

Operating a self-erecting tower crane

Code OHSCER18

Workplace Health and Safety Queensland is moving to a new learning and assessment system for certificates to work in prescribed occupations. Learning and assessment will now be conducted in the Vocational Education and Training (VET) sector in which units of competency set out the knowledge and skills needed to demonstrate competent performance in a prescribed occupation.

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Unit Name

Operate a self erecting tower crane

Definition for self erecting tower crane as described in the draft Australian Standards AS2550.20 Cranes, hoists and winches Part 20 Self erecting tower crane

A form of tower crane whose tower and boom/jib elements are not disassembled into component sections and which can be transported between sites as a complete unit, and whose erection and dismantling processes are an inherent part of the crane's function.

Unit Descriptor

This unit specifies the competency required to safely and effectively operate a self erecting tower crane (remote control) to lift and move loads.

This unit does not include any dogging/rigging work associated with the assembly/disassembly of the self-erecting tower crane.

However it does provide an understanding of specific skills and knowledge for dogging activities relating to the operation of self erecting tower cranes.

This unit includes safe operation, shutting down the crane and monitoring of the crane during its operation.

Element

Performance Criteria

1. Plan and prepare for lifting

- 1.1 *Site specific work instructions*, including operational plans, site plans, specifications, quality requirements and operational details are obtained confirmed and applied.
- 1.2 Identify *site specific hazards* including overhead powerlines.
- 1.3 Operator's position and/or walkway are clearly defined and clear of hazards.
- 1.4 *Safety requirements* are followed in accordance with safety plans and policies.
- 1.5 Signage/barricade requirements are identified and implemented.
- 1.6 *Plant, tools and equipment* are selected to carry out tasks consistent with the requirements of the job, checked for serviceability and any faults are rectified or reported prior to commencement.
- 1.7 Load quantity requirements are calculated in accordance with plans and/or specifications.
- 1.8 Load appropriate to the work application are identified, obtained, prepared, safely handled and located ready for use.
- 1.9 *Environmental protection requirements* are identified for the project in accordance with environmental plans and regulatory obligations and applied.
- 1.10 Load charts have been read and correctly interpreted by crane operator.

Element	Performance Criteria
2. Conduct pre-operational routine checks	2.1 Crane has been erected in accordance with manufacturer's specifications and safety regulations.
	2.2 Routine <i>pre-operational equipment checks</i> are carried out in accordance with the manufacturers' checklist provided for the crane.
	2.3 <i>Start up procedures</i> have been performed in accordance with manufacturers' specifications and site requirements.
	2.4 The <i>service log book</i> for the crane has been <i>checked</i> to ensure all service requirements have been met and action taken as required.
	2.5 <i>Prior to operation, equipment and site area</i> are visually checked for any evidence of damage, structural weakness, interference, changes in stability requirements and any faults reported to an authorised person for corrective action.
	2.6 Ground/base has been certified to ensure it will withstand crane operation without subsidence.
	2.7 Self erecting tower crane has been stabilised to ensure a level operating platform.
	2.8 <i>Counterweights/outriggers and stabilisers</i> are deployed and in accordance with manufacturers specifications.
3. Conduct post start up checks	3.1 <i>Post start up checks</i> has been carried out in accordance with the manufacturers' and employers' site requirements and manufacturers' checklist provided for the crane.
	3.2 <i>Attachments, movements and control functions</i> operate correctly and comply with operating requirements.
	3.3 <i>The operating, emergency controls and safety devices</i> are located and identified and correctly tested in accordance with manufacturers' specifications.
	3.4 Operating radius is clear of obstruction, <i>communication</i> signals are confirmed and are conducted in accordance with AS2550.
	3.5 Defects and damage are reported according to site procedures.

