



Mobile Crane Safety



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1. INTRODUCTION

All operators of mobile cranes on CSBP sites shall be licensed and competent to operate the type of cranes they will be using.

All crane operators and or doggers will participate/be involved with the risk assessment document (JSA) for the tasks they and their machine/s were hired into do, by signing onto the JSA so he or she fully understands the hazards and steps of the task being carried out.

Particular hazards exist when operating mobile cranes. Operators, dogger's and personnel in the vicinity of the operating cranes must be alert to the potential for injury and/or damage at all times. These hazards include but not limited to:

- collision of the crane jib or its load, with personnel, equipment or buildings,
- contact with live aerial conductors (overhead power lines),
- overturning of the crane during lift,
- introduction of a source of ignition to a hazardous area,
- damage to underground services and drains.

This guide manual describes the safety controls and precautions to be followed when using mobile cranes. Conditions and requirements for the operation and use of cranes shall be in accordance with:

- Occupational, Safety and Health Regulation 1996,
- AS 2550 Cranes, Safe Use, in particular AS 2550.1 2011 General Requirements, AS 2550.5 2002 Mobile and AS 2550.11 2004 Vehicle Loading Cranes,
- AS 1418 Cranes including hoists and winches, in particular AS 1418.1 General Requirements, AS 1418.5 Mobile, AS 2550.11 2004 Vehicle Loading Cranes and AS 2759 – 2004 Steel Wire Rope.

Note: Equipment that can be proven to be intrinsically safe may be used with restricted areas as defined in Restricted Areas, Section 1.1

2. PLANNING

2.1 PROXIMITY HAZARDS

Consideration shall be given to the presence of proximity hazards. Proximity hazards include, but are not limited to, the following:

- (a) Overhead power lines.
- (b) Nearby structures or other cranes.

- (c) Excavations.
- (d) Fixed hazards.
- (e) Personnel movement within the crane working area.
- (f) Mobile equipment movement within the crane working area.
- (g) Public access areas including roadways, railways and rivers.
- (h) The effects of electromagnetic radiation (EMR) (e.g., busbars, strobe lights, induction furnaces, welding) on radio, infra-red or electronic controls.
- (i) The vicinity of airfields and aircraft flight paths (applicable to operating high cranes). Where necessary, aircraft warning lights shall be fitted to the highest part of the crane. The jib and boom sections shall be painted in high visibility colours in accordance with AS 1318.

2.2 VISIBILITY

The crane should be sited in such a way that the crane operator always has optimum visibility of the working area.

2.3 ENVIRONMENTAL RESTRICTIONS

Precautions should be taken against the effects of noise, exhaust gases, hydraulic fluids, lubricants, fuel, dust and other environmental pollutants emitted by the crane

2.4 CLEARANCES

Where two or more cranes work within a site, or share the same air space, procedures shall be established to maintain sufficient clearances to prevent contact between parts of the cranes and crane loads except where multiple crane lifting is carried out in accordance with AS 2550.1. When cranes operate on adjacent sites and may share the same air space, negotiations shall be carried out to formulate procedures to ensure sufficient clearances are maintained between the cranes.

3. FLEXIBLE STEEL WIRE ROPE (FSWR) CHECKS

The criteria by which ropes are evaluated and discarded will vary considerably from job to job, and the proper extent and frequency of inspection will depend on possible risk to personnel and equipment, the rate of wear, fatigue, corrosion, rope stretch, reduction in rope diameter, etc. The type and distribution of wire failures or deterioration in a rope are generally a very good indication of their origin.

- **Wear** - Wear occurs on internal wires and external wires. In both cases it is promoted by lack of lubrication, or incorrect lubrication, and also by the presence of dust and grit. Wear reduces the strength of ropes by reducing the cross-sectional area of the steel.
- **Corrosion** - Corrosion breaks may occur on the outside of the rope and on the inside of the strands where it is a much more serious and unsafe condition, generally because of lack of

lubrication of both wires and cores. In the presence of corrosion, abrasive wear is speeded up causing more rapid loss of section and strength.

- **Kinks** - A kink is a deformation created by a loop in the rope, which has been tightened without allowing rotation about its axis. Imbalance of lay length occurs, which will cause excessive wear, and in severe cases the rope will be so much distorted that it will have only a small proportion of its strength remaining. Kinking is more commonly met in Lang's lay ropes, because of the greater amount of torque built up in them under load. Such ropes should always be kept under tension, and it is wise to release any built-up torque in them, under control, to make the ropes neutral in operation.
- **Broken Wires** - Wire Ropes shall be replaced when the total number of broken wires measured over by a rope lay length exceeds 10% of the total number of wires in the rope length (A rope lay length is the distance for the lay of one strand as it travels 360° around the rope.)

