worksite. This will enable you to conduct your work in the safest and most efficient way. This may include:

- Identification and description of the work site (e.g. site details).
- Assessment of conditions and hazards (e.g. hazard report).
- Work requirements from work orders and supervisor instructions.
- Identifying equipment defects (e.g. fault reports or isolation systems).
- Accessing diagrams or plans.
- Safety Data Sheets.
- Consignment notes (items and weights).

IDENTIFY AND MANAGE HAZARDS

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

- A **RISK** is the chance of a hazard hurting you or somebody else or causing some damage.
- A **HAZARD** is the thing or situation that causes injury, harm or damage.

It is important that personnel/workers with the required relevant skills are involved in the risk identification process.

CONSULT WITH OTHER WORKERS ABOUT HAZARDS

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

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

These people may have information about site hazards. It is important to communicate with other personnel and safety officers before starting on a worksite to ensure that any workplace policies or site-specific procedures are followed.

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When looking for hazards ensure you look:

- **Above head height** - remember the load will be moving above your head.
- **At eye level** – look around to see if there is anything in the way of where you want to move the load.
- **On the ground (and below)** – Have a look at the ground conditions and think about where the load is being moved to. Will it support the weight of the load?

Common workplace hazards include:

- Ground Conditions:
  - Surface condition
  - Underground Services
  - Weight bearing ability
- Poor lighting.
- Overhead Hazards:
  - Electricity/Powerlines
  - Overhead service lines
  - Obstructions
  - Trees
- Surrounding Structures:
  - Buildings
  - Obstructions
- Traffic:
  - Pedestrians
  - Vehicles
  - Other plant
- Weather:
  - Wind
  - Lightning
  - Rain / Storms
- Site hazards:
  - Other workers
  - Equipment and machines
  - Facilities
  - Other equipment
- Other hazards:
  - Dangerous materials
  - Chainsaws
  - Pressure washers

- Tidal areas

Make a note of any hazard you identify in the area. Remember, a hazard can also be a situation so keep an eye on how the people around you are working too.

Each task/procedure/function needs to be evaluated for risks, as well as the work area where the work is being carried out.

You should also check records of injuries and incidents, safety tags and talk to other workers.

Safety Data Sheets (SDS) can be useful tools in identifying potential hazards so make sure you check the SDS documents for your site.

Talk to other workers, your manager, supervisor, team leader or health & safety representative to find out if the risk has already been addressed, and what techniques are available to you to resolve it.

If you find that there is no documentation or guideline in place to resolve an identified risk, you need to assess the risk and identify a feasible course of action to deal with it.

It is important that all records, policies and procedures are kept up to date so that the most relevant information is available and used.

CRANE SAFETY

The following should be observed when working with cranes:

- 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 ground can cause machine damage and injury.
- Derating of the crane capacity will be required when performing crane lifts; for example, in windy conditions or on soft and uneven ground. 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 no essential personnel away from the operating area.
- 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.
- Do not walk under or work on a raised load.
- Do not ride the load or on the crane hook.

CHECK THE PATH OF MEVEMENT

When planning your work check the path of movement for the crane and load for any obstructions. This is to make sure that you have identified all hazards in the path of movement and put effective control measures in place.

When checking the path of movement think about:

- The size (dimensions and mass) of the load.
- Dimensions of the crane.
- The suitability of the pickup and landing sites.
- Underground services.
- Communication arrangements with the dogger.
- Preventing pedestrians and workers accessing the pathway. If there is a need for spotters/observers.
- The distance and speed of travel and the direction of travel.
- Any obstructions:
    - Equipment and materials. ○
      Other vehicles, plant and people.
      ○ Buildings and other structures.
    - Overhead powerlines.

Always decide on the path of movement for a load during your planning, before you move the load.

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 45kph and wait until the wind reaches a safe working level. If possible, avoid lifting in windy conditions.

Consider for operating in windy conditions:

- Winds speeds are usually greater at higher levels than at ground level.
- High wind speed guts are common in windy conditions.
- Derate the crane capacity and lifting equipment to suit conditions.
- Maintain effective communications with all team members.
- Use restraining lines to limit any load swing.
- Avoid handling loads that have large wind catching surfaces.

COMMUNICATION REQUIREMENTS

As a crane operator you need to be able to communicate effectively with those around you while you work. This may include workers such as dogger's and riggers.

It is important that you are able to understand all the instructions necessary to use all relevant equipment safely.

This can include:

- Manufactures guidelines (instructions, specifications, checklists).
- Industry operating procedures.
- Workplace procedures (work instructions, operating procedures, checklists).

Select appropriate communication methods while planning and preparing for crane operations, before work is started.

Communication methods may take the form of:

- Verbal and non-verbal language.
- Listening.
- Questioning to confirm understanding.
- Written instructions.
- Signage.
- Making and interrupting hand signals.
- Bells, buzzer and whistle signals.
- Use of communication equipment such as fixed channel two-way radios.
- Appropriate worksite protocols.

Choosing the most appropriate communication method for the job will depend on the specific circumstances you may encounter during operations.

For instance, if the crane operator remains constantly in view of the person dogging the load then hand signals would be an effective communication method. If however the load is not always going to be in sight of the crane operator then whistle signals could be employed.

Fixed channel two-way radios can be used when they are going to prove more effective than other methods.

They are particularly useful when the operator is out of view of the load and whistle signals could not be heard or would prove confusing due to other crane operators in the area.

WORKING NEAR ELECTRICITY/POWERLINES

Working near powerlines can be dangerous if you are not careful.

It is vital that you are aware of the safe operating distances for different types of electricity/power lines and the steps you must take if the task requires you to work closer than these prescribed distances.

Generally, if you are required to work closer than the prescribed safe work distance you must:

- Contact the relevant local electrical authority for exemption.
- Have the electricity/power lines shut off (or insulated if this is not possible).
- Use a safety observer - A safety observer is a competent person who watches and guides plant and equipment around electricity/power lines. Check with each state authority for their safety observer requirements.

Distances vary depending on the voltage of the electricity/power lines. You should refer to the local electrical authority for information and advice to determine the voltage of electricity/power lines in your work area.

Figure 6 – Typical Powerlines

SA / TAS / ACT (AS2550.1)

In South Australia, Tasmania and the ACT, equipment must not be closer than the following distances to electric/power lines:

Electricity/Powerline Type	Distance
Distribution lines up to and including 133kV (usually poles)	6.4m or 3.0m with a qualified 'safety observer'
Transmission lines greater than 133kV (towers)	10m or 8m with a qualified 'safety observer'

VICTORIA

In Victoria the Framework for Undertaking Work Near Overhead and Underground Assets states that equipment must not be closer than the following distances to electricity/power lines:

Electricity/Powerline Type	Distance
Distribution lines up to and including 66kV (power poles)	6.4m or 3.0m with a qualified 'safety observer'
Transmission lines greater than 66kV (towers)	10m or 8m with a qualified 'safety observer'

NEW SOUTH WALES

In New South Wales, equipment operation may not be any closer than the following distances to electric/power lines:

Electricity/Powerline Type	Distance
Up to 132kV	3.0m
132kV up to 330kV	6.0m
More than 330kV	8.0m

To work closer than these distances requires authority from the relevant electrical authority and adherence to cl.64(2)(e) of the regulations.

QUEENSLAND

The Queensland Electrical Safety Regulation breaks down the distances in detail. Exclusion zones are broken down not only by size of electricity/power line but also by the competency level of the operator. This means that the requirements should be clarified with the electrical authority before work commences even if the distance appears to be outside the zones.

The Code of Practice gives the following minimum distances as guidance:

Electricity/Powerline Type	Distance
Up to 132kV	3.0m
132kV up to 330kV	6.0m
330kV to 500kV	8.0m

WESTERN AUSTRALIA

In Western Australia this falls under Regulation 3.64 from the OSH Regulations and states the following as the minimum distances:

Electricity/Powerline Type	Distance
Less than 33kV	3.0m
Over 33kV	6.0m
Over 133kV	8.0m

NORTHERN TERRITORY

In the Northern Territory safe electric/power line working distances falls under the Electricity Reform (Safety and Technical) Regulations. Table 2, Schedule 3 gives the following minimum distances:

Electricity/Powerline Type	Distance
Up to 33kV	1.5m
Above 33kV to 132kV	3.0m
Above 132kV to 275kV	4.0m
275kV to 330kV	6.0m
Above 330kV to 500kV	8.0m

Table 2 – Powerline clearance distances

TIGER TAILS

Tiger tails are used as a visual aid to identify the location of overhead electricity/power lines. It is important to note that tiger tails DO NOT insulate the electricity/power lines so exclusion zones and safe operating distances must still be maintained, even when tiger tails are present.

Figure 7 – Tiger Tails

RISK AMANGEMENT

Risk Management is the process of reducing or managing the risks when working with a hazard or in a hazardous situation and should take into consideration the context of the organisation and work site.

Risk Management must be conducted in accordance with:

- Legislative, organisational and site requirements/procedures.
- Australian Standards.
- Codes of Practice.
- Employment and workplace relations legislation.
- Equal employment opportunity and disability legislation.

Consultation, communication, monitoring and review should be planned for and carried out at every stage of the risk management process.

Identifying risks and hazards and establishing ways of controlling them usually includes talking to the people with knowledge of the situation, or who are directly affected by any action you may take.

Controlling a hazard should be a team effort and it's important that everybody not only has input, but knows what they need to do and how/if they need to change their work processes to suit.

Monitoring and review are an important part of the risk management process and should be planned for at every stage. Monitoring and review involves regular surveillance and checking and clearly identifying the responsibilities of those involved.

It is important that monitoring and review results are recorded, reported and stored for future reference.

PRE—WORK HAZARD ASSESSMENT E.G. SWMS/JSEA'S ETC

A Risk Assessment to identify hazards is to be undertaken prior to commencing work. Such Risk Assessments as an example may include:

- Personal Risk Assessments; ○ Take 5, and ○ SLAMS.
- Group Risk Assessments; ○ Safe Work Method Statements (SWMS), and ○ Job Safety and Environment Analysis (JSEA's).

SWMS/JSEA's may also have been used in the development of as Safe Work Procedures (SWP) and Standard Operating Procedures (SOP). They detail the steps required to carry out a task as well as how specific hazards and risks related to a task will be managed.

They fulfil a number of objectives:

- They outline a safe method of work for a specific job.
- They provide a documented set of steps / processes that workers must read and understand before starting the job.
- They assist in meeting legal responsibilities for the risk management process, hazard identification, risk assessment and risk control.
- They assist in effectively coordinating the work, the materials required, the time required and the people involved to achieve a safe and efficient outcome. They are a quality assurance tool.

How do you complete a SWMS/JSEA?

Each organisation will have different forms and documents to manage risk, some called SWMS, JSEA, JSA etc. The fundamental steps remain the same as follows:

- Break the job down into its basic steps.
- Identify the workplace hazards associated with each step.
- Identify controls to eliminate or control those hazards.

- Rate / rank the risk with the controls in place, this is called the residual risk.
- Once agreement to the hazards and risk ratings has been achieved, the residual risk must be as low as reasonably achievable.
- Each person signs the SWMS/JSEA acknowledging that they have understood its contents.
- Put controls in place.
- Proceed with job, monitoring the controls for effectiveness and looking for new hazards.

The SWMS/JSEA must be available for inspection at any given time and must be reviewed as conditions change.

RISK / HAZARD ASSESSMENT

Risk/Hazard Assessment has 2 stages:

(1) Risk/Hazard Analysis.

Risk analysis is used to determine the seriousness of a hazard based on how likely it is to happen and the consequences if it does happen. The risk level of each identified hazard should be worked out. Risk analysis comprises of 3 factors Likelihood, Consequence and Risk level.

Using a table similar to the one below, you can analyse how high the risk level is.

Likelihood	Consequence				
	Insignificant	**Minor** First Aid required	**Moderate** Medical attention and time off work	**Major** Long term illness or serious injury	**Severe** Kill or cause Permanent Disability or Illness
Almost certain	M	H	H	VH	VH
Likely	M	M	H	H	VH
Possible	L	M	H	H	VH
Unlikely	L	L	M	M	H
Rare	L	L	M	M	M

Table 3 – Likelihood vs Consequence Matrix

(2) Risk/Hazard Evaluation.

Risk evaluation is based upon the outcomes and results of the risk analysis.

Risk evaluation involves making decisions about:

- Have all the hazards been controlled.
- Is the residual risk acceptable.
- Is it safe to proceed.

Your evaluation should be used to determine how soon you should act to remove or control the hazard to achieve an acceptable level of risk.

You can do this using a table similar to the one shown below:

Risk Level	Action
Very High	Act immediately: The proposed task or process activity must not proceed. Steps must be taken to lower the risk level to as low as reasonably practicable using the hierarchy of risk controls.
High	Act today: The proposed activity can only proceed, provided that: 1. The risk level has been reduced to as low as reasonably practicable using the hierarchy of risk control. 2. The risk controls must include those identified in legislation, Australian Standards, Codes of Practice etc. 3. The risk assessment has been reviewed and approved by the Supervisor. 4. A Safe Working Procedure or Safe Work Method has been prepared. 5. The supervisor must review and document the effectiveness of the implemented risk controls.
Medium	Act this week: The proposed task or process can proceed, provided that: 1. The risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls. 2. The risk assessment has been reviewed and approved by the Supervisor. 3. A Safe Working Procedure or Safe Work Method has been prepared.
Low	Act this week: The proposed task or process can proceed, provided that: 1. The risk level has been reduced to as low as reasonably practicable using the hierarchy of risk controls. 2. The risk assessment has been reviewed and approved by the Supervisor. 3. A Safe Working Procedure or Safe Work Method has been prepared.

Table 4 – Hazard Evaluation Level example

Note: Any hazard with a residual risk level of high or very high should have further risk treatment measures (controls) in place to reduce the risk to an acceptable level. They will also require a higher level of approval in most cases and a higher level of risk management processes.

RISK/HAZARD TREATMENT

Once hazards have been identified, risk treatment options (controls) need to be considered and applied. Risk treatment involves selecting one or more controls to modify and reduce a risk and then implementing the control. Controls act as a barrier or layers preventing the unwanted event from happening. Every control has its limitations or holes in each layer and can be likened to a piece of Swiss cheese, the more layers / controls the more effective.

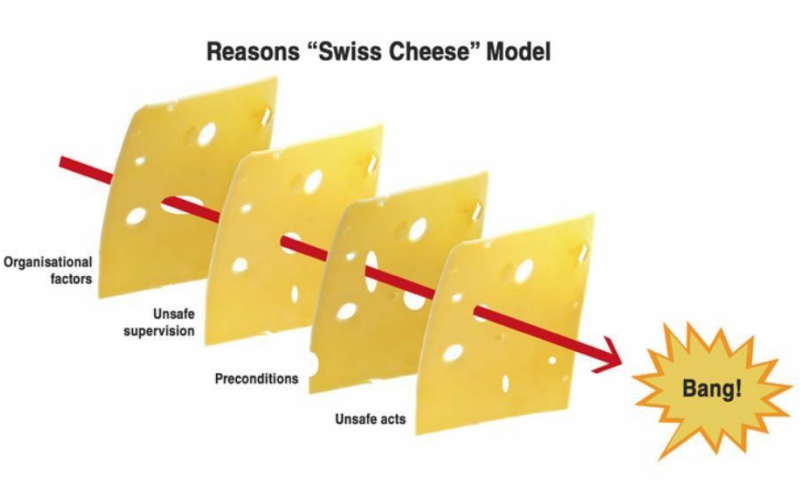


Figure 8 – "Swiss Cheese" model

HIERARCHY OF CONTROL

Control measures can be ranked from the highest level of protection and reliability to the lowest. The WHS Regulations require duty holders to work through this hierarchy to choose the control that most effectively eliminates or minimises the risk in the circumstances. This may involve a single control measure or a combination of two or more different controls.

