Safety in Construction No. 8

CODE OF PRACTICE FOR POWER OPERATED ELEVATING WORK PLATFORMS

Important Note:

All the publications in the Publications Archive contain the best guidance available at the time of publishing. However, you should consider the effect of any changes to the law since then. You should also check that the Standards referred to are still current.

Department of Labour,
Wellington New Zealand

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Code of Practice for Power-Operated Elevating Work Platforms

1. Introduction

The aim of the Construction Act is to make better provision for the safety of workers. This code has been published to assist realising that aim. The sections of the Construction Act and Regulations concerned with elevating work platforms are included in the Appendix.

2. Scope

The power-operated elevating work platforms to which this code applies are work platforms where height is adjustable by powered means using articulation, a scissors mechanism, a telescoping boom or tower or any combination of these, and which are either vehicle mounted, self-propelled, towed or manually moved, to give workers access to work above or below ground level. It includes personnel buckets temporarily or permanently attached to truck hoists.

This code does not apply to the following:

– forklift trucks with working platforms;

– cages or skips temporarily attached to crane hooks;

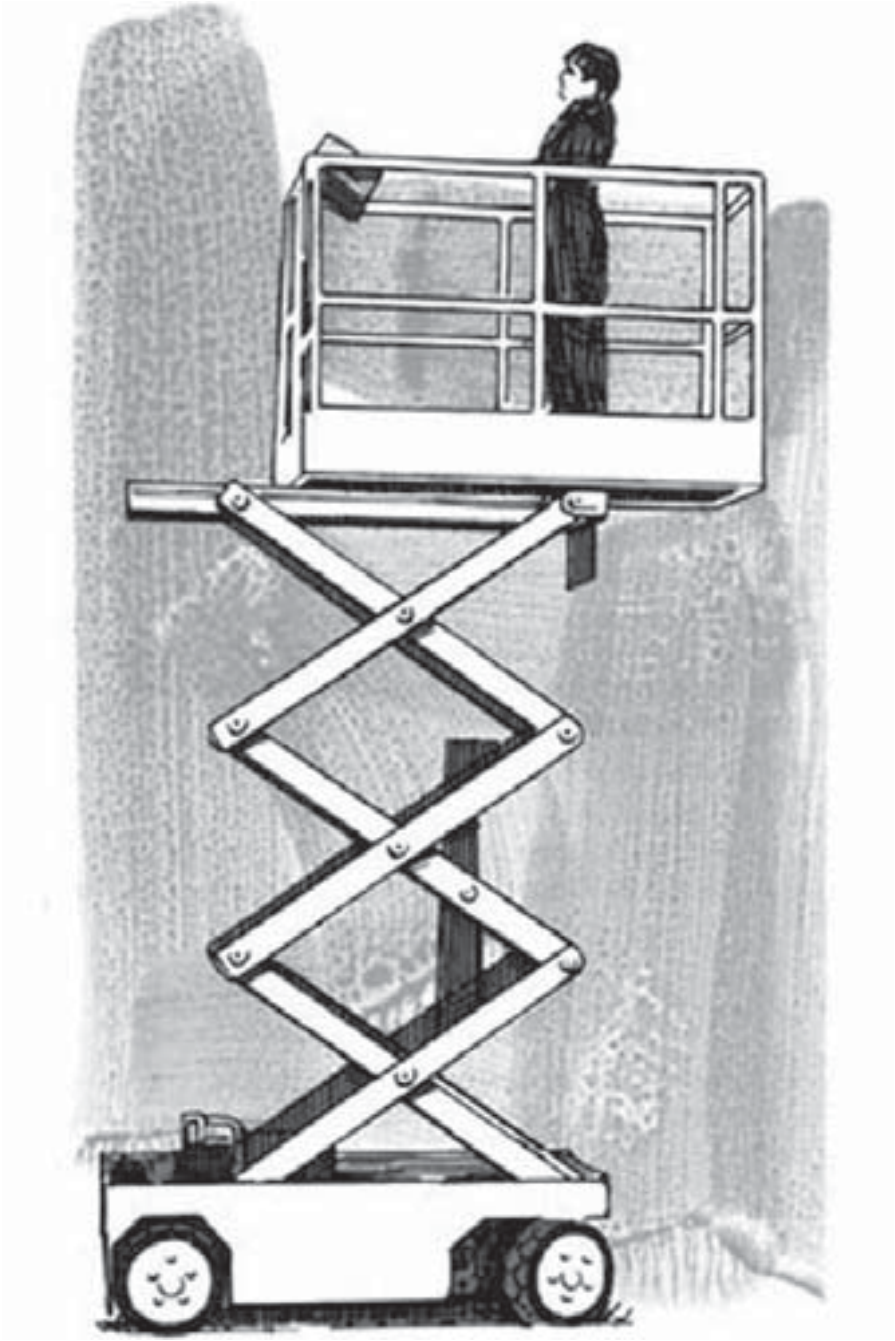
– personnel buckets temporarily attached to a mobile crane.