For example, a wire rope of 6 x 24 constructions would contain a total of 144 wires. Ten percent of this total number would be 14. So, if the total numbers of broken wires measured over a rope lay length in the worst section of rope is less than 14, the rope is still serviceable.

For further information on Australian practice concerning wire ropes, refer to **AS 2759 - 2004 Steel Wire Ropes - Application Guide. (Refer to Appendix A.)**

4. LOADING

Crane operators and dogger must understand and check the weight or load charts applicable to the crane to be used.

Weights should be marked on loads, contained on manifests or shown on drawings. If the load weight is not available, estimate the weight (using weight charts or tables) and include the weight of lifting beams, chains, slings, block and hook. (Hook could weigh up to 1 tonne on a 50 tonne crane).

Note: All cranes with capacity of 16 tonne and upwards have a load indicator in the cab.



Do not raise a load if it exceeds the safe working load (swl) indicated on the load chart of jib extension. Ascertain the weight of all loads before lifting.

5. CRANE STABILITY DURING ERECTION AND DISMANTLING PROCEDURES

Precautions shall be taken when erecting and dismantling a crane to ensure that the stability of the crane is maintained. In particular, the following procedures shall be followed where applicable:

- Only parts and components meeting the manufacturer's specification shall be used.
- Jointing pins shall be assembled so that they can be removed by a person standing on the outside of the assembly.
- All outrigger jacks shall be fitted with foot plates according to manufacturer's instructions.
- All outrigger jacks shall be fitted and adjusted in accordance with the operating instructions.
- The correct amount of counterweight shall be fitted on the crane and at the appropriate location before the boom or jib is raised.
- When the operating length of boom or jib is reduced, the specified counterweight shall be removed to ensure that the backward stability of the crane is not adversely affected.
- Appropriate precautions shall be taken before a long boom is lowered to the ground level.
- To maintain the best margin of stability when a long boom is raised or lowered to the ground level, the hook blocks shall be lowered and rested on the ground before the Boom or jib is lowered.
- Where timbers are used under outrigger footplates, they shall be arranged so that successive layers are laid at 90° to each other (pig sty fashion) so that the top layer is in line with the outrigger arm.

6. CRANE SIGNALS

If, at any stage of the operation, the crane operator does not have a clear and unobstructed view of the load and its vicinity, or the point of attachment for a load, a competent person, trained in slinging or rigging, must be appointed as the dog person. Only the appointed dog person shall give the necessary signals to the crane operator, using the signals as shown in Signals for Crane Operators in AS 2550.1 - 2011 (Refer to Appendix B.)

Note: Two way radio shall be used when the crane operator and dogger cannot see each other, and the bell, whistle or buzzer signal is inappropriate

7. PRECAUTIONS

7.1 GENERAL PRECAUTIONS

Observe the following precautions when operating a mobile crane:

- Do not leave a crane unattended even for a short time, unless all loads have been removed, lowered to the ground or the engine shut down and brakes applied.
- Do not operate a crane in high or gusty wind conditions that may put the load or personnel at risk. Always use the cranes load rating charts for guidance, these have wind and weather factors built into them.
- Do not use flat web slings to raise, lower or suspend a load.
- Do not use a fibre rope slings if a suitable steel wire rope can be used.
- Faulty slings shall be tagged for destruction with an Out of Service Tag and returned to the area reliability planner.
- Discard any wire rope used on a crane, when the visible number of broken wires in any length of rope diameter exceeds 5% of the total number of wires in the wire rope (refer also to 1.2).
- Check that there are no loose objects on a load that could fall during lifting. Pay special attention to the tops of the containers.
- All lattice boom cranes fitted with outriggers will have the outriggers operational at all times. No slewing of these cranes is to take place unless outriggers are fully extended and in place.
- Do not use the crane to drag the load along the ground. Severe overloading may result.
- Do not exert a sideways pull on a shackle or eyebolt.
- Lower the load under crane power, except where a chain and block system is attached between the crane hook and the load.
- The work area, equivalent to that of the extended jib, should be barricaded off to ensure unauthorised personnel do not enter the area.



If a tipping sensation is felt, lower the load, not the boom. Lowering the boom will make it worse

DANGER

Not all wheeled cranes are suitable for travelling with loads attached

- A crane dogger shall walk alongside a load using tag lines attached to the load, slung from a crane while the load is being transported from one area to another.
- A Load may be tied back to the crane to prevent the load from swaying, whilst the load is being transported.