The hierarchy of control is as follows:

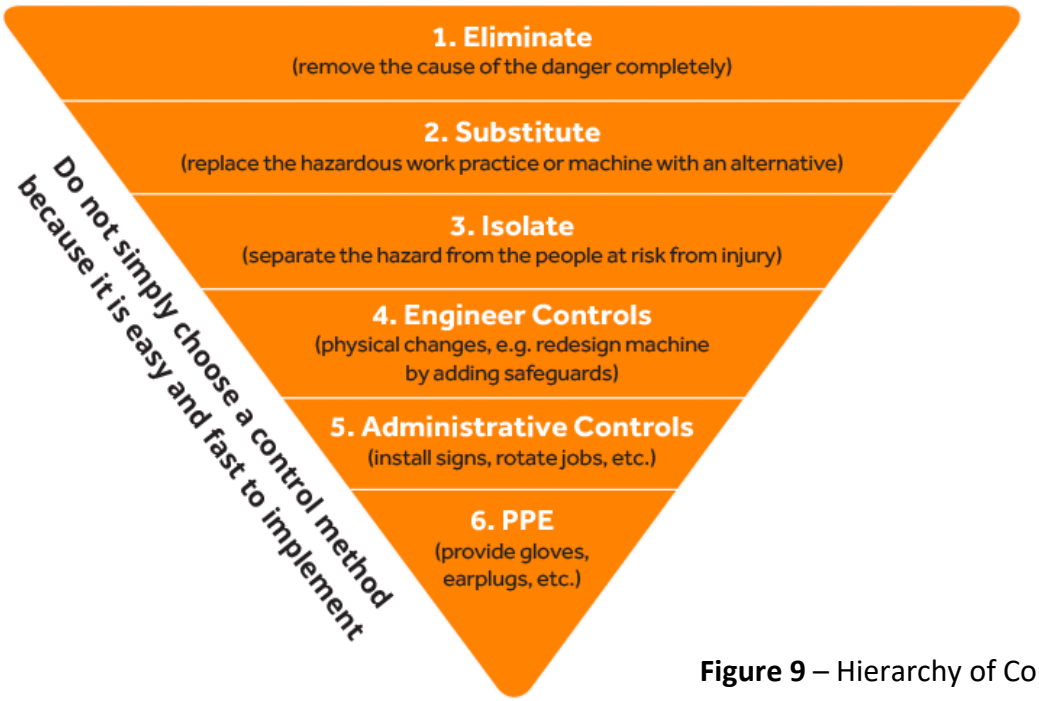


Figure 9 – Hierarchy of Control

SAFE WORK PRACTICES

Safe work practices are methods that must be implemented to make sure a job is carried out as safely as possible. Safe work practices are governed by legislative requirements and workplace procedures and relate to such things as drugs and alcohol at work, requirements for safe work at heights, including safety devices, general requirements for use of personal protective equipment and clothing just to name a few.

The scope of tasks and the safe work practices you are going to apply should be referred to, and documented, when completing Safe Work Method Statements (SWMS) or Job Safety and Environment Analysis (JSEA).

This will provide a guideline for how to carry out all tasks safely in accordance with WHS requirements.

APPLY CONTROL MEASURES

Control measures need to be implemented before you start work, or as soon as a hazard is identified during the work.

Talk to the other workers in the area to make sure they are aware of the work you are doing, and the control measures you have put in place.

Control measures could include:

- Disconnecting power when working near power lines or overhead services.
- Putting safety tags on electrical switches or isolators to stop somebody from turning the power back on while you are working on or near power lines.
- Insulating power lines.
- Using a safety observer (also known as a spotter) inside the exclusion zone to make sure you don't get too close to power lines.
- Setting up barricades and traffic control to keep the area clear.
- Placing pedestrian controls (barricades, signs, etc.) to limit the number of people in the area.
- Moving any obstructions out of the way.
- Wearing PPE such as high-visibility clothing and non-slip work boots.
- Setting up additional lighting in the work area.
- Put excavation safeguards in place (if applicable).

Check the situation after you have applied a control measure to see if more controls, or different controls are needed to make the job safe. If more controls are needed, make sure they are applied before you start or continue the work.

STRATEGIES FOR TRAFFIC CONTROL

If the work area is going to be shared with pedestrians, site personnel, vehicles or mobile plant, you will need to make sure you have control measures in place before you start.

These may include:

- Using a flag person or traffic controller to control traffic.
- Setting up flashing hazard lights.
- Setting up warning signs and barriers.
- Setting up pedestrian and vehicle exclusion zones. Using a Traffic Management Plan.

STRATEGIES FOR OPERATION IN DARKNESS

If dogging operations are being carried out at night, or in darkened areas, adequate lighting needs to be provided across the entire work area.

This is to make sure that the all workers can see properly and carry out their work safely.

WORKING AROUND PEOPLE

If personnel are working around a slewing crane and are close to the outriggers or chassis there is a risk that they might be struck or crushed by the crane or load as it is being slewed.

An exclusion zone should be set up to keep personnel a safe distance away from the crane during operations.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) is clothing and equipment designed to lower the chance of you being hurt on the job. It is required to enter most work sites.

You should select and inspect your PPE before you start work. This could include but not limited to:

- Hard hat.
- Rubber soled shoes.
- Hand protection – gloves.
- Eye protection – goggles, visors or glasses.
- Ear protection – plugs or muffs.
- Breathing protection – masks or respirators.
- Hi-visibility clothing – clothing that makes you stand out and lets other people know where you are.
- Weather protection – clothing that protects you from the sun or from the cold.

Make sure any PPE you are wearing is in good condition, fits well and is right for the job.

If you find any PPE that is not in good condition, tag it and remove it from service. Then tell your supervisor about the problem and they will organise to repair or replace the PPE.

LOAD ASSESSMENT

Part of putting together a job includes assessing the load itself. Different types of loads will have different requirements for safe lifting.

The person who slings the load (a person holding a dogging licence) is responsible for the establishing the weight of the load that is to be lifted. The crane operator is responsible for communicating with the person slinging the load and giving them appropriate information such as the capacity of the crane that is to be used.

By identifying the weight of the load you will be able to properly assess whether or not the crane will be able to shift the load and the limitations of operation for the crane.

I is extremely dangerous to attempt to lift a load of unknown weight. You could cause structural damage to the crane and damage to lifting gear and load.

You can determine the weight of the load a number of ways, these include:

- Checking with the driver who delivers the load. The weight may be marked on the delivery docket (consignment note) or on a weighbridge certificate.
- Checking the load itself. The weight may be marked on the load or the packaging it arrives in.
- Weighing the load.
- Estimating the weight of the load through appropriate calculations.

COMMON LOADS

Material	Mass	Material	Mass
1 cubic meter of Aluminium	2.7t	1 cubic meter of Hardwood	1.1t
1 cubic meter of Ashes	0.8t	1 cubic meter of Sand (dry)	1.3t
1 cubic meter of Blue Metal	2.0t	1 cubic meter of Sand (wet)	1.5t
1 cubic meter of Cast Iron	7.2t	1 cubic meter of Softwood	0.75t
1 cubic meter of Steel	7.9t	1 cubic meter of Terra Cotta	1.8t
1 cubic meter of Clay	1.9t	1 cubic meter of Water	1.0t
Material	**Mass**	**Material**	**Mass**
1 cubic meter of Coal	0.846t	25 bags of Cement	1.0t
1 cubic meter of Concrete	2.4t	1000 Bricks	4.0t
1 cubic meter of Copper	9t	200 litre (44 gal) drum (full)	200kg
1 cubic meter of Earth	1.9t	200 litre drum (empty)	10kg
1 cubic metre Bronze	8.5t	1 cubic metre Granite	2.6t
1 cubic metre of Iron Ore	5.4t	1 cubic meter of Lead	11.2t
1 cubic meter of Poly Pipe	1.1t		

Table 5 – Common Load Weights

CHOOSING THE RIGHT CRANE FOR THE JOB

Part of planning the job is to check that the crane will be able to shift the load safely. This means you need to check the capability and limitations of the crane.

When choosing the right crane or cranes for the job it is important to take into account:

- Environmental conditions you are going to work under including weather and ground conditions.
- Size of work access points.
- Number and frequency of lifts.
- Weights and dimensions of loads.
- Maximum height and radius of the lifts.
- Procedure for the movement of loads (e.g. lifting only, mobiling).

Refer to the manufactures specifications, crane chart and range diagrams to see if the crane is appropriate for the job.

You will be able to use this information to configure the crane for operation.

CRANE AND EQUIPMENT CHECKS

Before using a crane or other equipment you will need to check that it is in safe working order and is suitable for the task.

Routine checks include:

- Pre-start checks (checks done before the crane is started up).
- Operational checks (checks made after the crane is started up).

If you find a Dander/Safety tag attached to the crane or an item of equipment whiles carrying out an inspection then you must leave it in place. Do not remove the tag or use the crane or equipment (unless you have authorisation to remove the tag/s).

The only people that can remove the tag is the person who put it there or someone authorised to remove it in line with workplace safety precautions.

PRE-START CHECKS

Routine pre-start checks should be carried out according to procedures including:

- The manufactures guidelines. This may include a range of instructions, specifications including the operator's manual or appropriate checklists.
- Industry operating procedures.

- Workplace procedures, instructions, operating procedures and checklists.

Routine pre-start checks include:

- Visually check the motor.
- Signs of damage to the structure, including:
  - The crane ○ The boom/jib
- The condition of the tyres/tracks Tyres are at correct pressure All fluid levels including:
  - Oil (motor, hydraulic, gearbox)
  - Fuel ○ Battery acid level ○ Radiator water/coolant level ○ Lubrication (grease)
- No evidence of fluid/oil/water leaks, particularly under the crane.
- Hydraulic rams and hoses for damage or leaks.
- Outriggers/stabilisers and packing.
- Crane configuration.
- All wire ropes, anchorages, wedge sockets and splices.
- Winch drum condition.
- Slew ring where visible.
- Jib.
- Needle (where applicable).
- Rooster sheave (where applicable).
- Retaining pins.
- Auxiliary hoist (where applicable).
- Rope and rope drums.
- Lifting hook.
- The logbook is present, current and checked for maintenance records and defects.
- Safety tags – check that none are on the crane.
- Load charts are present and appropriate to the crane.
- Signs/signage and labels (or notices) are present, correct and legible. This includes:
  - Rated capacity ○ Manufactures data plate and labels ○ Load charts ○ Crane decals ○ Control labels
- Communication system.

BOOM CHECKS

The boom and superstructure of the crane must be checked to ensure there are no defects that would make the crane unsafe to use.

Boom defects to check for include:

- Cracks – particularly in the boom, superstructure or welds.
- Bends or twists in the boom or superstructure.
- Flaking paint.
- Loose bolts.
- Oil leaks.
- Rust from joints or welds.

TYRES

Check that all tyres are in good condition and are inflated to the correct pressure as stated on the cranes load chart or in the operators manual.

The stability of the crane depends on the tyres being correctly inflated. The tyre pressure also affects the capacity of the crane.

If the tyre pressure is lower than the pressure on the load chart then the crane will only be able to lift less weight.

You will need to inspect crawler tracks and mechanisms if the crane is fitted with them.

LIFTING HOOK

Inspect the lifting hook for damage or excessive wear. Defects that would render a lifting hook unserviceable include:

- Cuts, gouges or more than 10% wear.
- Bill stretched more than 5%.
- Cracks or twisting of the hook.
- Exposure to excessive heat.
- Safety latch that is damaged or missing.
- Rated capacity mark/stamp missing from the hook.

SHEAVES

Sheaves lead the rope over the head of the cranes hoist and are used in pulley systems to gain a mechanical advantage. Make sure that the flexible steel wire rope (FSWR) sits neatly in the base of the sheave groove. The amount of FSWR sitting in the groove should be either one third (1/3), 120° or as per the manufactures specifications.

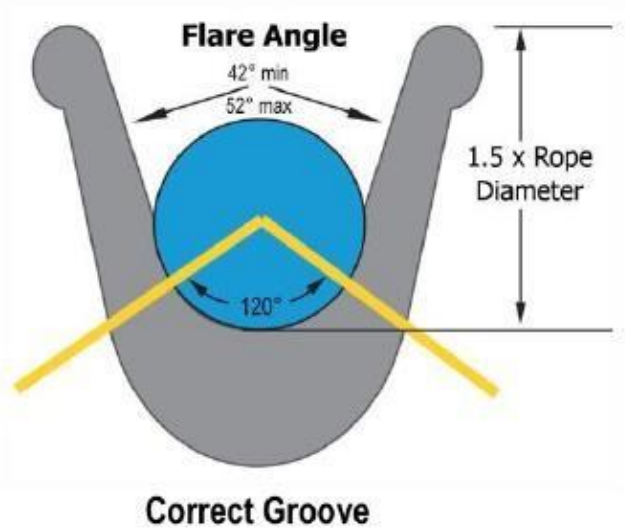
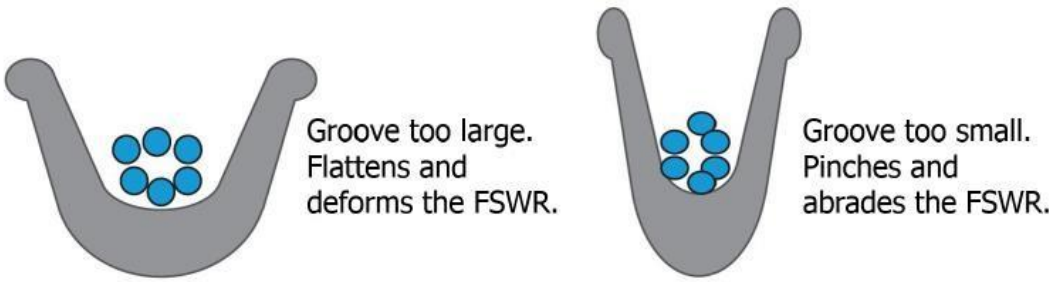


Figure 10 – Sheave angle

The groove depth of the sheave should not be less than 1.5 times the diameter of the FSWR (or in accordance with the manufactures specifications).

If the grooves are too large then the rope will be flattened and deformed. If the grooves are too small the rope will be pinched and abraded. Any damage to the FSWR may lead to its failure.

Figure 11 – Sheave Grooves



Inspect the sheaves for damage or excessive wear. Defects that would render a sheave unusable include:

- Sheave is twisted or deformed or out of shape.
- Excessive wear in any grove.
- Damage (e.g. cracks) in the flange.
- Worn sheave pins or wear of the hinge pin.
- Damage to cheek plates or cheek plate wall/partition that is too far from or too close to the sheave.

Figure 12 – Sheave

DRUMS

The drum is the pulling mechanism that rotates, hauls in and stores surplus wire.

The braking mechanism is connected to either the drum or the gearing. The drum or gearing is joined to the drive mechanism.

Drums are measured from the centre to the inside flange. A drum that measures 1m from the flange is therefore a 0.5m drum.

The rope should lie neatly on the drum and not be bunched up. When the hook block is at its lowest possible point there should be still a minimum of three full turns on the drum (or as per the manufactures specifications).

Figure 13 – Winch Drum (FSWR crossover) When the drum has been wound to is maximum turns the flange must still extend 2 rope diameters above the outer layer of rope.

The rope must be anchored to the drum with a fixed mechanical anchorage such as a socket and wedge or a clamp and bolts.

Be aware of the danger of not properly tightening an anchorage – DO NOT rely on the frictional grip relayed by the two turns on the drum.

WEDGE SOCKETS

A wedge socket is used to securely hold the tail of a hoist wire rope. A minimum of 200mm of tail on the dead end of the rope should project from the wedge socket.

A clamp and bolts or bulldog clamp should be applied to the tail of the rope below the socket. Methods of terminating a hoist rope in a wedge rope socket are shown below:

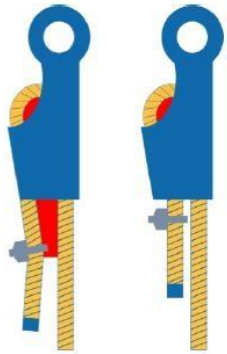
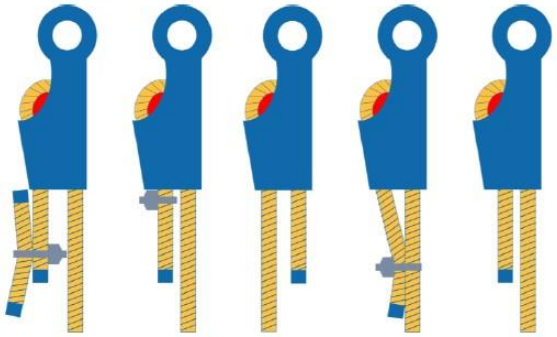
Correct Methods	Incorrect methods
	

Figure 14 – Wedge Sockets

BOOM PAWL

Check to see if the boom pawl has engaged the ratchet. This could mean that the boom brakes are creeping due to mechanical failure, moisture or the condition of the brakes.

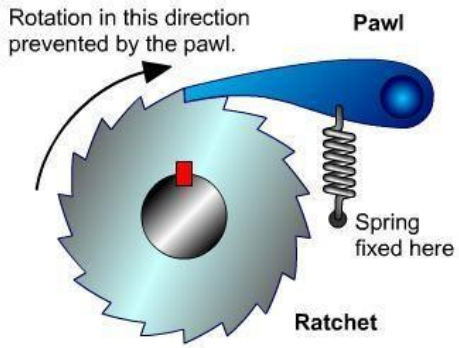


Figure 15 – Pawl & Ratchet

LIFTING EQUIPMENT

Inspect lifting equipment for damage or defects before each use. Check for more than 10% wear I the following:

- Shackles.
- Chains.
- Crane sling shortners.
- The bite of the hook.

If there is more than 10% wear the lifting equipment is not safe to use.

Figure 16 – Lifting Equipment (examples)

LOCATE AND IDENTIFY CONTROLS

Before starting up the crane and carrying out operational checks, it is important that you are familiar with the location of various controls and their functions.