Element	Performance Criteria
4. Manoeuvre crane	<p>4.1 Activities are co-ordinated with riggers/doggers and other crane operators.</p> <p>4.2 Radius of loads is planned and travelled to minimise danger to people and facilities in accordance with the plan.</p>
5. Perform the lift	<p>5.1 Traffic flow and work area conditions are continually monitored to ensure safe operation</p> <p>5.2 <i>Load characteristics</i> are assessed in accordance with crane limitations and rigging/dogging requirements.</p> <p>5.3 <i>Crane controls and functions</i> are used within manufacturer's specifications to effectively lift and position loads or establish services.</p> <p>5.4 <i>Monitoring systems and alarms</i> are acted upon and/or reported in accordance with site requirements and manufacturers specifications.</p> <p>5.5 Work is completed in accordance with the agreed crane schedule.</p>
6. Shut down and secure crane	<p>6.1 Crane is <i>shut down</i> in accordance with manufacturer's specifications and site requirements.</p> <p>6.2 The crane and equipment is correctly <i>stowed and secured</i> in accordance with manufacturer's instructions and the appropriate Australian standard.</p> <p>6.3 Work area has been cleared and materials used disposed of, reused or recycled in accordance with site practice.</p> <p>6.4 Plant, tools and equipment are cleaned, checked, maintained and stored in accordance with manufacturers' recommendations and standard work practices.</p>

Range of Variable

The range of variables explains the range of contexts within which the performance and knowledge requirements of this standard may be assessed. The scope of variables chosen in training and assessment may depend on the work situations available.

What may be involved in *routine checks* of a self erecting tower crane?

Planning and preparation is to include:

- worksite inspection
- equipment defect identification and assessment of conditioning
- identification of hazards
- determination of work requirements.

Operations may include but not be limited to:

- telescope in and out
- slew left and right
- operate outriggers
- luff movements in and out
- trolley in and trolley out
- hoist up and down in combination and operate attachments.

Before the commencement of each work shift, the crane should be given a visual inspection and functional test. Tests that can be conducted by the operator include:

- operating and emergency controls
- brakes
- safety switches
- interlocks including limiting and indicating devices
- structure
- wire ropes to ensure they are on the drum and correctly reeved on the sheave.

The self erecting tower crane requires assembly and commissioning documentation prior to operation.

The self erecting tower crane range is considered within the load capacity, height and jib extension for each particular model.

What range of *attachments or features* may be used?

Attachments may include:

- spreader bars
- spreader beams
- brick/block cages
- rigging attachments
- specialized lifting equipment
- piling/boring
- equalizing equipment
- various types of slings
- general lifting gear
- safety devices.

Features may include:

- Method of control – pendant or radio remote
- Ground or cabin - tower or mast
- a-frame
- plates
- long traveling systems
- hook block
- sheaves
- electrical control cabinet
- main isolating switch
- earth wire
- outriggers or stabilizers and jibs.

Remote control devices must have the information provided by the indicating devices displayed on them, and these devices must be fully operational.

What *range of self erecting tower cranes* may be operated?

The self erecting tower crane range is considered within the load capacity, height and jib extension for each particular model.

Types of self erecting tower cranes may include:

- telescopic hydraulic mast
- telescopic lattice mast
- hydraulic telescopic boom.

Self-erecting tower cranes can be pendant controlled and/or wireless remote controlled or cabin controlled and be operated from the ground or the cabin.

Self erecting tower crane components may include but not be limited:

- outriggers
- stabilisers
- remote control
- braking systems
- locking mechanisms
- self levelling systems
- rail systems
- cabins
- computer controls and technology.

What *enterprise requirements* may apply to this standard?

Enterprise requirements may include:

- standard operating procedures
- industry standards
- production schedules
- material safety data sheets
- work notes
- plans
- product labels
- manufacturers' specifications

- operators manuals
- enterprise policies
- procedures (including waste disposal, recycling and re-use guidelines)
- supervisors oral and written instructions
- current state/territory occupational health and safety legislation
- advisory standards
- codes of practice
- Australian Standards AS2550 and AS1418.

The necessary movements may include:

- luffing
- slewing
- hoisting telescoping boom
- climbing and trolleying.

What *hazards* may be encountered in the workplace?

Hazards may include, but are not limited to:

- uneven/unstable terrain
- exposure to chemicals
- dangerous or hazardous substances
- movements of equipment, goods
- materials and vehicular traffic
- trees
- overhead service lines
- bridges/walkways
- surrounding buildings
- obstructions
- structures
- facilities
- other equipment
- excavations
- projected excavations
- open excavations
- flight paths
- dangerous materials
- underground services
- recently filled trenches
- personnel
- lifting equipment
- suspended walkways
- wind/weather conditions
- environmental conditions and
- operator travel routes.