DANGER

Do not operate a crane closer than 6 m to any overhead powerline or electrical conductor, without appropriate safeguards to prevent accidental contact.

- Use tag lines to prevent loads from turning or swaying while the crane is in motion of lifting a load.
- Avoid sudden braking and fast hoisting, luffing and slewing.
- Do not under any circumstances, use a crane to lift a load over personnel, or allow anyone to ride the load.
- Keep personnel well clear of the suspended loads.
- BHB tractor cranes shall be fitted with a safety fender (see Figure 1).

7.2 PLANT AREA PRECAUTIONS

- Unless there is no alternative, do not operate a large crane over live process equipment. If such an operation is unavoidable, a TBRA shall be generated with specific scope for working over live plants and the risk assessment will include a lift assessment from experienced crane supervisors/operators that operate the hired machines, a Work Permit must be obtained from the area responsible.
- When cranes enter into plant areas there is always a chance of the crane being an ignition source and as such will be required to have all necessary permits and certification relating to

access criteria as well as a gas test carried out were applicable. This is more prominent but not limited to operational plants such as Cyanide production and Ammonia production.

- Where people not involved in the lifting operation but could otherwise come into the area steps to prevent that from happening will be required, barriers shall be provided at ground and all levels to prevent this occurring. Appropriate warning signs shall be displayed on the barriers. Pedestrians should be barricaded from the area of the lift and communications of alternative routes around the vicinity of the crane and associated equipment.
- These plants require that all communication devices shall be rated to prevent ignition sources, if working in a plant that has hazardous areas with an ignition risk.
- Within 50 m of the ammonia storage tanks and the ammonia nitrate tank, maximum outrigger loads are not to exceed 20 tonne per metre² (t/m²).

1. Crane drivers are to be instructed not to exceed a ground loading of 20 T/m² on any outrigger at any time.
2. The area of support blocks under outriggers is to be estimated as follows:

$$\text{Area of block (m}^2\text{)} = \frac{\text{Gross Weight of Crane} + \text{Weight to be lifted}}{20}$$

The guard structure shall be bolted to the axle to eliminate transverse welds.

The centre lines of the axle and bumper shall be on the same level.

The length of the bumper shall be equal to the overall width of the crane + 50 mm.

Tyre width + 25 mm.

75 mm nominal bore pipe or 127 mm x 64 mm RSC.

12 mm thick conveyor.

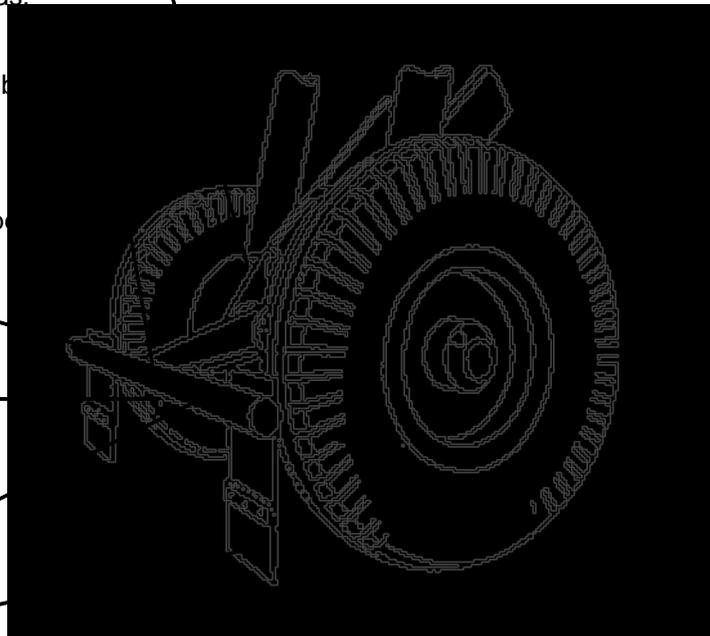


Figure 1 Fender for BHB Tractor Crane

8. OPERATION NEAR AERIAL CONDUCTORS (OVERHEAD POWERLINES)

This refers to hazards and risks presented by the set-up and operation of cranes in the vicinity of overhead electrical conductors (overhead conductors that are insulated or bare). Electricity supply bodies in each State may have issued guidelines for the use of cranes and other plant in the vicinity of overhead conductors.

Before operating crane from the stowed condition, a check for the presence of overhead conductors and power lines shall be undertaken

All aerial conductors shall be treated as live unless the crane operator has received, from the electricity distributor or transmission line operator, documentary evidence that the conductors have been positively de-energized, isolated and earthed.