Make sure all control labels are present and legible.

Controls may include:

- Steering.
- Hand brakes.
- Travel brakes.
- Slew brake lock.
- Slewing levers.
- Boom extension levers (where fitted).
- Hoisting and lowering levers.
- Luffing levers.
- Throttle control.

Figure 17 – Crane cabin and controls Check the Crane Logbook

The crane logbook is used to record information on crane operation, servicing and repairs, the daily safety checks that are completed and to report defects and whether the defects have been rectified.

The crane logbook may also be called the:

- Service logbook.
- Logbook.
- Service book.
- History record.

All defects must be recorded in the crane logbook, along with any action taken to return the crane to service.

You should check the logbook to make sure:

- It is applicable to the crane.
- The crane owner is recorded.
- The crane's registration/certificate is current.
- Previous daily safety checks have been carried out and recorded.
- There are not any reported defects that have not been fixed (rectified).
- All repairs and defect rectifications are recorded.

As the crane operator you must record all crane defects in the logbook (crane operator's logbook) and according to any other workplace procedures.

Note: Do not start up the crane if previously reported defects have not been fixed.

As well as the crane logbook, check that all signs, labels and decals are present and readable. This information will tell you the cranes capacity and capabilities.

START THE CRANE

To start the crane you will need to safely access the cabin. Use any ladders, steps, footholds or grab rails provided.

Climb into the cabin safely using three points of contact at all times. This means having two hands and one foot or two feet and one hand in contact with the crane at all times. Make sure all points of contact are free from slipping or tripping hazards e.g. grease, mud or debris.

Start the crane according to manufacture start-up procedure.

If you hear abnormal noises after starting up you will need to shut the crane down. Put a danger tag or out of service tag on the crane and report the noise to the appropriate person.

CHECK THE CRANE SAFETY DEVICES

Check all safety devices on the crane including:

- Horns and sirens.
- Audible and visual reversing devices.
- Operator restraint devices e.g. safety belt.
- Lights.
- Two-block/double block system.

The load mass indicator should be calibrated every six months (or in accordance with the manufactures specifications).

You can test the accuracy of the load mass indicator by selecting a load that you already know the weight of, lifting it and comparing the result on the indicator against the known weight of the load. Load mass indicator testing should be done following the manufactures specifications.

OPERATIONAL CHECKS

Operational checks or post start-up checks are done after pre-start checks and only if no faults or defects were found.

Make sure you have plenty of room to test out the crane before starting it up.

It is important that the crane is tested to the full range of its capacity to ensure that the crane is safe and functioning correctly.

Operational Checks include:

- All hazard controls are in place.
- You have a clear view from the operating position across all work zones, whenever possible. This will ensure that your view is not obstructed when carrying out operations.
- All crane movements and controls are smooth and tested to the full extent of their capacity including:
    - Boom movements including in and out(extending/telescoping) and luffing

○ Hoist movements including slew, raise and lower ○ Controls, including the throttle control Inspecting the travel limits.

- Warning devices and systems.
- Warning lights and devices.
- Horn, Lights and drive indicator.
- Communications.
- Brakes.
- Steering.
- All gauges are functioning correctly.
- Slew brake lock.
- Travel brakes.
- Hand brakes.
- Limit switches.
- Two-block/double block system present and in good condition.

- Outriggers/stabilisers deployed and functioning.
- Tyres are clear of the ground.
- Packing is the correct size and has been placed correctly.
- The crane is level and stable.
- Checking the maximum radius and load radius indicator.

You may also be required to input data into the cranes computer and make sure that it is accurate and matches the configuration of the crane.

CHECK COMMUNICATION EQUIPMENT

Inspect all communication equipment before starting the crane work to make sure that it is working correctly and that effective communications can be established and maintained at all times.

Where radio communication equipment is used, the transmitting frequencies of the equipment must be selected to prevent interference to or from other radios equipment being used in the vicinity of the crane.

REPORT ANY FAULTS

You can use an inspection checklist/logbook to record all checks carried out and all defects identified.

If you find any faults or defects on the crane or the crane cannot function to the full range of is movements, you must:

1. Tag out the crane to isolate it from use.
2. Report the defect.
3. Do not use the crane until the fault has been fixed.
4. Record the fault in the crane logbook.

Report any evidence of tampering or interference with the crane to your supervisor or other responsible person.

DO NOT use the crane or equipment until it has been fixed and returned to service.

CHECK GROUND CONDITIONS

Before setting up the crane you will need to make sure the ground is suitable for the work being done and that it will support the weight of the crane and load.

Ground conditions that you may encounter include:

- Rough uneven.
- Backfilled.

- Soft soils.
- Hard compacted soils.
- Rock.
- Bitumen.
- Concrete.

The ground should be checked by a competent person such as an engineer before setting up the crane so that the bearing pressure value of the soil can be established.

Check to make sure there are no underground services running through the area where you plan to set up the crane. The pressure of the equipment could cause damage to the underground services, pipes or cables.

The crane could become unstable during operation if the ground is unstable e.g. rough, uneven or soft. Setting up the crane on uneven ground will also decrease the capacity of the crane. Do not set up the crane on backfilled trenches. They may not have compacted completely and are dangerous to set the crane up on. You may need to use plates or packing under the outriggers/stabilisers to make sure the crane remains stable on soft ground.

When setting the crane up on a concrete slab, an engineer's report is required to confirm that the concrete slab can support the weight of the crane and load.

DRIVE THE CRANE TO THE WORK AREA

If you are satisfied that the ground at the work area is suitable for the crane operations, drive the crane to the work area and begin to set up.

Follow all manufactures specifications, procedures and relevant motor vehicle road legislation when driving the crane to the work area.

Maintain safe speeds and watch out for pedestrians and other vehicle traffic on site. Turn on warning lights to warn others of your approach.

It is important to remember that the HRW Licence to operate a mobile slewing crane does not include the licence to drive the crane on public roads, thoroughfares or to the work area.
You will need the appropriate truck licence to drive the crane on roads.

POSITION THE CRANE FOR WORK

Once you have arrived at the work area you will need to correctly position the crane for work operations.

Make sure the crane is placed so that all tasks can be carried out safely and efficiently.

Ensure that you:

- Establish the safe working radius 9or reach) of the crane.
- Check that there are adequate clearances from hazards and structures such as power lines or buildings.
- The crane is in an appropriate position for the work to be completed.

If any wheels or outriggers/stabilisers begin to sink during set-up you will need to stop operations and rectify the sinking. You may need to add more packing under the outriggers/stabilisers or if this is not possible you will need to move the cane to a more suitable and stable position.

Use a bubble level indicator to make sure the crane is level when setting up.

Take into account the specific issues related to a particular work area.

SETTING UP CLOSE TO TRENCHES/EXCAVATIONS

Do not set up outriggers/stabilisers close to an excavation. The pressure of the crane could cause a collapse of the excavation wall.

The distance to safely set up a crane near a trench or excavation will depend on the soil conditions. However, the general rule is to position the crane at a distance that is the same as the depth of the excavation or trench.

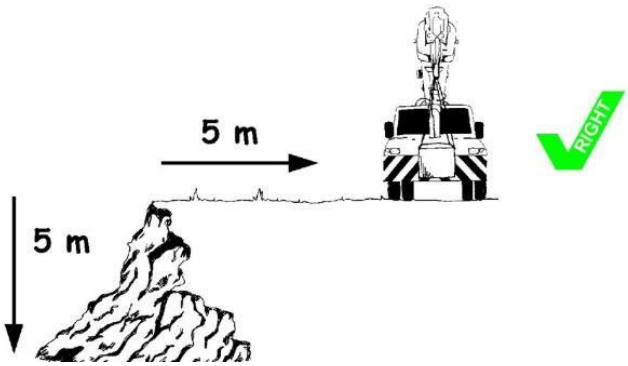


Figure 18 – Excavation Distance

SETTING UP AND OPERATING CLOSE TO BUILDINGS

If you were working near a building there are a number of things to consider and actions to take:

- If possible, set up the boom so that it slews away from the building.
- Determine if protection for the building will be required e.g. fitting screens to easily damaged areas such as windows.
- Pay close attention to the effect of wind on loads, as wind speeds tend to increase around buildings.
- Take extra care of back-filled trenches placed close to the building.

SETTING UP IN RESTRICTED SPACES

When setting up a crane in a restricted space it is important to consider and ensure that:

- Access is adequate – the carne can enter, operate and exit the work area.
- The manufactures specifications can be followed while operating the crane.
- The boom can be safely slewed without striking any surrounding structures.
- The possibility of the need to use a guide.
- There is adequate access for the load to be slung and landed safely.

OUTRIGGERS/STABILISERS

Once the crane is in position you may need to deploy the outriggers. Outriggers (sometimes called stabilisers) are hinged or sliding beams that are used to keep the crane stable during operation.

Outriggers can be used with packing to help distribute the weight of the crane and load on softer ground.

The outriggers need to be fully extended to bring the tyres off the ground and make the crane level (in accordance with the manufactures specifications).

Never reset the outriggers while the crane is in use, as this can cause major instability.

If the carne is set up and one or more wheels or outriggers begin to sink you must stop operations. If possible, rectify the sinking. If this isn't possible you will need to relocate the crane to an area where it is possible to ensure the crane stability.

PACKING

Selecting the correct packing is important. There are different kinds and sizes of packing available including:

- Steel plates.
- Hardwood packing (pigstying or cribbing).

Packing must cover as much area as possible to distribute the load. Make sure you determine the minimum area of the packing under each outrigger to ensure that the carne and load remain stable at all times.

Hardwood (pigstying) packing should be arranged so that each layer is at a 90° angle to the one underneath.

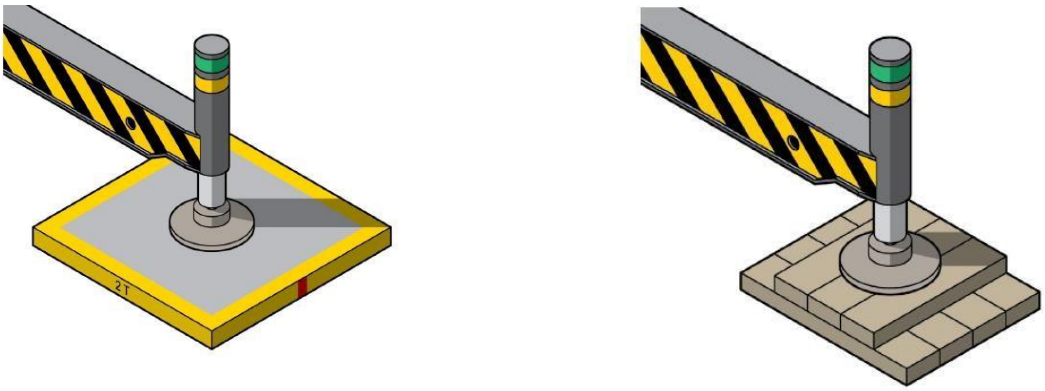


Figure 19 – Packing

CALCULATING THE REQUIRED SIZE OF PACKING

Working out the size of the packing area required is an important step in safely setting up the crane.

You may need to use packing or mats under the outriggers to make the crane stable on soft ground. Different ground and soil types have different load bearing pressures depending on how firm or dense they are.

Soil Type	Load Bearing Pressure (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

Table 6 – Ground pressure

When working out the area of required packing you will need to know:

- Total mass of crane.
- Total mass of the load.
- The soil bearing pressure.

If this information is known you can then use the following formula to work out the required size of packing in metres squared (m^2).

$$\text{Area of packing } (m^2) = \frac{0.65 \times (\text{Crane Mass} + \text{Load Mass})}{\text{Soil Bearing Pressure (V)}}$$

Example – Calculating the Required Area of Packing

If a mobile slewing crane that weighs 29200kg is to be set up to lift a 15T load on compacted gravel. What is the smallest packing pad needed for each outrigger?

The following outrigger pads are available:

- $0.25m^2$, $0.5m^2$, $0.75m^2$, $1m^2$

The first step is to deduce all the information required.

- Total Crane Mass = 29200kg = 29.2T
- Load to be lifted = 15T
- Compacted Gravel = $40T/m^2$

Now that the data is in an easily accessible format we can use it to find the minimum required area of packing for this configuration.

CALCULATIONS

$$\text{Area of packing } (m^2) = \frac{0.65 \times (\text{Crane Mass} + \text{Load Mass})}{\text{Soil Bearing Pressure (V)}}$$

$$= \frac{0.65 \times (29.2 + 15)}{40}$$

$$= \frac{0.65 \times (44.2)}{40}$$

$$= \frac{28.73}{40}$$

$$= 0.72\ m^2$$

Therefore the smallest packing pad needed for each outrigger would have an area of 0.72 m^2, so the required outrigger size 0.75m^2.

CONFIGURE THE CRANE

The crane will need to be configured properly to suit the tasks that are to be done. This may include configuration of the boom/jib, fly jib or counterweights. Carry out all crane configuration procedures according to the manufactures instructions.

Consult the load chart for the crane to make sure the crane is configured correctly for the loads that need to be lifted.

BOOM CONFIGURATION

The boom and jib may need to be assembled for the lift. Make sure the maximum radius luff limits are known, and the boom extension is secured according to the manufactures specifications.

FLY JIB

You can find the ratings of the fly jib by consulting the load chart. For instance, a fly offset at 15 degrees will have a lower rating than at zero degrees.

If a fly jib is stowed on the main boom section then the rated capacity of the crane may be reduced.

Also check the load chart or crane specifications to see if you are allowed to mobile the crane with a load on the fly jib.

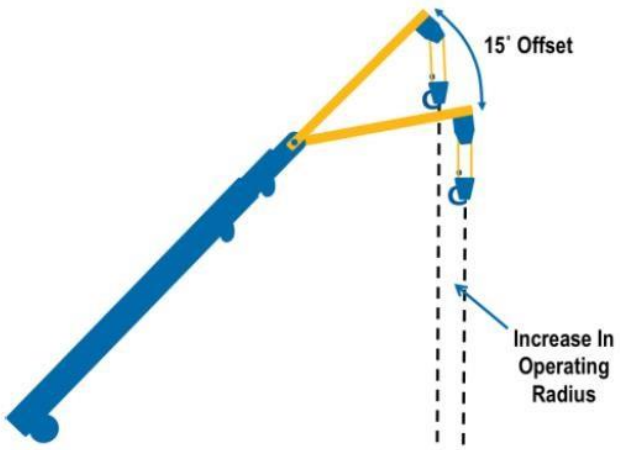


Figure 20 – Fly Jib Offset

COUNTERWEIGHTS

Small cranes usually have a fixed counterweight, whereas larger cranes may have counterweights that can be removed and configured. Consult the manufactures specifications to find information on when and how to configure counterweights and how to secure them to the crane. Extra counterweights can only be added if the manufactures specifications allow it.

A counterweight should be clearly marked with its weight/mass and the crane manufactures name/trademark.

Note: Misuse of counterweights could result in crane instability or structural damage to the crane.

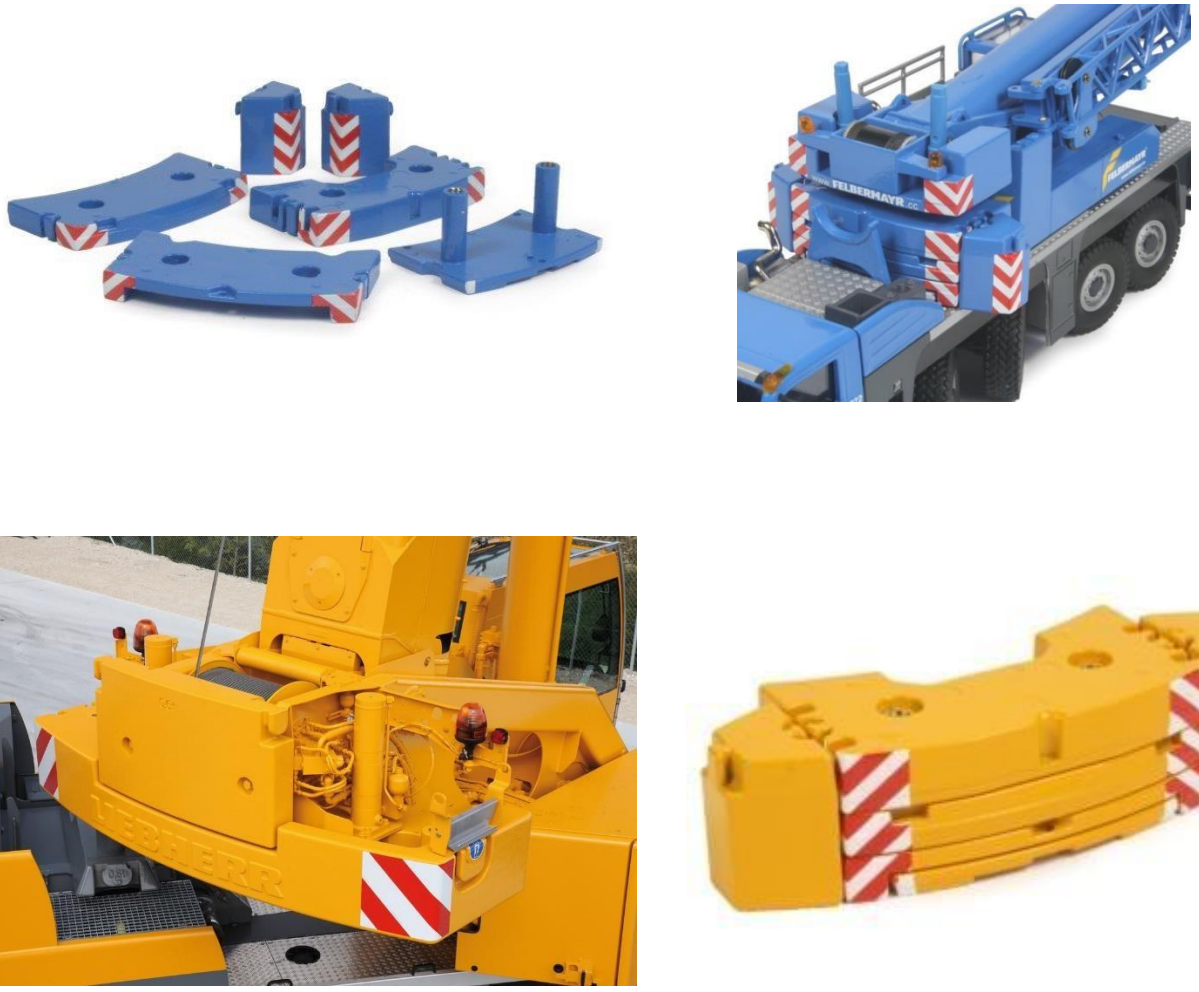


Figure 21 – Counterweights

INPUT COMPUTER DATA

Note: Not all cranes are fitted with a crane computer. Check the operator's manual for the crane you are using to see if it has a crane computer installed.