What *occupational health and safety requirements* may be relevant to this standard?

Occupational health and safety requirements include safe systems and procedures for ensuring loads are secure and within working specifications.

These procedures may include:

- identification and avoidance of obstacles during load-shifting operation
- incorporation of hazard and risk control
- maintaining safe operating position for crane operator to maintain unobstructed view as much as practicable,
- handling of loads including lifting and carrying
- manual handling
- the application of emergency/defensive action and techniques for controlling loads.

Other items include:

- application and storage of hazardous substances
- outdoor work including protection from solar radiation
- noise
- dust
- trash
- protecting people in the workplace
- appropriate use and maintenance of personal protective equipment
- calculation of loads
- load charts specific to the crane
- use of lifting equipment and associated gear to manufacturers' specifications
- extreme environment temperatures (hot/cold)
- use of high visibility clothing/reflective vests
- traffic management
- barricades
- crane design and item registration.

Safe operating procedures are to include but not be limited to:

- the conduct of operational risk assessment and treatments associated with power cables
(including overhead service trays)
- cables (overhead power lines and conduits)
- lighting
- earth leakage boxes
- trip hazards
- working with dangerous materials
- working in confined spaces
- surrounding structures
- restricted access barriers and working at heights
- traffic or pedestrians and areas where personnel are working.

Emergency procedures related to equipment operation are to include but not be limited to:

- emergency shutdown and stopping
- fire extinguishing equipment
- first aid requirements and
- evacuations.

What permits may be relevant to this standard?

Any permits required to carry out job activity are obtained from the relevant authorised personnel or authority.

What *workplace* may be relevant to this standard?

The work area may include but is not limited to:

- factories
- wharfs
- ships
- warehouses
- manufacturing plants
- building sites
- civil construction
- demolition sites
- quarries
- mine sites and
- waterways.

What *personal protective equipment* may be relevant to this standard?

This may include but is not limited to:

- safety boots
- hat/hard hat
- overalls
- gloves
- protective eyewear
- hearing protection
- respirator or face mask
- sun protection and
- task specific personal protective equipment.

What needs to be considered for *personal/public safety*?

Site/non site personnel are safeguarded (protected) by a variety of measures including:

- erection of barricades
- posting of signs
- traffic control consistent with principles of the hierarchy of risk control.
- Hoardings and overhead gantries are also provided in line with the appropriate codes of practice.

Appropriate equipment is selected to ensure personal safety and protection including guards/spotters where appropriate.

Who are *site/non site personnel*?

Non site personnel may include but not be limited to:

- members of the public
- visitors to the site
- delivery drivers or
- union representatives.

Site personnel may include but not be limited to:

- employees
- contractors
- sub-contractor
- management
- trainees and
- apprentices.

How might the operation of a self-erecting tower crane be demonstrated in a *safe, controlled and correct* manner?

- Appropriate selection and use of crane controls
- Features, settings and operational techniques for the specific site
- Weather conditions for the day/night of operation are taken into consideration.
- Crane is operated with due consideration to the indicators and limiters, and without causing damage to machinery, equipment, load, personnel, property or environment (including soils and property structures).
- Correct operation includes using appropriate methods for load-shifting site procedure so that corrective actions including defensive techniques are implemented.

Operations may include but not be limited to:

- telescope in and out
- slew left and right
- operate outriggers
- luff movements in and out
- trolley in trolley out
- raising/lowering cabin
- hoist up and down in combination and operate attachments.

What are the *key considerations* when coordinating operations?

This may involve the maintenance of communication and co-operation between crane operator and other relevant persons to ensure the application of the principles of hierarchy of control in the co-ordination of work activity.

What *communication* considerations are demonstrated?

The effective use of communication methods such as:

- hand
- radio and
- whistle signals in accordance with Australian Standard AS2550

What *self management skills* may be associated with self erecting tower cranes?

This may include:

- deciding on a process to move a load
- communicating these ideas to on-site supervisors, project managers, workplace health and safety officer, dogger and other people working on site.

Bad weather warnings may result in the crane being shut down and secured. The crane should be shut down and secured in accordance with AS1418 part 4.

What procedures may be included in the *shut down* of a self-erecting crane and *securing of site*?