Where such documentary evidence has been made available, it shall state the date and time frame of isolation and any special conditions and precautions. The crane shall not be operated in contravention of this documentary information.

8.1 PRECAUTIONS WHEN OPERATING NEAR LIVE AERIAL CONDUCTORS

The crane shall only be operated within close proximity of live aerial conductors, if the separation distances appropriate to the 'NO-GO-ZONE' or 'SPOTTER-REQUIRED ZONE', and risk controls identified are maintained.

A site-specific risk assessment shall be completed before the commencement of the job by a trained and competent person. This assessment shall be verified immediately before work commences, and its relevance monitored during the job. If initial associated circumstances change, work shall cease until an appropriate risk assessment is undertaken.

Where a spotter is required to inform the operator in the event of the crane approaching the zone boundaries shown, the following applies:

- a) The spotting operation shall be carried out by a competent person. Required competency levels may be defined by the Office of the Chief Electrical Inspector or similar body in the applicable State.
- b) The spotter shall be positioned so as to minimize the risk of exposure to hazards.
- c) The spotter shall be able to clearly observe the separation distances.
- d) The spotter shall not undertake any other work whilst performing spotting duties.
- e) The spotter shall be specifically instructed in the workplace hazards applicable to the site.

- f) The spotter shall be able to communicate with the crane operator at all times during erection operation and dismantling.

8.2 SEPARATION DISTANCES AND RISK CONTROLS

Where possible, the zone separation distances should be not less than those identified. These separation distances shall include allowance for sag and sway of line(s) due to the effects of wind and temperature.

Where the separation distances cannot be achieved, the electricity distributor shall be notified in writing. The crane shall not be operated within the 'no go zone' until the applicable requirements below are satisfied.

The separation distance between the crane and aerial conductors and risk controls when operating in the vicinity of aerial conductors shall comply with the following:

Overhead power lines (*up to and including 133 kV*) -The following applies:

- 1) No go zone - The crane shall not be operated in the 'no go zone' as indicated for overhead power lines up to and including 133 kV, unless —
 - a) Written permission from the electricity distributor has been obtained;
 - b) All conditions specified by the electricity distributor are complied with;
 - c) The electricity distributor is notified before commencing work;
 - d) A spotter performs spotting duties; and
 - e) A pre-start site/job meeting has been convened and a risk assessment completed.
- 2) **Spotter required zone** - The crane shall not be operated in the 'spotter required zone' as indicated in Figure 6.3.3 for overhead power lines up to and including 133 kV, unless—
 - a) Written permission from the electricity distributor has been obtained;
 - b) A spotter performs spotting duties; and
 - c) A pre-start site/job meeting has been convened and a risk assessment completed.

Overhead power lines (greater than 133 kV) the following applies:

- 1) **No go zone** - The crane shall not be operated in the 'no go zone' as indicated for overhead power lines greater than 133 kV, unless —
 - a) An easement entry permit has been provided by the electricity distributor;
 - b) Written permission from the electricity distributor has been obtained;

- c) All conditions specified by the electricity distributor are complied with;
 - d) The electricity distributor is notified before commencing work;
 - e) A spotter performs spotting duties; and
 - f) A pre-start site/job meeting has been convened and a risk assessment completed.
- 2) **Spotter required zone-** The crane shall not be operated in the ‘spotter required zone’ as indicated for overhead power lines greater than 133 kV, unless—
- a) Written permission from the electricity distributor has been obtained;
 - b) An easement entry permit has been provided by the electricity distributor;
 - c) A spotter performs spotting duties; and
 - d) A pre-start site/job meeting has been convened and a risk assessment completed.
- **Down shop conductors-** Before mobile machinery is set up for operation in the vicinity of down shop conductors, the power supply to the conductors shall be isolated prior to the operation unless appropriate control measures have been developed and implemented.

NOTES:

- 1) Down shop conductors, e.g., collector rails should be clearly identified.
 - 2) Clearances from down shop conductors should be in accordance with **AS/NZS 3000**.
- **Barriers at ground level** - Where people not involved in the lifting operation could otherwise come into the area of possible voltage step potential, barriers shall be provided at ground level and all levels to prevent this occurring. Appropriate warning signs shall be displayed on the barriers. Pedestrians should be barricaded from the area of possible voltage step potential in the vicinity of the crane and associated equipment.
 - **Person to crane contact** - Only the crane operator shall be in contact with any part of the crane during operation. If the load needs to be steadied during lifting, a non-conducting ‘tagline’ shall be used. All persons involved in the crane operation in contact with the ground shall be provided with appropriate means of insulation from the ground.
 - **NOTE:** In many instances, more than one dogger may be required to handle taglines located to apply counter-reacting forces, to prevent the load swinging in the direction of tension of one of the taglines.
 - **Earthing systems** - An appropriate earthing system shall be fitted to the crane and shall be in use. Operators and those working in proximity to the crane shall be advised of the limits of the effectiveness of the earthing equipment.