The crane computer is used to help configure the boom/jib and counterweights.

It also includes the load limiting/indicating system used to warn you in situations where the crane is overloaded or likely to become unstable.

When setting up the crane, all relevant details should be entered into the crane computer (where applicable). This may include:

- The weight of the load to be lifted.
- The boom length.
- The operating radius.
- The total weight of the lifting gear.

Figure 22 – Crane Computer

Test that the crane computer is working by comparing the computer results with the crane load chart, or complete pre-operational testing in the manufactures specifications.

TEST COMMUNICATION EQUIPMENT

Before starting work you will need to make sure any communication equipment you are using is working properly on-site. Consult the manufactures instructions to make sure the equipment is working correctly.

Check for radio interference and make sure you are not interfering with other workers onsite who may also be using radios. Use a dedicated frequency to prevent interference with other equipment. Make sure batteries are fully charged and that you have spare batteries in case they are needed.

DETERMINE CRANE CAPACITY

You will need to determine the characteristics and capabilities of the crane you are going to use so that it can be configured to suit the loads that are to be moved.

Information relating to the capabilities of a crane can be found in:

- The appropriate load charts.
- The manufactures specifications.
- The operator's manual.
- Marked or labelled on the crane itself.

The lifting capacity of a crane is limited by structural strength (when the operating radius is small) and stability (when the operating radius is large).

LOAD CHARTS

Load charts or crane charts contain details of the crane and the information you need to properly calculate the crane's capacity in any given configuration.

As well as the crane's dimensions and weight, the load chart will tell you the:

- Operating radius of the crane.
- Rubber ratings.
- Weight of the hook block.
- Winch line pull in tonnes or kilograms.
- Rated capacity for a given configuration (crane radius and boom length).
- Multiple rope fall capacities (e.g. 2-fall and 4-fall hook block configurations).

Check the load chart to determine how different boom and counterweight configurations will affect the capacity of a crane.

LOAD RATINGS IN LBS WITH ALL OUTRIGGERS AND STABILIZERS EXTENDED AND THE CRANE LEVEL

LMI CODE #1

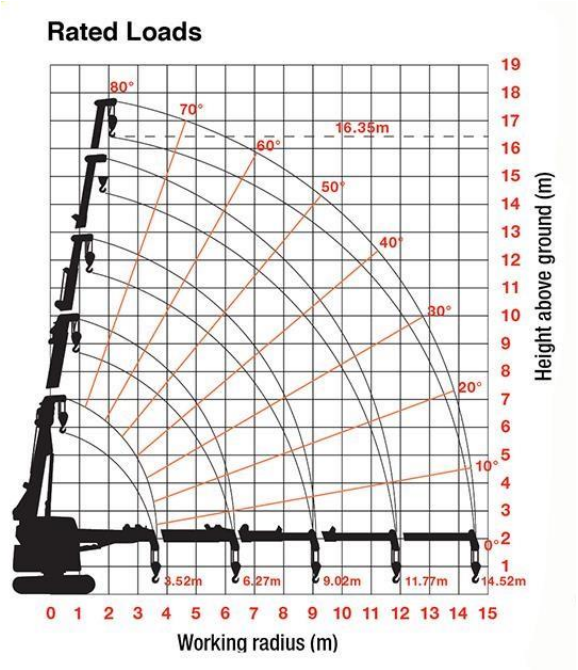
OPERATING RADIUS FT	LOADED BOOM ANGLE / BOOM LENGTH AND MARKER		A		B		C		D	
	∠	36.5 FT	∠	61 FT	∠	82 FT	∠	103 FT	∠	124 FT
6	81	50000								
8	77	37820								
10	74	31640								
12	71	27260	79	22200						
15	66	22630	77	20320						
20	57	17650	72	15530	78	14600				
25	46	14340	67	12510	74	11620	79	10500		
30	33	11410	61	10410	70	9570	76	9020	79	6500
35	4	7590	56	8840	66	8060	73	7540	77	6100
40			50	7600	62	6900	70	6400	75	5800
45			43	6280	58	5970	67	5500	72	5150
50			35	5190	54	5200	63	4760	70	4430
55			25	4170	49	4380	60	4150	67	3830
60					44	3540	57	3620	64	3320
65					39	2860	53	2970	62	2880
70					32	2290	49	2400	59	2460
75					24	1800	45	1920	56	1980
80					9	1350	41	1500	53	1570
85							36	1150	50	1210
90							30	830	46	900
95							24	560	43	630

Figure 23 – Load Chart (example)

Load charts have a solid line running across them:

- All numbers **ABOVE** the line are based on structural strength. Overloading the crane in these configurations will result in structural damage to the crane.
- All numbers BELOW the line are based on stability. Overloading the crane in these configurations will result in crane instability.

Load charts will contain a range diagram. As the name suggests, the range diagram is used to work out the lifting range of the crane. This chart indicates what boom length is required to pick up and lift a load in relation to distance and height.



A range diagram may provide the following information:

- Boom elevation height versus height of a building or structure.
- Crane configuration requirements.
- Jib attachment operating radius.
- Minimum allowable clearance between load blocks and the head sheave (tip of boom).

Where a precise reading is not available on the load chart you must always use the higher operating radius. The increased operating radius decreases the rated capacity.

DO NOT risk overloading the crane.

If the load chart is unreadable from age or wear you must not operate the crane. Have the load chart replaced before attempting to lift anything with the crane.

FACTORS THAT AFFECT THE AMOUNT A CRANE CAN LIFT

One of the most important things you need to know in order to work out the crane‘s capacity is the operating radius. This is the distance at which a crane can operate safely with a known weight.

You will need to take into account a number of factors to make sure that you are working within the operating radius of the crane. This can include:

- The boom/Jib angle.
- The boom/Jib length.
- Boom/jib deflection.

The fly jib may be offset at an angle causing the rated capacity of the crane to decrease.

Boom/Jib deflection should also be taken into account when determining the capacity of a crane. Boom/Jib deflection is the slight bending of the boom/jib under the weight of the load. Boom/Jib deflection can result in a slight increase in the operating radius, which reduces the amount weight that can be lifted safely by the crane.

NOTE: Luffing the boom up will decrease the operating radius, allowing the crane to safely lift more.

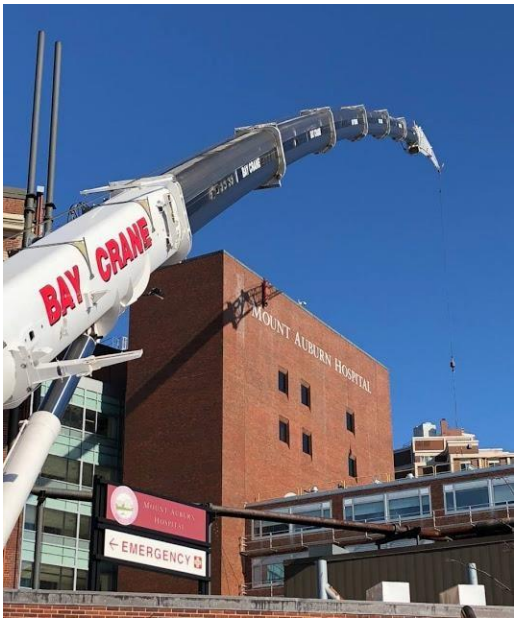


Figure 24 – Boom Deflection

Before attempting to lift anything you need to calculate the amount of weight that the crane will be lifting. You need to subtract the weight/mass of any lifting gear, including hook block, slings, spreader beams, kibbles and ladles, from the rated capacity to work out the weight of a load that you can safely lift with the cane.

All of these items must be deducted from the rated capacity of the crane to determine the actual rated capacity of the crane at a particular radius.

The hook block may be reeved to gain a mechanical advantage in the lifting gear. A hoist that is using a block with multiple falls of rope (sheaves or parts) may be able to raise a heavier load. Always make sure the load is within the safe range for the crane.

It is important to take into account the forces and loads placed on the crane and the load when conducting operations. This may include:

- **DYNAMIC FORCES** - Caused by the movements of the crane and load.
- **WIND LOADS** - Caused by the pressure of wind on the crane or load.

Check that the crane hook has an adequate rated capacity for the loads that are to be lifted. The rated capacity of a hook should be stamped or marked on the hook itself.

CRANE CAPACITY CALCULATIONS

It is important that you are able to calculate the capacity of the crane configurations using information found on the load chart.

Each crane has a set of documents that outline its unique specification.

Example 1 – Lifting on the Main Hook with the Jib stowed.

You will often be lifting loads on the main hook, with the jib stowed. Using the "Crane Specifications – Slewing Mobile crane (Up to 60 Tonnes)" information found in Appendix B, work out the maximum load that can be lifted on the main hook when the crane is to be set up in the following configuration:

Crane Configuration	
Outriggers	Maximum Extension
Main Boom Length	21.30m
Working Radius	12.0m
Operating Area	360° (over side and rear)
Jib	Stowed
Lifting Gear	2 Sheave Hook Block

Step 1 – Select the Applicable Load Chart Section

The first step in working out the maximum load is to work out which section of the specifications relates to the configuration of the crane.

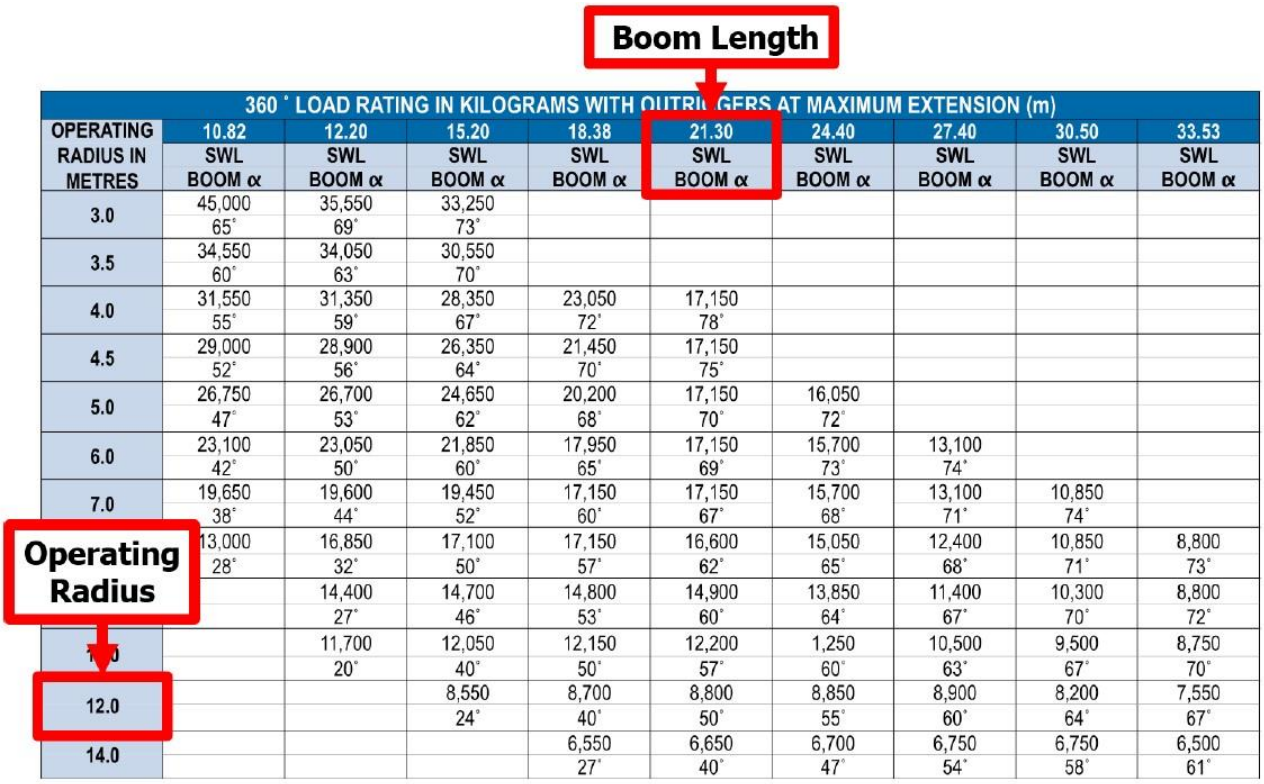
This configuration is on outriggers at maximum extension and with an operating area of 360° so we will be referring to the "360° Load Rating in Kilograms with Outriggers at Maximum Extension (m)" chart.

360 ˚ LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65˚	35,550 69˚	33,250 73˚						
3.5	34,550 60˚	34,050 63˚	30,550 70˚						
4.0	31,550 55˚	31,350 59˚	28,350 67˚	23,050 72˚	17,150 78˚				
4.5	29,000 52˚	28,900 56˚	26,350 64˚	21,450 70˚	17,150 75˚				

Step 2 – Determine the Rated Capacity for the Configuration

The second step in working out the maximum involves using the chart to find the rated capacity that corresponds to the main boom length and the operating radius.

The main boom length is 21.30m and the operating radius is 12.0m.



360 ˚ LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65˚	35,550 69˚	33,250 73˚						
3.5	34,550 60˚	34,050 63˚	30,550 70˚						
4.0	31,550 55˚	31,350 59˚	28,350 67˚	23,050 72˚	17,150 78˚				
4.5	29,000 52˚	28,900 56˚	26,350 64˚	21,450 70˚	17,150 75˚				
5.0	26,750 47˚	26,700 53˚	24,650 62˚	20,200 68˚	17,150 70˚	16,050 72˚			
6.0	23,100 42˚	23,050 50˚	21,850 60˚	17,950 65˚	17,150 69˚	15,700 73˚	13,100 74˚		
7.0	19,650 38˚	19,600 44˚	19,450 52˚	17,150 60˚	17,150 67˚	15,700 68˚	13,100 71˚	10,850 74˚	
[illegible]	13,000 28˚	16,850 32˚	17,100 50˚	17,150 57˚	16,600 62˚	15,050 65˚	12,400 68˚	10,850 71˚	8,800 73˚
[illegible]		14,400 27˚	14,700 46˚	14,800 53˚	14,900 60˚	13,850 64˚	11,400 67˚	10,300 70˚	8,800 72˚
[illegible]		11,700 20˚	12,050 40˚	12,150 50˚	12,200 57˚	1,250 60˚	10,500 63˚	9,500 67˚	8,750 70˚
12.0			8,550 24˚	8,700 40˚	8,800 50˚	8,850 55˚	8,900 60˚	8,200 64˚	7,550 67˚
14.0				6,550 27˚	6,650 40˚	6,700 47˚	6,750 54˚	6,750 58˚	6,500 61˚

The intersecting point between the “Main Boom Length” column and the “Operating Radius” row contains all of the rated capacity and boom angle information related to this configuration.