The crane is shut down in accordance with manufacturers' and owners' instructions including load is safe, detached from the hook and in a stable position.

Inspect, stow and secure all relevant equipment—lifting gear, attachments, defective equipment is identified and segregated, reported to supervisor and logged and tagged, with equipment locked and key removed.

What *records* may need to be kept or updated?

Records may include:

- Log books
- maintenance records
- records of faults and potential faults
- repairs carried out according to owners requirements and manufacturers specifications and operating procedures.

What *team work* would be required?

Working with other plant/crane operators, dogger(s) and qualified personnel to move loads.

What *problem solving* would be required?

Problem solving skills would be required to:

- Direct crane/hoist operator in the movement of a load when the load is out of the operator's sight.
- Apply load charts
- Assess suitability of load
- Ensure load is secured properly

Evidence Guide

What evidence is required to demonstrate competence for this standard as a whole?

Competence in this standard requires evidence of the ability to utilise the components and controls of a self erecting tower crane to carry out operations without damage to the crane, vehicles, loads or property and without endangering people. It requires the ability to conduct pre-start and shut-down procedures to ensure mechanical reliability, communicate and cooperate with other personnel such as co-workers, general public, prevent spillage and contamination, demonstrate emergency operating procedures and maintain operating records and assess for safe working environment.

What **critical aspects of evidence** are required to demonstrate competency in this unit?

- Complete operation of a self-erecting tower crane including all lifting and moving functions to the maximum extension and in the lifting and moving of at least three different load types and sizes to different locations on the site.
- Complete three separate lifts with the assistance of a qualified dogger which must include:
 - One out of operator view utilizing whistle/radio signals; and
 - One where the crane rotates at least 180 degrees.
- The learner must provide a log book detailing a nominal 40 hours self erecting tower crane operation signed off by an appropriately qualified and experienced crane operator.

What **specific knowledge** is needed to achieve the performance criteria?

Knowledge and understanding of self erecting tower cranes is essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The specific knowledge requirements for this competency standard are identified below:

- Components, controls, features, operational techniques and use of equipment for self erecting tower cranes.
- Operating principles, operating methods and enterprise procedures.
- Knowledge of load-shifting processes, procedures, lifting slings, equipment and apparatus.
- Job safety analysis techniques for the identification and reporting of obstacles and hazards in the work areas.
- Knowledge and understanding of crane load charts and operating formulae to calculate load masses.
- Understand the competency requirements of a qualified dogger.
- Knowledge of methods of assembly/disassembly.
- Knowledge of operating principles of indicating devices, limit devices and condition monitoring.
- Set crane type, characteristics, technical capabilities and limitations.
- Techniques for calculating working load limits (WLL) and safe working limit (SWL) for various ropes, slings and chains used in lifting operations and calculating load mass requirements and level of capacity for operating a self erecting tower crane.

- Material safety data sheets and materials handling methods.
- Job safety analysis (JSA) and work method statements (WMS).
- Knowledge and understanding of communication signals (hand, whistle and two-way radio) in accordance with AS2550.
- Manufacturers specifications, relevant acts, regulations and codes of practice for self erecting tower cranes.
- Environmental impacts and minimization measures in the use of self erecting tower cranes.
- Quality requirements in the use of self erecting tower cranes (AS 1418 and AS 2550).
- Plant, tools and equipment types, characteristics, uses and limitations used in crane operation.
- A knowledge and understanding of wind and weather situations that effect self erecting tower crane operations.
- A knowledge and understanding of safe working requirements and distances from electrical power lines and equipment.
- An understanding of the erection process of a self erecting tower crane.

What does the term '**instruction**' mean for this unit?

The term instructions is described in AS 2550.1 Cranes, hoists and winches – Safe Use Part 1: General requirements as follows:

- Instructions shall be prepared, maintained and made readily available to the appropriate personnel, to ensure the safe use of the crane. Such instructions shall include the manufacturer's instructions, recommendations and specification where available or where any of these instructions, recommendations and specifications are not available from the manufacturer or are deemed inappropriate, they shall be drawn up by a competent person. All instructions shall be not less than those specified in this Standard.

What **specific skills** are needed to achieve the performance criteria?