- **NOTE:** The purpose of the earthing system is to provide an alternate path to earth to minimize risks to personnel and plant, and it may not be likely to trip circuit breakers that form part of the electricity transmission system.
- **High visibility bunting** - Where high visibility bunting is applied to the conductors, it shall not be regarded as insulation.

8.3 AERIAL CONDUCTOR (OVERHEAD POWERLINE) CONTACT

If the crane or load contacts aerial conductors, the relevant electricity distributor shall be immediately notified of the situation and, until assistance is received, a competent person shall remain in a prominent position to warn of the danger of electrocution.

In such an event the crane operator should act as follows:

- a) Remain inside the cabin or on the crane.
- b) Warn all other personnel to keep away from the crane and not to touch any part of the crane, rope or load.
- c) Without anyone approaching the crane, operate the crane in such a manner to break contact, where possible.
- d) When unable to move or disentangle the crane from the aerial conductors, remain inside the cabin or on the crane and take no further action until it is confirmed that conditions are safe.
- e) When it is essential to leave the cabin or crane because of fire or some other reason then, to avoid being electrocuted, jump clear as far away from the crane as possible and avoid touching the crane and the ground at the same time. When moving away from the crane, shuffle or hop slowly across the affected area to avoid a simultaneous contact with areas of high potential difference

9. CRANE PERSONNEL WORKBOX

Workboxes should only be used where other means of access are unsafe or impracticable.

Crane workboxes shall be designed only for use of personnel with the minimum tools and materials required to perform the necessary work.

If a crane workbox is required then a JSA or TBRA shall be generated and a Work Permit for using the personnel work box to lift personnel shall be obtained from the area responsible and completed, and the conditions complied with.

A crane workbox shall be compliant with AS1418.17 1996. For information about the use of a crane personnel work box, see Elevated Work Platform (GM-11-038-04).

APPENDIX A
AS 2759 – 2004

**LIMITS OF DEGRADATION FOR DISCARD OF GENERAL LIFTING PURPOSE
ROPES, CRANE ROPES AND HOIST ROPES**
(See Notes 1 and 2)

1	2	3	4
Type of degradation	Construction (see Note 3)	Limit of degradation for discard (see Note 4)	
		Maximum allowable number of broken wires over a length of 6 times the rope's diameter	Maximum allowable number of broken wires over a length of 30 times the rope's diameter
Broken wires	6 × 19 (12/6/1)	5	10
	6 × 19 S (9/9/1)	3	6
	6 × 26 SW (10/5 and 5/5/1)	5	10
	6 × 25 FW (12/6 and 6/1)	5	10
	6 × 29 FW (14/7/7/1)	7	14
	6 × 24 (15/9/F)	5	10
	8 × 19 S (9/9/1)	5	10
	8 × 25 FW (12/6 and 6/1)	6	13
	6 × 36 SW (14/7 and 7/7/1)	7	14
	6 × 37 (18/12/6/1)	10	19
	6 × 41 SW (16/8 and 8/8/1)	9	18
	18 × 7 NR	1	2
	34 × 7 NR	2	4
	4 × 48	2	4
Wear	All types	Outer wires are worn more than one-third of their diameter	
Loss of area	All types	The loss of metallic area due to visible combined wire wear and broken or cracked wires exceeds 10%	
Corrosion	All types	Corrosion is marked by noticeable pitting or loosening of outer wires	

APPENDIX B

AS 2550.1 – 2011

MOTION	HAND SIGNAL	WHISTLE, BELL OR BUZZER SIGNAL	MOTION	HAND SIGNAL	WHISTLE, BELL OR BUZZER SIGNAL
Hoisting raise		2 short ••	Hoisting lower		1 long —
Luffing boom up		3 short •••	Luffing boom down		4 short ••••
Slewing right		1 long, 2 short — ••	Slewing left		1 long, 1 short — •
Jib-trolley out: telescoping boom extend		1 long, 3 short — •••	Jib-trolley in: telescoping boom retract		1 long, 4 short — ••••
Travel and traverse		Not applicable	STOP		1 short •
CREEP SPEED: APPROPRIATE HAND SIGNAL FOR MOTION WITH HAND OPENING AND CLOSING					