360 ' LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65°	35,550 69°	33,250 73°						
3.5	34,550 60°	34,050 63°	30,550 70°						
4.0	31,550 55°	31,350 59°	28,350 67°	23,050 72°	17,150 78°				
4.5	29,000 52°	28,900 56°	26,350 64°	21,450 70°	17,150 75°				
5.0	26,750 47°	26,700 53°	24,650 62°	20,200 68°	17,150 70°	16,050 72°			
6.0	23,100 42°	23,050	21,850	17,950 65°	17,150 69°	15,700 73°	13,100 74°		
7.0	19,650 38°			17,150 60°	17,150 67°	15,700 68°	13,100 71°	10,850 74°	
8.0	13,000 28°			17,150 57°	16,600 62°	15,050 65°	12,400 68°	10,850 71°	8,800 73°
9.0		14,400 27°	14,700 46°	14,800 53°	14,900 60°	13,850 64°	11,400 67°	10,300 70°	8,800 72°
10.0		11,700 20°	12,050 40°	12,150 50°	12,200 57°	1,250 60°	10,500 63°	9,500 67°	8,750 70°
12.0			8,550 24°	8,700 40°	8,800 50°	8,850 55°	8,900 60°	8,200 64°	7,550 67°
14.0				6,550 27°	6,650 40°	6,700 47°	6,750 54°	6,750 58°	6,500 61°
16.0				5,050 14°	5,200 34°	5,250 42°	5,300 49°	5,350 53°	5,350 58°
18.0					4,100 17°	4,200 35°	4,250 43°	4,250 47°	4,300 53°
20.0						3,350 24°	3,400 37°	3,450 43°	3,450 49°
22.0						2,700 10°	2,750 30°	2,800 38°	2,850 45°
24.0							2,250 18°	2,300 31°	2,350 39°
26.0								1,850 24°	1,900 32°
28.0								1,500 19°	1,550 30°
30.0									1,250 17°

8,800
50°

The rated capacity for this configuration is 8800kg, with a boom angle of 50°.

Step 3 – Determine the Weight of Lifting Gear

The third step consists of determining what adjustments (or deviations) need to be made to the rated capacity.

Deductions include the weight of any lifting gear and the jib.

Adjustments:

- The lifting gear being used in this example is the two sheave hook block and it weighs 300kg.
- The jib is stored on the boom and weighs 400kg.

This makes a total deduction of:

300 + 400 = 700kgs

WEIGHT OF LIFTING EQUIPMENT				
LIFTING GEAR	SINGLE LINE WEIGHTED HOOK	2 SHEAVE HOOK BLOCK	3 SHEAVE HOOK BLOCK	5 SHEAVE HOOK BLOCK
WEIGHT TO BE DEDUCTED FROM SWL	150 kgs	300 kgs	350 kgs	400 kgs

JIB WEIGHTS – BOOM DEDUCTIONS			
BOOM EQUIPPED WITH	JIB STORED	8.69m	15.54m
BOOM DEDUCTION	400 kgs	900 kgs	1800 kgs

Step 4 – Complete Calculations

The fourth step involves subtracting the weight of any lifting gear and the jib from the rated capacity of this configuration.

The maximum load that can be lifted by a configuration can be found by using the following formula:

Maximum Load = Rated Capacity – Weight of Lifting Gear

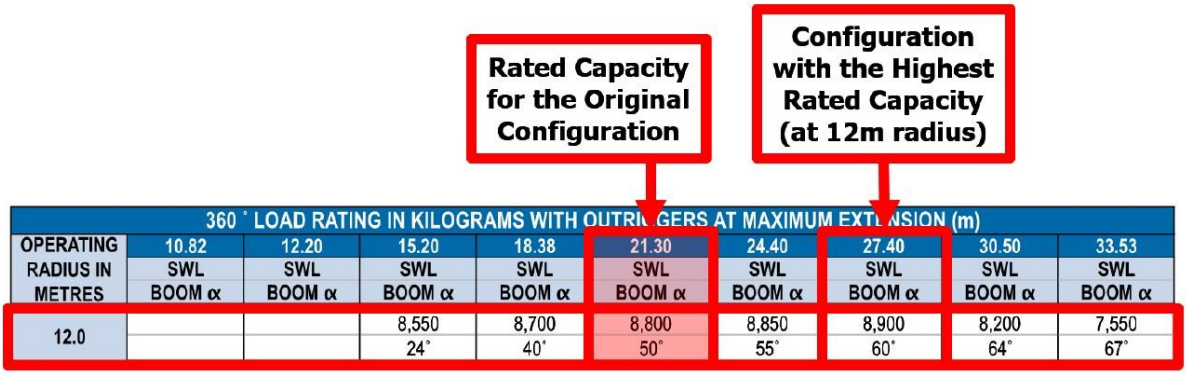
Maximum Load = Rated Capacity – Weight of Lifting Gear
= 8800kg – 700kg
=8100kg

Therefore, the maximum load that could be lifted in this configuration would be 8100kg.

INCREASING THE CAPACITY USING THE SAME RADIUS

On some occasions you will need to determine if a heavier load can be lifted, while keeping the same operating radius.

To determine if this is possible focus on the row with the same operating radius. Using the information from example 1 this would be the 12.0m radius row.
Looking across the row the highest possible rated capacity occurs when the boom is extended to 27.4m, with the capacity increased from 8800kg to 8900kg. This is an increase of 100kg.



360 ° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)

OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
12.0			8,550 24°	8,700 40°	8,800 50°	8,850 55°	8,900 60°	8,200 64°	7,550 67°

It is important to note that if the boom is extended past 27.4m the capacity decreases.

Example 2 – Lifting on the Main Hook with the Jib Extended.

For some lifts the jib will be fitted to the main boom rather than being stowed. Even when the jib is fitted you may still need to lift loads using the main hook.

Use the "Crane Specifications –Slewing Mobile Crane (Up to 60 Tonnes)" found in Appendix B to work out the maximum load that can be lifted on the main hook using the following configuration:

Crane Configuration	
Outriggers	Maximum Extension
Main Boom Length	27.40m
Working Radius	16.0m
Operating Area	360° (over side and rear)
Jib	15.54m jib fitted with single line auxiliary hook incorporating a 20° offset.
Lifting Gear	5 Sheave Hook Block

Step 1 – Select the Applicable Load Chart Section

The first step in working out the maximum load is to work out which section of the specifications relates to the configuration of the crane.

This configuration is on outriggers at maximum extension and with an operating area of 360°. Because the jib is not being used to lift the load we will be referring to the "360° Load rating in Kilograms with the Outriggers at Maximum Extension (m)" chart.

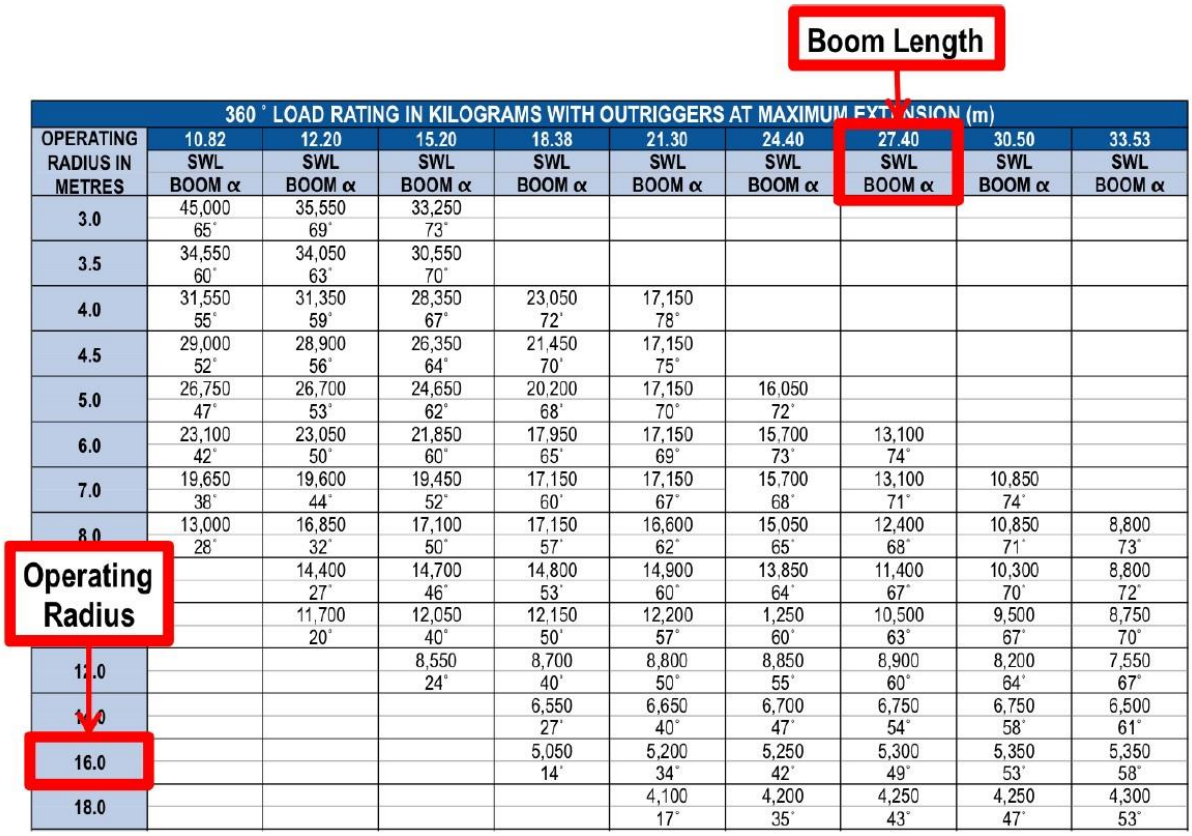
360 ° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)

OPERATING RADIUS IN METRES	10.62 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65°	35,550 69°	33,250 73°						
3.5	34,550 60°	34,050 63°	30,550 70°						
4.0	31,550 55°	31,350 59°	28,350 67°	23,050 72°	17,150 78°				
4.5	29,000 52°	28,900 56°	26,350 64°	21,450 70°	17,150 75°				

Step 2 – determine the Rated capacity for the Configuration

The second step in working out the maximum load involves using the chart to find the rated capacity that corresponds to the main boom length and the operating radius.

The main boom length is 27.40m and the operating radius is 16.0m.



360 ° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65°	35,550 69°	33,250 73°						
3.5	34,550 60°	34,050 63°	30,550 70°						
4.0	31,550 55°	31,350 59°	28,350 67°	23,050 72°	17,150 78°				
4.5	29,000 52°	28,900 56°	26,350 64°	21,450 70°	17,150 75°				
5.0	26,750 47°	26,700 53°	24,650 62°	20,200 68°	17,150 70°	16,050 72°			
6.0	23,100 42°	23,050 50°	21,850 60°	17,950 65°	17,150 69°	15,700 73°	13,100 74°		
7.0	19,650 38°	19,600 44°	19,450 52°	17,150 60°	17,150 67°	15,700 68°	13,100 71°	10,850 74°	
8.0	13,000 28°	16,850 32°	17,100 50°	17,150 57°	16,600 62°	15,050 65°	12,400 68°	10,850 71°	8,800 73°
		14,400 27°	14,700 46°	14,800 53°	14,900 60°	13,850 64°	11,400 67°	10,300 70°	8,800 72°
		11,700 20°	12,050 40°	12,150 50°	12,200 57°	1,250 60°	10,500 63°	9,500 67°	8,750 70°
12.0			8,550 24°	8,700 40°	8,800 50°	8,850 55°	8,900 60°	8,200 64°	7,550 67°
14.0				6,550 27°	6,650 40°	6,700 47°	6,750 54°	6,750 58°	6,500 61°
16.0				5,050 14°	5,200 34°	5,250 42°	5,300 49°	5,350 53°	5,350 58°
18.0					4,100 17°	4,200 35°	4,250 43°	4,250 47°	4,300 53°

The intersecting point between the “main boom length” column and the “operating radius” row contains all of the rated capacity and boom angle information relating to this configuration.

360 ° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
3.0	45,000 65°	35,550 69°	33,250 73°						
3.5	34,550 60°	34,050 63°	30,550 70°						
4.0	31,550 55°	31,350 59°	28,350 67°	23,050 72°	17,150 78°				
4.5	29,000 52°	28,900 56°	26,350 64°	21,450 70°	17,150 75°				
5.0	26,750 47°	26,700 53°	24,650 62°	20,200 68°	17,150 70°	16,050 72°			
6.0	23,100 42°	23,050 50°	21,850 60°	17,950	17,150	15,700 73°	13,100 74°		
7.0	19,650 38°	19,600 44°	19,450 52°			5,700 68°	13,100 71°	10,850 74°	
8.0	13,000 28°	16,850 32°	17,100 50°			5,050 65°	12,400 68°	10,850 71°	8,800 73°
9.0		14,400 27°	14,700 46°			3,850 64°	11,400 67°	10,300 70°	8,800 72°
10.0		11,700 20°	12,050 40°	50	57	,250 60°	10,500 63°	9,500 67°	8,750 70°
12.0			8,550 24°	8,700 40°	8,800 50°	8,850 55°	8,900 60°	8,200 64°	7,550 67°
14.0				6,550 27°	6,650 40°	6,700 47°	6,750 54°	6,750 58°	6,500 61°
16.0				5,050 14°	5,200 34°	5,250 42°	5,300 49°	5,350 53°	5,350 58°
18.0					4,100 17°	4,200 35°	4,250 43°	4,250 47°	4,300 53°
20.0						3,350 24°	3,400 37°	3,450 43°	3,450 49°
22.0						2,700 10°	2,750 30°	2,800 38°	2,850 45°
24.0							2,250 18°	2,300 31°	2,350 39°
26.0								1,850 24°	1,900 32°
28.0								1,500 19°	1,550 30°
30.0									1,250 17°

5,300
49°

The rated capacity for this configuration is 5300kg, with a boom angle of 49°.

Step 3 – determine the Weight of Lifting Gear
The third step consists of determining what adjustments (or deductions) need to be made to the rated capacity.

Deductions include the weight of any lifting gear and the jib.

Adjustments:

- The Lifting gear being used in this example is the five sheave hook block and it weights 400kg.
- The jib is 15.54m and is fitted on the boom and weighs 1800kg.
- The jib is fitted with a single line weighted hook (auxiliary hook), which weighs 150kg.

This makes a total deduction of:

400 + 1800 + 150 = 2350kgs

WEIGHT OF LIFTING EQUIPMENT				
LIFTING GEAR	SINGLE LINE WEIGHTED HOOK	2 SHEAVE HOOK BLOCK	3 SHEAVE HOOK BLOCK	5 SHEAVE HOOK BLOCK
WEIGHT TO BE DEDUCTED FROM SWL	150 kgs	300 kgs	350 kgs	400 kgs

JIB WEIGHTS – BOOM DEDUCTIONS			
BOOM EQUIPPED WITH	JIB STORED	8.69m	15.54m
BOOM DEDUCTION	400 kgs	900 kgs	1800 kgs

Step 4 – Complete Calculations

The fourth step involves subtracting the weight of any lifting gear and the jib from the rated capacity of this configuration.

The maximum load that can be lifted by a configuration can be found by using the following formula:

Maximum Load = Rated Capacity – Weight of Lifting Gear

Maximum Load = Rated Capacity – Weight of Lifting Gear
= 5300kg – 2350kg
= 1950kg

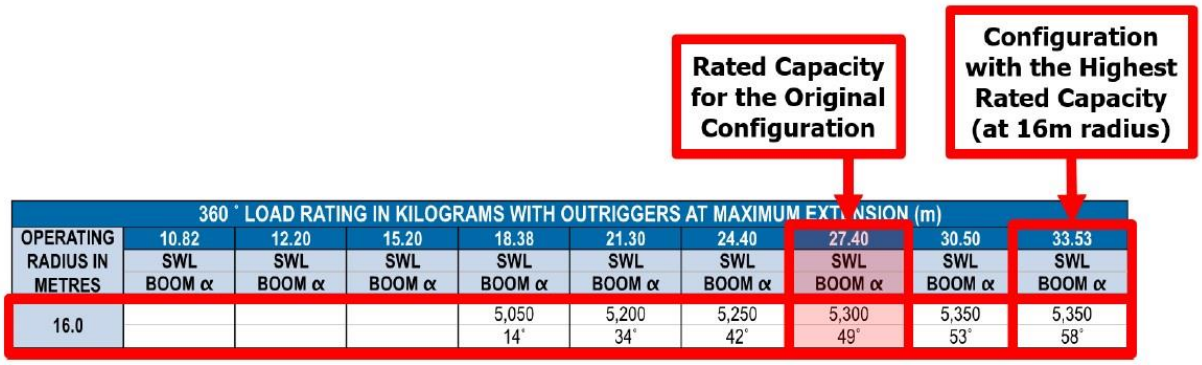
Therefore, the maximum load that could be lifted in this configuration would be 1950kg.

INCREASING THE CAPACITY USING THE SAME RADIUS

On some occasions you will need to determine if a heavier load can be lifted, while keeping the same operating radius.

To determine if this is possible focus on the row with the same operating radius. Using the information from example 2 this would be the 16.0m row.

Looking across the row the highest possible rated capacity occurs when the boom is extended to 33.53m, with the capacity increased from 5300kg to 5350kg. This is an increase of 50kg.