To achieve the performance criteria, appropriate literacy and numeracy levels as well as some complementary skills are required. These include the ability to:

- Readily familiarize self with local conditions.
- Inspect and select lifting equipment.
- Ability to apply the correct technique for slinging and lifting loads of various weights, shape and size.
- Perform routine safety, basic service and maintenance procedures on self erecting tower crane.
- Demonstrate emergency operating procedures.
- Demonstrate safe and environmentally responsible workplace practices.

- Read and interpret site planning, operators' manuals, manufactures specifications, work and maintenance plans and material safety data sheets.
- Comprehend and apply task instructions.
- Measure and calculate load masses and how these relate to the crane's rated capacity.
- Manual lifting techniques.
- Ability to assess weight of load, select appropriate slings and determine crane capability.
- Ability to work at heights incorporating the use of fall arrest systems.
- Identify and eliminate defective equipment and/or gear.

In what **context** should assessment occur?

- The application of competency is to be assessed in the workplace or realistically simulated construction site.
- Assessment is to occur using standard and authorised work practices, safety requirements and environmental constraints.
- Assessment of essential underpinning knowledge, other than confirmatory questions, will usually be conducted in an off-site context.
- Assessment is to comply with relevant regulatory requirements including specified Australian Standards.

What **methods of assessment** should apply?

- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of relevant contexts) together with application of underpinning knowledge.
- Assessment must be by direct observation of tasks, with questioning on underpinning knowledge and it must also reinforce the integration of key competencies.
- Assessment methods must confirm the ability to access and correctly interpret and apply the essential underpinning knowledge/skills.
- Assessment may be applied under project related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.

What are the **specific resource requirements** for this unit?

The following resources must be made available:

- Workplace location or simulated workplace
- Tools and equipment appropriate to operating a self erecting tower crane
- Realistic activities covering the mandatory task requirements

- Specifications and work instructions
- A self erecting tower crane
- Appropriate slings, chains and lifting equipment
- A qualified dogger
- Communication equipment (radios, whistles)
- Occupational Health and Safety Certification Training and Assessment Delivery Guide
- Occupational health and safety assessment instruments
- Occupational health and safety authority learner guide and
- Occupational health and safety authority trainer guide

What processes should be applied to this competency standard?

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the **key competencies**, although others may be added. The questions below highlight how these processes are applied in this competency standard. Following each question is the number in brackets indicating the level to which the key competency needs to be demonstrated where:

0 = not required

1 = perform the process

2 = perform and administer the process

3 = performance, administer and design the process

1. How can communication of ideas and information be applied?	Communicate ideas and information orally and in writing in plain English to enable confirmation of work requirements, passage of information and requests to other workers during operations and the reporting and recording of work outcomes. Level 1
2. How can information be collected, analysed and organised ?	Collect, organize, interpret and understand the information required for operating a self erecting tower crane including work instructions, plans, sketches, diagrams, safety instructions, labels, quality procedures, manufacturers' instructions, material safety data sheets and equipment instructions. Level 2
3. How can activities be planned and organised ?	Conduct activities associated with operating self erecting crane including the coordination and use of equipment, materials and tools to avoid back tracking and rework. Level 2
4. How can team work be applied?	Work with others and in a team by recognising dependencies and using co-operative approaches to optimize satisfaction and productivity. Level 1
5. How can the use of mathematical ideas and techniques be applied?	Use mathematical ideas and techniques to correctly calculate time to complete tasks, estimate measurements, distances and levels, calculate material requirements and established quality checks and interpret load charts. Level 2
6. How can problem solving skills be applied?	Establish safe and effective work processes which anticipate likely problems and blockages and systematically work around those to avoid or minimise reworking and avoid wastage. Level 1
7. How can the use of technology be applied?	Use workplace technology related to operating a crane including the use of calculators, the use of communication devices, the use of indicators and limiting devices, condition monitoring equipment and the reporting and/or recording of results. Level 1

Are there any other competency standards that could be assessed with this one?

This competency standard could be assessed on its own or in combination with the other units of competency relevant to the job function.

There is essential information about assessing this competency standard for the consistent performance and where and how it may be assessed in the Assessment Guideline developed by the National Occupational Health and Safety Commission. All users of this competency standard must have access to this guideline.