360 ° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)

OPERATING RADIUS IN METRES	10.82 SWL BOOM α	12.20 SWL BOOM α	15.20 SWL BOOM α	18.38 SWL BOOM α	21.30 SWL BOOM α	24.40 SWL BOOM α	27.40 SWL BOOM α	30.50 SWL BOOM α	33.53 SWL BOOM α
16.0				5,050 14°	5,200 34°	5,250 42°	5,300 49°	5,350 53°	5,350 58°

Example 3 – Lifting on the Auxiliary Hook with the Jib Fitted (Based on Radius)

When the jib is fitted a load can also be raised on the hook fitted to the jib, which is the auxiliary hook.

The maximum load that can be raised on the auxiliary hook using the same configuration details as in example 2 can also be found by referring to "Crane Specifications – Slewing Mobile Crane (Up to 60 Tonnes)" found in Appendix B.

Step 1 – Select the Applicable Load Chart Section

The first step to finding the maximum load that a configuration can lift is to locate the relevant information in the crane specifications.

For this configuration we will be using "jib Load Rating – kgs" table because the auxiliary hook is fitted to the jib.

JIB LOAD RATING – kgs

JIB OFFSET	2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050

Step 2 – Determine the Rated Capacity for the Configuration

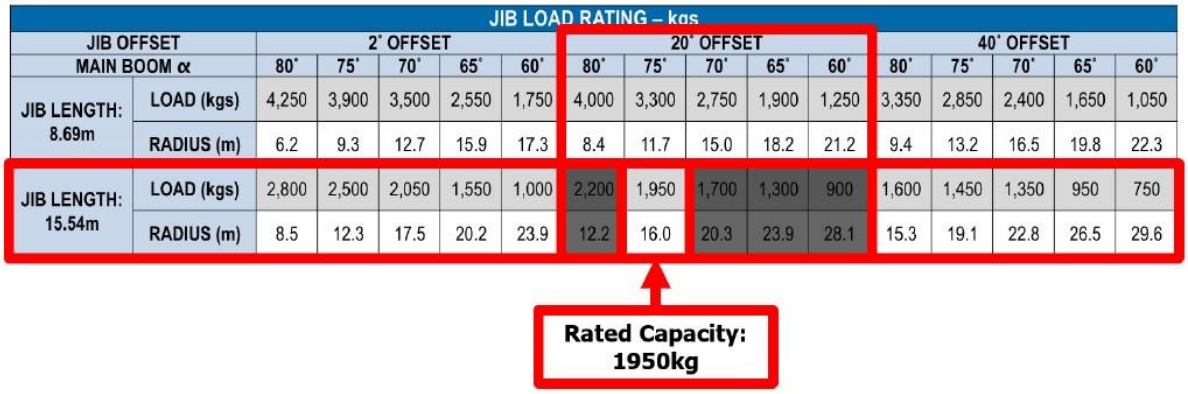
The second step in working out the maximum load involves using the chart to find the rated capacity that corresponds to the offset, jib length and the operating radius.

The jib offset is 20° and the jib length is 15.54m.

JIB LOAD RATING – kgs																
JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.69m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9.4	13.2	16.5	19.8	22.3
JIB LENGTH: 15.54m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

The intersecting point between the "Offset" column and "Jib length" row contains the information for different operating radius lengths.

The Operating radius we require is 16.0m. The rated capacity for this configuration can be found in the corresponding load row.



JIB LOAD RATING – kgs																
JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.69m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9.4	13.2	16.5	19.8	22.3
JIB LENGTH: 15.54m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

The rated capacity for this configuration is 1950kg.

If the exact radius is not listed you should go to the next highest radius. For example, if the required radius was 15m, the next highest radius would be 16.

Step 3 – Determine the Weight of Lifting Gear

The third step consists of determining what adjustments (or deductions) need to be made to the rated capacity.

Deductions include the weight of nay lifting gear. The jib does not need to be deducted because the Jib load Rating has already been included in the rated capacity amount.

Adjustments:

- The lifting gear being used in this example is the five sheave hook block and it weights 400kg.
- The jib is fitted with a single line weighted hook (auxiliary hook), which weighs 150kg.

This makes a total deduction of:
400 + 150 = 550kg

WEIGHT OF LIFTING EQUIPMENT				
LIFTING GEAR	SINGLE LINE WEIGHTED HOOK	2 SHEAVE HOOK BLOCK	3 SHEAVE HOOK BLOCK	5 SHEAVE HOOK BLOCK
WEIGHT TO BE DEDUCTED FROM SWL	150 kgs	300 kgs	350 kgs	400 kgs

Step 4 – Complete Calculations
The maximum load that can be lifted by a configuration can be found by using the following formula:

Maximum Load = Rated Capacity – Weight of Lifting Gear
= 1950kg – 550kg
= 1400kg

Therefore, the maximum load that could be lifted in this configuration would be 1400kg.

Example 4 – Lifting on the Auxiliary Hook with the Jib Fitted (Based on Angle)

During some lifts the required configuration will be based on a required boom angle, rather than the radius.

Use the "Crane Specifications – Slewing Mobile Crane (Up to 60 Tonnes)" found in Appendix B to work out the maximum load that can be lifted on the auxiliary hook using the configuration from example 2, using the boom angle, rather than a required working radius.

Crane Configuration	
Outriggers	Maximum Extension

Main Boom Length	27.40m
Boom Angle	65°
Operating Area	360° (over side and rear)
Jib	15.54m jib fitted with single line auxiliary hook incorporating a 20° offset.
Lifting Gear	5 Sheave Hook Block

Step 1 – Select the Applicable Load Chart Section

The first step to finding the maximum load a configuration can lift is to locate the relevant information in the crane specifications.

For this configuration we will be using the "Jib Load Rating – kgs" table because the auxiliary hook is fitted to the jib.

JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050

Step 2 – Determine the Rated Capacity for the Configuration

The second step in working out the maximum load involves using the chart to find the rated capacity that corresponds to the offset, jib length and the boom angle.

The jib offset is 20° and the jib length is 15.54m.

JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.[illegible]m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9.4	13.2	16.5	19.8	22.3
JIB LENGTH: 15.54m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

The required boom angle is 65°.

JIB LOAD RATING – kgs																
JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.69m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9.4	13.2	16.5	19.8	22.3
JIB LENGTH: 15.54m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

The rated capacity for this configuration can be found in the corresponding load row for the 15.54m length jib.

JIB LOAD RATING – kgs																
JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM α		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.69m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9.4	13.2	16.5	19.8	22.3
JIB LENGTH: 15.54m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

The rated capacity for this configuration is 1300kg.

Step 3 – Determine the Weight of Lifting Gear
The third step consists of determining what adjustments (or deductions) need to be made to the rated capacity.

Deductions include the weight of any lifting gear. The weight of the jib does not need to be deducted in this configuration because the jib Load rating has already been factored into the rated capacity amount.

Adjustments:

- The lifting gear being used in this example is the five sheave hook block and it weights 400Kg
- The jib is fitted with a single line weighted hook (auxiliary hook), which weighs 150kg.

This makes a total deduction of:
400 + 150 = 550kg

WEIGHT OF LIFTING EQUIPMENT				
LIFTING GEAR	SINGLE LINE WEIGHTED HOOK	2 SHEAVE HOOK BLOCK	3 SHEAVE HOOK BLOCK	5 SHEAVE HOOK BLOCK
WEIGHT TO BE DEDUCTED FROM SWL	150 kgs	300 kgs	350 kgs	400 kgs

Step 4 – Complete Calculations

The maximum load that can be lifted by a configuration can be found by using the following formula:

Maximum Load = Rated Capacity – Weight of Lifting Gear
= 1300kg – 550kg
= 750kg

Therefore, the maximum load that could be lifted in this configuration would be 750kg.

REVIEW WORK PLANS AND INFORMATION

Before starting any crane operations you will need to make sure that all necessary factors have been considered so that you can do any lifts safely.

Make sure you have taken into account the following:

- The weights and dimensions (sizes) of loads you need to move.
- The chosen crane is capable of lifting these loads.
- Access to and egress from the areas you are working in or the routes you need to take, including the loading and set-down sites.
- Hazards and obstructions been dealt with.
- Potential boom deflection when releasing a load.

When you are confident that all necessary factors have been considered and all potential problems dealt with, you will be able to start operations.

POSITION THE CRANE HOOK

The crane hook should be positioned above the centre of gravity of the load before lifting operations are commenced. This will help to keep the load from swinging out of control, slipping from the sling arrangement when lifted, or being dragged or snigged when it is moved. Get the dogger or rigger to guide you to make sure the crane hook is positioned correctly above the load.

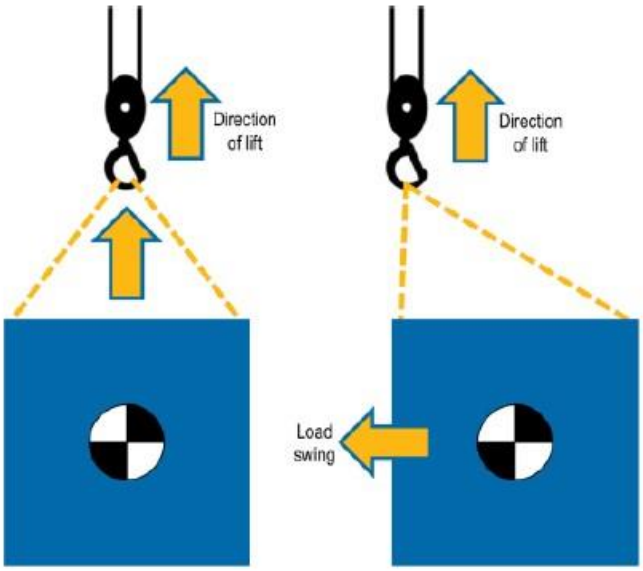
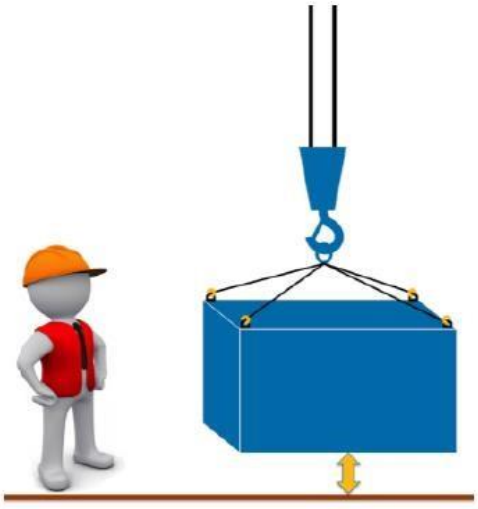


Figure 25 – Hook Position

CONDUCT A TEST LIFT

Before moving the load it is important to conduct a test lift.

A test lift is performed by raising the load slightly off the lifting plane (e.g. ground or truck bed). Associated personnel such as dogger's and riggers will be able to determine if the load is slung correctly by the amount the load moves as lifted.



Conducting a test lift will allow you to check: The load is: Stable Secure

- The crane functions are working correctly.

Test lifts can also be used to ensure that:

- Load measuring equipment can be used to verify the calculated weight of the load.
- Near-capacity loads do not overload the crane.
- Loads of unusual shape or weight distributions are slung correctly.
- All crane equipment is functioning correctly.
- Adjustments to the slinging can be made in a safe manner.

If there are any problems with the lift (e.g. the load is unstable or slung incorrectly) then you should lower the load immediately and make the necessary adjustments before conducting another test lift. Don't continue working until the issues have been addressed and fixed.

FOLLOW COMMUNICATION SIGNALS

Always follow the directions given to you by the person dogging the load. To direct you they may use:

- Hand Signals.
- Whistle Blasts.
- Two-Way radios.

They may also use verbal communication, particularly when planning the move or discussing the work.

If at any point you are unsure of the directions being given to you, stop all crane motions and confirm the instructions with the person giving them (dogger, spotter, or observer).

Figure 26 – Hand Signals (example)

Shown here are the hand signals and whistle signals used in Australia.

ACTION	WHISTLE, BELL or BUZZER	HAND SIGNAL
Hoist Raising	2 Short ●●	
Hoist Lowering	1 Long ▬	
Luffing Boom up	3 Short ●●●	
Luffing Boom Down	4 Short ●●●●	
Slew Right	1 Long, 2 Short ▬ ●●	
ACTION	**WHISTLE, BELL or BUZZER**	**HAND SIGNAL**

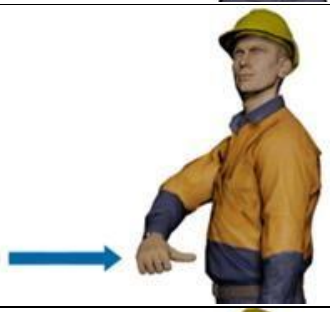
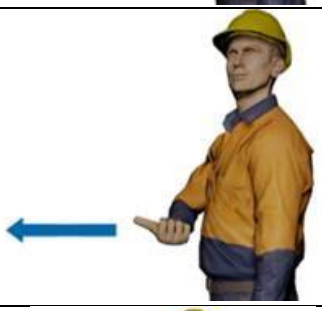
Slew Left	1 Long, 1 Short 	
Jib/Trolley Out **Telescoping Boom Extended**	1 Long, 3 Short 	
Jib/Trolley In **Telescoping Boom Retract**	1 Long, 4 Short 	
Stop	1 Short 	

Table 7 – Hand & Whistle Signals

OPERATE THE CRANE

Once you are satisfied that the load is ready to be moved safely, begin the lift. If your view is obstructed, get a competent person to warn you of any hazards in the path of the load.

If new or unforeseen hazards appear while operations are being carried out, you will need to stop and control them before carrying on with your work.

Always operate the crane according to procedures, including:

- Manufacture's guidelines.
- Industry operating procedures.
- Workplace procedures.

Consult the crane's load charts and manufacture's specifications to find information when deciding which side of the rubber-rated crane is the most stable to lift a load over.

CRANE MOVEMENTS

Follow all appropriate procedures and standards when transferring loads. Make sure all crane movements are controlled and smooth. Quick or jerky movements may cause the load to swing, increasing the operating radius to a dangerous length resulting in a carrier instability or structural damage to the crane.

Relevant crane movements will be determined by the task requirements. They may include:

- Moving the boom/jib up and down, otherwise known as luffing.
- Operating the outriggers/stabilisers.
- Slewing the boom/jib.
- Telescoping in and out.
- Travelling or mobiling the crane.

Consult the load chart to find out what effect slewing the boom from the front of the vehicle to the back of the vehicle will have on the lifting capacity of the crane (it may vary a great deal).

Always stay within the safe operating radius of the crane.

If at any time the crane cannot function to its full range of movements you must:

- Tag out the crane.
- Log the issue in the crane logbook.
- Report the issue following workplace requirements.

USING THE LUFF PAWL

Luffing down too quickly may cause the pawl to bend or break as it engages the ratchet.

Note: Exercise extreme caution when luffing down with the luff pawl engaged!

You can disengage the pawl, before luffing out, by depressing the luff pawl button and luffing up very slowly.

DOUBLE BLOCKING

A hoist limit or cut –out switch can be used to stop the winch or warn the operator before the hook block makes contact with the head block.

Figure 27 – Hook & Head Block

If the hoist limit switch is exceeded this can cause damage to the crane by the hook/block assembly being dragged into the head sheaves, or double blocking (sometimes known as two-blocking), which prevents further winding up of the hoist drum.

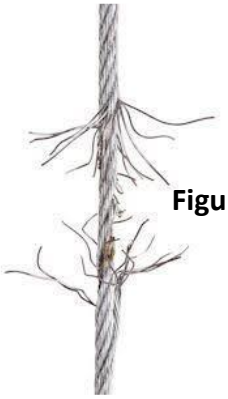


Figure 28 – Broken FSWR

Double blocking can result in the following:

- Broken flexible Steel Wire Rope (FSWR).
- Dropped load.
- Damaged sheave.
- Structural damage to the crane.

Ensure that the hoist limit/cut-out switch is checked and fully functioning before operating the crane.

LIFTING PERSONNEL

If you are going to lift personnel with a crane you will need to use a workbox that meets all the necessary requirements of the workplace, the crane manufacture and Australian Standards.

When lifting personnel with the crane, ensure that the dogger is located in a position where they can safely observe and direct the movements of the crane.

Figure 29 – Work Box / Man Cage

USING TAG LINES

If other personnel are involved in the lift, the dogger may use a tagline to assist in controlling the load and the safe landing of the load.

It is necessary to use a tagline when working near overhead powerlines or if there is a risk of a loss of control during the landing process.

Dry non-conductive rope, natural fibre rope or dry natural rope should be used as taglines to reduce the risk of conductivity.

Figure 30 – Tag Line

Non-conductive ropes should be used as taglines to reduce any risk of conductivity.

Note: make sure the tagline is at least 16mm in diameter.

MONITOR THE MOVEMENT OF THE LOAD

It is important to continually monitor the movement of the load to make sure the load remains safe, that no workers are put in danger and that the crane remains stable. This enables you to identify and control any hazards that may occur while moving the load.

Do not raise or lower the boom or load over workers or pedestrians. This is extremely dangerous and could result in a serious injury or death.

Never drag or snig the load as this may cause the crane to overload, cause damage to the crane, load or lifting equipment, or cause the crane to become unstable.

REVIEW THE ROUTE OF TRAVEL

Before moving off with the crane and load check that the path of movement is appropriate for the crane.

You should check the route of travel for:

- Uneven or dangerous terrain and other obstacles or obstructions.
- Hazards that may have appeared while you have been operating the crane.
- All surfaces over which you are to travel can take the weight of the crane.
- Pot holes and soft or rough ground.
- Powerlines.
- Overhead obstructions.
- Obstacles.
- Workers in the area.
- Blind corners.
- Traffic flow.
- Underground services.

Organise to have materials moved out of the way where possible and have traffic controlled to prevent an accidents.

CONFIGURE THE CRANE TO MOBILE LOADS

Configure the crane to mobile the load according to the manufactures instructions.

If you are required to mobile the crane with a load on the hook make sure the crane boom and rope are configured with the boom retracted and lowered, with minimal fall in the rope, and as close to the ground as is reasonably possible.

Make sure all outriggers/stabilisers are stowed and locked before the crane is mobilised, Store all loose components and restrain the boom according to procedures. Disengage all drives and put the controls in the off position. Release any brakes and prepare to mobile the crane.

MOBILE THE LOAD

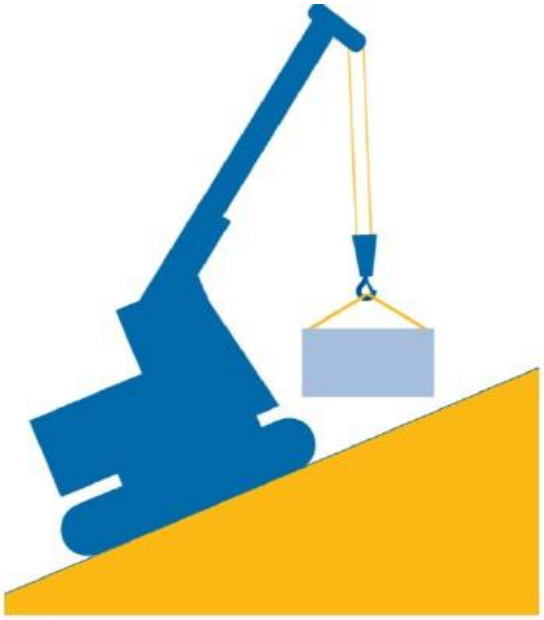
Follow all safety procedures while mobiling a load including:

- Keep to an appropriate speed. This could be:
  - A speed that is safe for the working environment
  - As slow as possible ○ At walking pace
- Accelerate and brake gently to minimise load swing.
- Keep the boom/jib at a minimum length.
- Keep the load as close to the ground as possible.
- Keep the boom/jib as low as possible and in line with the crane.
- If possible, try to stay on a firm, level surface while mobiling a load as this will keep the crane stable and keep the amount of load swing to a minimum. Keep the load stable by using taglines.

MOBILING LOADS ON SLOPES OR INCLINES

Extra care needs to be taken when mobiling loads on slopes or inclines. To do this safely you should:

- Always have the load facing up hill when moving up or down a hill.
- Be aware of the ground conditions – smooth, even, slippery, side slope etc.
- Consider:
    - Rated capacity of the carne ○ Speed of travel – it may be different to mobiling on level surfaces
    - Load swing ○ Having load as close to the ground as possible and safe
    - Minimum boom extension and angle
- Operate in accordance with the crane load chart and manufactures instructions.



Mobiling a load up an incline is hazardous and you will need to be careful that the crane does not loose stability.

MONITOR WEATHER CONDITIONS

Keep an eye on the weather conditions around the crane.

WIND

Be particularly careful of the effect of wind.

The force of the wind may cause the load to swing or spin around or cause instability or damage.

Facing the crane into the wind may force the boom back into the crane causing structural damage to the crane. It may also cause the crane to tip backwards. The effect will depend on the type of crane superstructure.

The effect of wind during load shifting operations can be minimised by applying the slew brake, lowering the load and making it safe, confirming that the slew brake is applied, applying guy ropes and braces or by stopping work completely.

If wind speeds exceed the allowable limits for the carne you will need to lower the load and make the carne and load safe.

Check the manufactures specification or the crane itself for information related to maximum allowable wind speeds for operations.

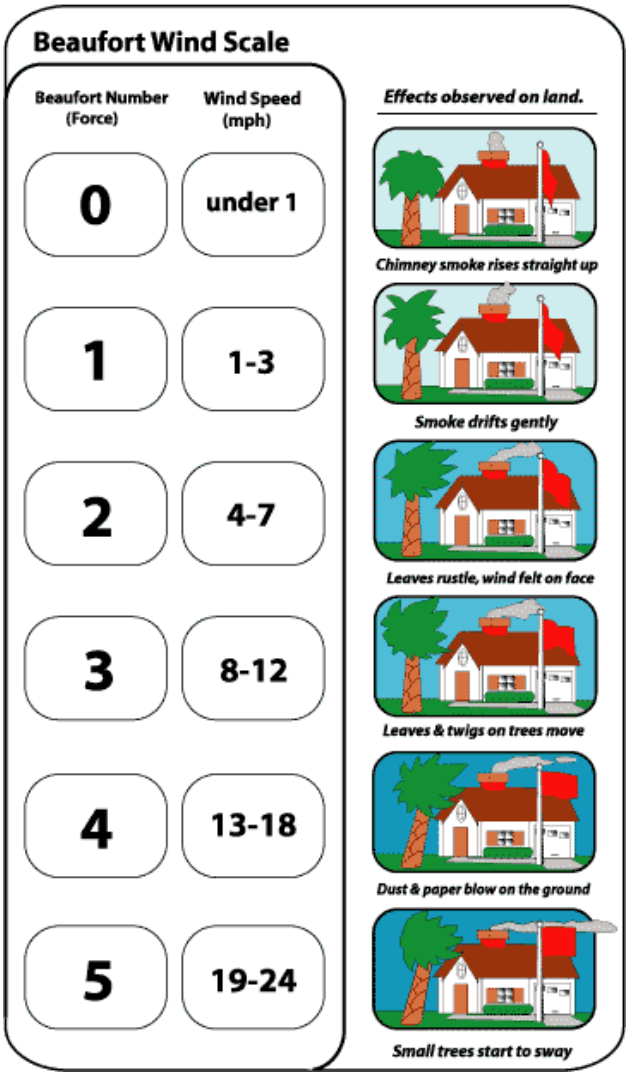


Figure 31 – Beaufort Wind Scale

ELECTRICAL STORM

If a severe electrical storm is approaching you

should lower the load and pack up the crane. Do not operate the crane during an electrical storm.

If it begins to rain heavily and you have to stop operating the crane for a period of time, you must re-check the ground conditions before recommencing work. If the ground has become unsuitable you will have to move the crane to a new position.

LAND THE LOAD

It is important to minimise upwards boom/jib movement when releasing a heavy load from the crane hook. Slowly and smoothly release the load, lowering the boom/jib a fraction to compensate for any upward movement.

Land the load at the prepared load destination. The load destination should be prepared to ensure that the load is stable and secure from movement once landed. Loads should be landed on blocks or packing (where necessary) to allow the safe removal of the lifting gear.

Round loads should be chocked to prevent the load from rolling or shifting once the lifting gear is removed. Lifting equipment should be properly stored or prepared for the next task.

Do not continue to winch/luff down after landing the load or hook block. This can cause bird nesting, loose spooling of the winch wire or unsheaved rope in the sheaves.

Do not leave the crane controls until you have done the following:

1. Made sure the crane is not still carrying a load.
2. Raised the crane hook to a safe height.
3. Shut down the crane according to manufactures specifications.
4. Folded/retracted the boom (if applicable).
5. Secured the crane against unauthorised use.

Note: No load should be allowed to remain suspended on the hook if the crane is going to be left unattended. Leaving the load suspended from the hook creates the risk that the load may lower, swing or become unstable.

UNPLANNED AND UNSAFE SITUATIONS

Unplanned or unsafe situations can occur at any time while you are operating the crane. These may include:

- Failure/loss of control (e.g. brakes, steering). Failure of equipment (e.g. hydraulic system).
- Environmental conditions (e.g. wind, lightning, storms).
- Obstacles and obstructions.
- Unusual or difficult terrains.

If an unsafe incident occurs whilst you are operating the crane you will need to:

1. Stop work immediately and if is safe to do so.
2. Access the problem.
3. Find a solution if possible (resolve the problem).
4. If needed, seek advice and assistance.
5. Report the incident according to procedures.

CRANE MALFUNCTIONING

Keep a look out for indications that the carne is malfunctioning, including warning lights, cutouts and alarms, during crane operations. They may indicate that a defect has occurred>

If you observe these warning signs you will need to the following:

1. Stop.
2. Identify the problem.
3. Slowly lower the load, ensuring it is under control.
4. Tag out the crane.
5. Report the problem to the appropriate person.
6. Fill out the logbook.
7. Do not use the crane until the problem has been fixed.

PROBLEM WITH A LIMITING DEVICE

If you found a limiting device had been damaged or was not working correctly you would need to take the following steps:

1. Stop work immediately.
2. If you are carrying a load then it should be lowered to the ground (if safe to do so).
3. Put a danger tag on the crane.
4. Report the problem to an appropriate person.
5. Record the issue in the logbook for repair so any defects can be fixed.

ABNORMAL NOISES AND VIBRATIONS

If at any time during the shifting of loads there is an abnormal movement of the boom or hoist, such as vibrations, or abnormal noises you should immediately:

1. Notify the dogman and anyone in the immediate area.
2. Stop the operation/task.
3. Lower the load (if applicable).

4. Shut down the crane.
5. Tag out the crane.
6. Report the problem to the appropriate person.
7. Have the crane inspected to check for any damage caused.
8. Fill out the logbook.
9. Do not use the crane until the problem has been fixed.

LOOSE CONNECTION PINS

If you notice during operations that the connection pins on the lattice boom section on a pin jib crane are loose, you will need to stop work straight away and contact an authorised person (e.g. supervisor).

PROBLEM WITH THE CRANE 'S COMPUTER OR VISUAL DISPLAY

If the computer or visual display is not working correctly when lifting loads, you will need to:

1. Slowly lower the load, ensuring it is under control (if applicable).
2. Shut down the crane.
3. Assess the computer or visual display unit and decide if the problem can immediately be fixed.
4. Tag out the crane.
5. Refer to the load chart.
6. Report the problem to the appropriate person.
7. Fill out the log book.
8. Do not use the crane until the problem has been fixed.

UNSTABLE CRANE OR LOAD

If the crane becomes unstable during operations (e.g. an outrigger pad begins to sink), you will need to lower the load, stop operating the crane, assess the situation and seek help.

If the outrigger packing begins to sink into the ground during crane operation, you must immediately:

1. Lower the load if it is safe and appropriate.
2. Stop operations.
3. Assess the situation.
4. Seek assistance.
5. Report the issue to the appropriate person.

If at any time the load becomes unstable, stop and lower the load (if safe to do so) and address the reason for the instability (e.g. lifting gear, crane, weather conditions).

CONTACT WITH POWER LINES AND OTHER ELECTRICAL EMERGENCIES

Emergency situations involving electricity are extremely serious as injury or death can occur very quickly. A timely and effective response is necessary to deal with the situation.

If the crane comes into contact with overhead power lines or the dogger shows signs of electrocution from the crane hook, you will need to:

- DO NOT touch anyone who is being electrocuted or is in contact with power lines.
- Warn others to stay away.
- Try to break the contact with the power line.
- Stop the crane.
- If it is safe to do so, stay in the crane. If this isn't possible, jump clear of the crane and then hop or shuffle away, at least 8m from the closest part of the crane. The emergency descent device may also need to be activated.
- Call for help.
- Render any assistance required.
- Secure the area.
- Follow the site procedures for first aid and reporting incidents.
- Report to the required parties:
    - Management ○ Power company ○ Safety regulator
- Before using the crane have it checked and approved for use.

WORKPLACE EMERGENCIES

Site emergencies may include:

- Fire (electrical, chemical, gas, mechanical, paper, wood or natural).
- Gas leak.
- Toxic and/or flammable vapour emissions.
- Vehicle/machine accident.
- Chemical spill.
- Injury to workers.
- Structural collapse.

Always communicate with the person dogging the load prior to leaving the crane.

EMERGENCY RESPONSE

If an emergency situation arises it is essential to communicate the important information. You should communicate:

- That an emergency situation exists.
- The nature of the emergency (e.g. fire, structure collapse).
- Where the emergency is and the unsafe area/s.

Always follow the emergency procedures for the workplace, such as evacuating personnel or contacting the first aid officer.

REPORTING THE EMERGENCY

There are a number of people that will need to be told about the emergency. These include:

- Other people at the workplace.
- The workplace safety officer.
- Management and supervisors.
- Emergency services.

When calling emergency services (dial 000) let the operator know the following details:

- Where the emergency is.
- What has happened.
- What is being done to address the emergency.
- Your name.

FIRST AID

First aid kits must be supplied by your employer. The location of these kits should be clearly marked with signage.

In the case of an emergency where somebody requires first aid, notify your supervisor or first aid officer and they will take action.

CONCLUDE OPERATIONS

Once the job has been completed you will need to conclude operations in accordance with site procedures and manufactures specifications.

Generally this will involve:

- Removing hazard control measures.
- Packing up the crane.
- Shutting down and securing the crane.

LEAVING THE CRANE OVERNIGHT

If you are leaving the crane unattended overnight you will need to:

- Remove the load and all lifting gear.
- Raise the hook to a safe height.
- Retract the boom (if applicable). Restrict access to the crane.

REMOVING HAZARD CONTROL MEASURES

Any hazard control measures that are no longer required should be removed from the work area (e.g. removal of temporary fences/barricades or signage).

PACKING UP THE CRANE

Once the hazard control measures have been removed, the crane needs to be packed up in preparation for travel to the designated secured shutdown location.

It is important that all site procedures and manufactures specifications are followed throughout this process.

The packing up of the crane may include:

- Stowing and securing the crane boom/jib.
- Applying motion locks and brakes.
- Stowing and securing the outriggers/stabilisers. Stowing and securing the plates and packing.

STOW AND SECURE THE CRANE BOOM/JIB

Stow the boom/jib during shutdown, before you move the crane. Follow all of the manufactures instructions and specifications when stowing the crane boom/jib.

Secure the boom using the relevant motion locks and brakes (e.g. hoist lock).

Secure the hook as per the manufactures specifications.

APPLY MOTION LOCKS AND BRAKES

It is important that all relevant motion locks and brakes are applied when shutting the crane down. Ensure that all manufactures specifications and site safety procedures are followed.

STOW AND SECURE OUTRIGGERS/STABILISERS

Follow all appropriate procedures when securing and stowing the outriggers/stabilisers. Retract all outriggers/stabilisers and (if applicable) lock them in with the correct pins.

STOW AND SECURE PLATES AND PACKING

Stow and secure all plates and packing. Clean the steel plates and place 'pig-sty' packing either on the carrier or in a designated storage area so they will be ready and easily accessible for future use.

PREPARING THE CRANE FOR TRAVEL

Once everything has been stowed and secured, check that the crane is prepared for travel to the designated shutdown area.

Make sure that the path of travel is clear and safe to drive the crane along. Ensure that the hook/lifting assembly is raised clear of any obstructions and all parts are in their designated configurations. Ensure that you follow all manufactures specifications and site procedures.

TRAVEL TO SHUTDOWN SITE

Once all appropriate checks have been made and the crane is deemed ready to travel, you may progress to the shutdown site.

Depending on site procedures you may travel to a designated site parking area or an offsite location. Ensure that you follow all manufactures specifications, site safety procedures and

the suite traffic management plans. If the crane is travelling to an offsite location, make sure that all road laws and regulations are followed.

SHUTTING DOWN AND SECURING THE CRANE

Once the crane is in the designated shutdown location ensure that you follow the manufactures specifications and site safety procedures.

A Typical shutdown procedure may include:

- Raising the hook clear of obstructions.
- Retracting the boom/jib.
- Making sure the hoist brake is applied (if applicable).
- Retracting/securing the boom/jib.
- Retracting the outriggers/stabilisers.
- Idling the engine to stabilise the temperature.
- Turning off the engine (where applicable).
- Putting all controls in neutral (if applicable).
- Turning the isolator switch off (if fitted) and securing it.
- Removing the ignition key (where applicable).
- Locking and securing the cabin (where applicable).
- Removing hazard controls if no longer needed. Securing the crane for travel.

CONDUCT POST OPERATIONAL CHECKS

After completing shutdown procedures it is important to conduct all post-operational checks to ensure that the crane is ready for the next operator.

Carry out these checks in accordance with the manufactures instructions and relevant site procedures. You are checking the crane for any damage or defects that have occurred during use.

Refer to the crane logbook or inspection checklist of items that should be checked on the crane.

A routine post-operational check of a slewing mobile crane may involve:

- Checking for any damage including:
  - Structural damage to the boom/jib
  - Damage to the crane
- Checking all fluid levels and for any signs of leaks.

- Making sure loose items are stowed or secured correctly, including plates and packing. Using load restraints if and when necessary.
- Stow the jib, following the manufactures specifications. This may involve lowering/raining/folding the jib, or raising/extending/unfolding the jib.
- Retracting or lowering the boom for any travel.
- Stowing and securing outriggers/stabilisers according to procedures.
- Checking that the hook/lifting assembly has been raised clear of obstructions.
- Any applicable controls are in neutral.
- Making sure the hoist brake is applied.
- Locking and securing the cabin controls and securing access to the crane.
- Turning the isolator switch off (if applicable) and securing it.
- Any other checks as specified in the manufactures instructions.
- Removing any hazard controls (if any are still in place and if required).

REPORT AND RECORD DEFECTS

Any faults that you find during the post-operational checks need to be recorded, reported and appropriately rectified, in line with workplace procedures.

Generally this will involve:

- Isolating the crane or faulty equipment and attaching a danger tag to it.
- Recording the fault as per site procedures (e.g. in the crane logbook or service logbook).
- Reporting the fault to an authorised person for corrective action.

APPENDIX A – SLEWING MOBILE CRANE (UP TO 60 TONNES) INSPECTION CHECKLIST

Slewing Mobile Crane Inspection Checklist			
Company Name:			Date:
Operator Name:			Site:
Machine Number:			
Check Type *(please circle)*	Pre-Start		Post-Operational
Component	**What to Check**	✓	**Comments**
Pre-Start Checks			
External Check			
Structure	Signs of damage to the crane or boom/jib		
Tyres or tracks	Inflation, pressure, tension, damage, covers.		
Outriggers/stabilisers and packing	Excessive wear, damage, cracks, leaks		
Underneath Machine	Leaks, loose parts, damage		
Crane configuration	Is correct for the requirements		
Hydraulic rams and hoses	Damage, wear , leaks		
Wire ropes, anchorages, wedge sockets and splices	Damage, wear, secure		
Winch drum	Cleanliness, damage, condition		
Slew ring	Damage, wear, secure		
Jib	Damage, wear secure		
Needle	Damage, wear secure		
Rooster sheave	Damage, wear secure		
Retaining pins	Damage, wear secure		
Lifting hook	Damage, wear secure		**Out of Service Tag Attached?** Yes / No

Decals and signage	Correct and legible, including rated capacity, manufactures data plate and labels, load charts, crane decals and control labels		
Overall machine	Loose or missing parts, damage, wear, missing guards and safety devices		
Component	**What to Check**	**✓**	**Comments**
Pre-Start Checks			
Engine Check			
Fluids	Oil (motor, hydraulic and gearbox), fuel, battery water, radiator water/coolant level and lubrication (grease)		
Batteries	Cleanliness, loose nuts and bolts		
Air filter	Damage, dirt build up, indicators		
Radiator	Damage, leaks, dirt build up, blockages.		
Hoses	Leaks, wear, damage		
Belts	Tightness, wear, cracks		
Overall engine	Damage, dirt build up, leaks		**Out of Service Tag Attached?** Yes / No
Internal/Cabin Checks			
Levers, controls and gauges	Damage, cleanliness, labels, working		
ROPS	Damage, cracks, wear		
Floor plates	Clear and free of oil/grease		
Seat and seat belts	Adjustment, damage, wear		
Fire extinguisher	Damage, charge, wear, in date		
Logbook, running sheet, vehicle history, service sheets	Present and correct		
Mirrors	Adjusted, clean, visible		**Out of Service Tag Attached?** Yes / No

Overall cabin interior	Cleanliness, damage, missing parts		
Operational Checks			
Master and isolation switches, start switch or key	Present, functioning, damage		
Joy sticks or levers	Functioning, damage, wear		
All crane movements and controls	Working, damage, wear, dirt build up on pedals		
Travel limits	Working correctly		
Warning devices, lights and systems	Functioning, damage, wear		
Horn, lights and drive indicator	Wear, damage, functioning		**Out of Service Tag Attached?** Yes / No

Component	What to Check	✓	Comments
Pre-Start Checks			
Operational Checks - cont.			
Communication system	Working reliably		
Gauges	Oil pressure, fuel level, engine temperature, hydraulics, speedometer		
Two-block/double block system	Present and in good condition		
Outriggers	Deployed and functioning, tyres clear of the ground, crane level and stable		
Packing	Correct size and has been placed correctly		
Radius	Maximum radius and radius load indicator		
Computer	Data accurate and matches crane configuration		**Out of Service Tag Attached?** Yes / No
Action Taken to Repair Slewing Mobile Crane:			

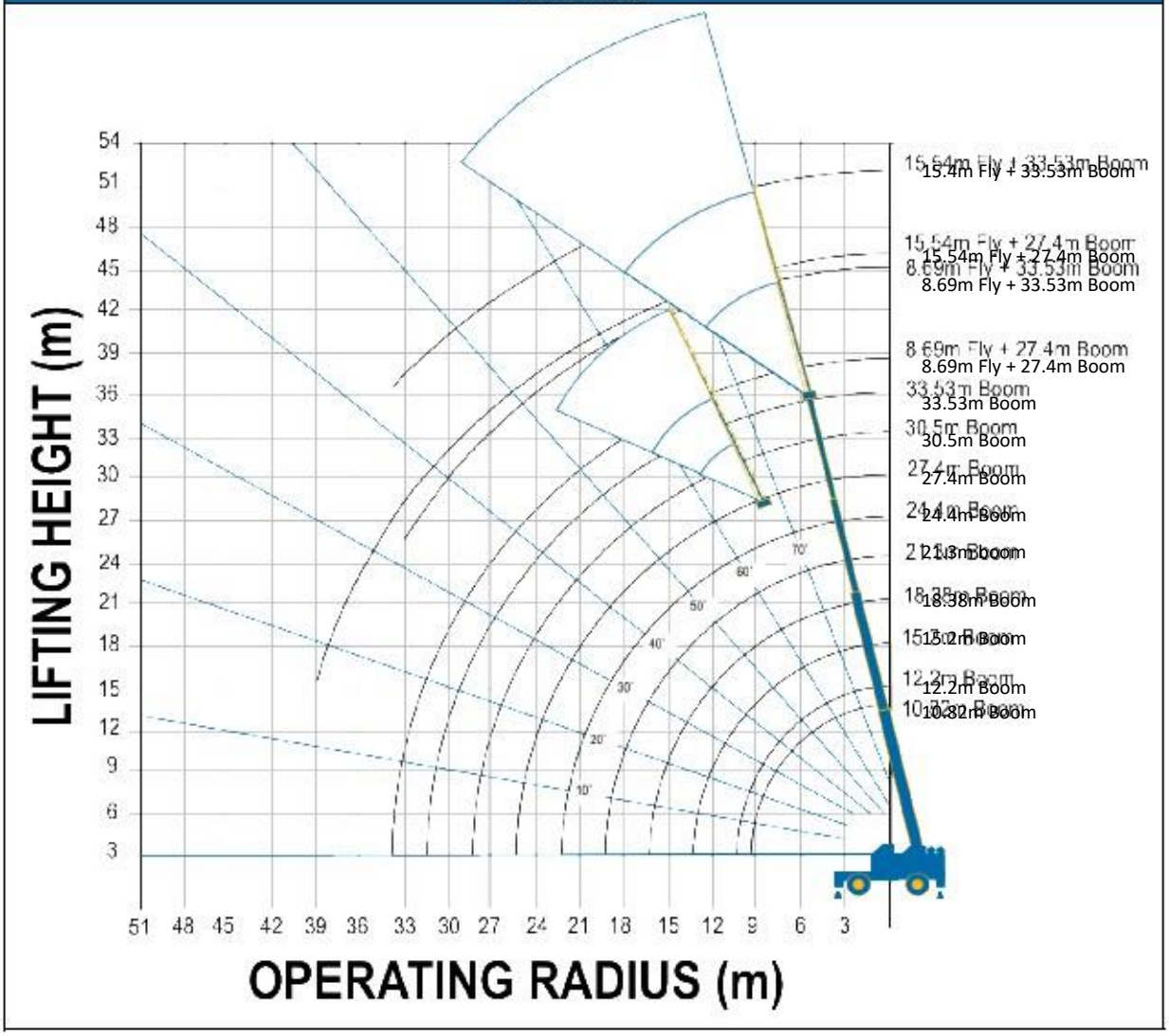
Name:		Date of Repair:
Return to Service Authority by Supervisor:		
Comments:		
Supervisor Name:	Signature:	Date:

APPENDIX B - CRANE SPECIFICATIONS – SLEWING MOBILE CRANE (Up to 60 Tonnes)

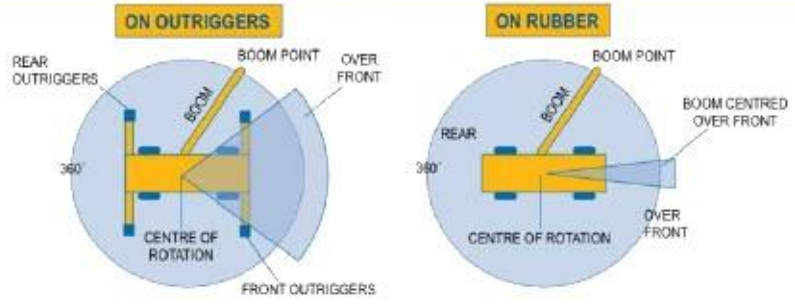
CRANE SPECIFICATIONS – SLEWING MOBILE CRANE (Up to 60 Tonnes)

This load chart is for assessment use only and must not be used for any other purpose.

RANGE CHART



AREA OF OPERATION



CRANE SPECIFICATIONS – SLEWING MOBILE CRANE (Up to 60 Tonnes)

This load chart is for assessment use only and must not be used for any other purpose.

360° LOAD RATING IN KILOGRAMS WITH OUTRIGGERS AT MAXIMUM EXTENSION (m)									
Operating Radius in METRES	10.82	12.20	15.20	18.38	21.30	24.40	27.40	30.50	33.53
	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL	SWL
	Boom	Boom	Boom	Boom	Boom	Boom	Boom	Boom	Boom
3.0	45,000	35.550	33,250						
	65°	69°	73°						
3.5	34,550	34,050	30,550						
	60°	63°	70°						
4.0	31,550	31,350	28,350	23,050	17,150				
	55°	59°	67°	72°	78°				
4.5	29,000	28,900	26,350	21,450	17,150				
	52°	56°	64°	70°	75°				
5.0	26750	26,700	24,650	20,200	17,150	16,050			
	47°	53°	62°	68°	70°	72°			
6.0	23,100	23,050	21,850	17,950	17,150	15,700	13,100		
	42°	50°	60°	65°	69°	73°	74°		
7.0	19650	19,600	19,450	17,150	17,150	15,700	13,100	10,850	
	38°	44°	52°	60°	67°	68°	71°	74°	
8.0	13,000	16,850	17,100	17,150	16,600	15,050	12,400	10,850	8,800
	28°	32°	50°	57°	62°	65°	68°	71°	73°
9.0		14,400	14,700	14,800	14,900	13,850	11,400	10,300	8,800
		27°	46°	53°	60°	64°	67°	70°	72°
10.0		11,700	12,050	12,150	12,200	11,250	10,500	9,500	8,750
		20°	40°	50°	57°	60°	63°	67°	70°
12.0			8,550	8,700	8,800	8,850	8,900	8,200	7,550
			24°	40°	50°	55°	60°	64°	67°
14.0				6,550	6,650	6,700	6,750	6,750	6,500
				27°	40°	47°	54°	58°	61°
16.0				5,050	5,200	5,250	5,300	5,350	5,350
				14°	34°	42°	49°	53°	58°
18.0					4,100	4,200	4,250	4,250	4,300
					17°	35°	43°	47°	53°
20.0						3,350	3,400	3,450	3,450
						24°	37°	43°	49°
22.0						2,700	2,750	2,800	2,850
						10°	30°	38°	45°
24.0							2,250	2,300	2,350
							18°	31°	39°

26.0								1,850	1,900
								24°	32°
28.0								1,500	1,550
								19°	30°
30.0									1,250
									17°

WEIGHT OF LIFTING EQUIPMENT				
LIFTING GEAR	SINGLE LINE WEIGHTED HOOK	2 SHEAVE HOOK BLOCK	3 SHEAVE HOOK BLOCK	5 SHEAVE HOOK BLOCK
WEIGHT TO BE DEDUCTED FROM SWL	150 kgs	300 kgs	350 kgs	400 kgs

JIB WEIGHTS – BOOM DEDUCTIONS			
BOOM EQUIPED WITH	JIB STORED	8.69m	15.54m
BOOM DEDUCTION	400 kgs	900 kgs	1800 kgs

HOIST REEVING						
NUMBER OF PARTS OF ROPE	1	2	3	4	5	6
PERMISSIBLE WINCH LOAD (kgs)	7,500	15,000	22,500	30,000	37,500	45,000

CRANE SPECIFICATIONS – SLEWING MOBILE CRANE (Up to 60 Tonnes)

This load chart is for assessment use only and must not be used for any other purpose.

JIB LOAD RATING - kgs																
JIB OFFSET		2° OFFSET					20° OFFSET					40° OFFSET				
MAIN BOOM		80°	75°	70°	65°	60°	80°	75°	70°	65°	60°	80°	75°	70°	65°	60°
JIB LENGTH: 8.69m	LOAD (kgs)	4,250	3,900	3,500	2,550	1,750	4,000	3,300	2,750	1,900	1,250	3,350	2,2850	2,400	1,650	1,050
	RADIUS (m)	6.2	9.3	12.7	15.9	17.3	8.4	11.7	15.0	18.2	21.2	9,4	13.2	16.5	19.8	22.3
JIB LENGTH: 8.69m	LOAD (kgs)	2,800	2,500	2,050	1,550	1,000	2,200	1,950	1,700	1,300	900	1,600	1,450	1,350	950	750
	RADIUS (m)	8.5	12.3	17.5	20.2	23.9	12.2	16.0	20.3	23.9	28.1	15.3	19.1	22.8	26.5	29.6

NOTES ON LOAD RATINGS	
DEFINITIONS	**Operating Radius** – The horizontal distance from the axis of rotation before loading the centre of the vertical hoist line or tackle with load applied.
	Loaded Boom Angle – This is given to assist in setting up the crane only. It gives an approximation of the radius for a specified boom length. This approximation does not allow for boom or tyre deflection. The ratings are only for the boom length and Load Radius shown.
	Safe Working Load (SWL) – The total suspended load, including the weight of load and handling equipment, that the machine can safely lift under ideal conditions at a given boom length and load radius.
WARNINGS	This machine has been designed to meet the requirements of AS1418.1 & 1418.5 and has been tested in accordance with these standards for pick and carry operations on tyres.
	The Safe Working Loads shown are for this machine as it was originally manufactured. The lifting capacities only apply when all the manufactures instructions have been rigidly followed. Any modifications to this machine or use of equipment other than specified can result in a reduction of capacity.
	If improperly operated or maintained, this machine can be hazardous. Operation and maintenance of this machine must be in compliance with the information in the operators, service, parts and safety manuals furnished.
	Reduced crane lifting capacities for the particular job shall be established by the operator with due allowances for adverse operating conditions. These conditions may include the supporting surface, pendulum action of the load, jerking or sudden stops of the load and other factors affecting stability, two machine lifts, electrical wires, adverse weather, wind hazardous surroundings, experience of personnel, etc.
	Safe working loads are based on freely suspended loads with the machine on a firm, level (max slope 1% gradient / 0.6°) and uniform surface. Lifting or travelling with the load on soft or uneven ground can be hazardous and will reduce the capacity of the crane. No attempt shall be made to drag the load along the ground in any direction.
	The SWL include the weight of hooks, blocks, slings and auxiliary lifting devices. Their weight must be subtracted from the listed rating to determine the net load that can be lifted.
	Loaded boom angles at specified boom lengths give only an approximation of the operating radius. The boom angle before loading should be greater to account for boom deflection increasing the radius as the load is lifted.
	Side loading of the machine and load swing out may cause structural failure of machine tip-over. Side loads may be generated by: lifting when not level; sudden acceleration or deceleration in articulating with a load; pushing a load; wind forces on a load and boom structure.
	It is safe to attempt to telescope any load within the limits of the rating chart. The maximum lad that may be telescoped is limited by hydraulic pressure, boom angle and powered boom sections lubrication.
	The maximum speed for pick and carry operations is 2km/h. The transmission shall be set to low range.