3. Definitions

Critical Weld One positioned where failure could affect the soundness of the structure and result in injury to a worker on the platform.

Direction Controls All controls necessary to raise, lower, rotate, telescope, drive or otherwise initiate the powered functions of the machine.

Employer Any person who is liable for the payment of wages of persons employed on the job, as in the Construction Act.



Self-propelled scissors action work platform.

Free Descent Descent at an uncontrolled rate.

Instability The condition where the overturning moments exceed the restoring moments.

Maximum Platform Height The vertical distance measured from the floor of the platform at its highest reach to the surface upon which the work platform is supported.

Operator A person who controls the movements of the work platform.

Outriggers Devices used to support the base and improve its stability. These may be used to level the machine.

Platform That portion of the equipment from which workers carry out work.

Registered Engineer An Engineer registered under the Engineers Registration Act 1924.

Safe Working Load (SWL) The maximum weight the platform is designed to safely support, under stated conditions.

Stability The condition when the total restoring moments exceed the overturning moments.

Stabilisers Devices used to maintain the stability of the work platform but not intended to lift or level the machine.

Toe-Boards Vertical barriers placed at floor perimeters to prevent materials falling off.

Work Platform The complete machine including the platform, lifting mechanism, chassis or vehicle as applicable.

4. Responsibilities

Only work platforms that have been designed in accordance with sound and accepted engineering practice, and constructed in accordance with that design may be used on construction work.

1. Employers must ensure that:

(a) The work platform is operated by a competent operator and is used in accordance with its operating instructions and this Code of Practice; or

(b) The machine is inspected regularly, is repaired and maintained by those competent to carry out the work and periodic testing is carried out in accordance with section 12.3 (page 17).

2. Operators must:

(a) Operate the work platform safely and in accordance with the operating instructions and this Code of Practice;

(b) Ensure that the SWL of the work platform is not exceeded;

(c) Never approach within 4 m of overhead power lines without the written consent of the supply authority.

5. General Requirements

5.1 Structural Safety Factors

(a) All ductile structural load-supporting elements shall have a structural safety factor in relation to the safe working load of not less than 2 based on the minimum yield strength of the material.

(b) All structural load-supporting elements made of non-ductile material such as fibreglass, shall have a structural safety factor of not less than 10, based on the minimum ultimate strength of the material.

5.2 Determination of Factor

The structural safety factor shall be calculated from the maximum stress applied to the element with the machine loaded with its SWL and shall include the effects of stress concentration and dynamic loading as follows:

$$SF = \frac{X}{(X_1 + X_2) \times 1.375}$$

Where: X = yield stress for the material

X_1 = stress due to the combined effect of the mass of the structure and a 15m per second wind acting on it.

X_2 = max stress due to the rated SWL

Note: The divisor 1.375 is the product of a stress concentration factor of 1.1 and a dynamic loading factor of 1.25. Lesser values may be approved if experiments and analysis on a prototype justifies this.

5.3 Design for Fluctuating Loads

All components and connections shall be designed to avoid stress concentration. Members subject to fluctuating loads shall be designed in accordance with Section 8 of BS 2573:Part 1:1983 and the fatigue stress in these shall not exceed those allowed there.

5.4 Struts

No strut shall have a slenderness ratio greater than 180 and notwithstanding 5.1 (a) above, the working stress shall be reduced to take account of its actual slenderness ratio, using standard reduction factors.

5.5 Hydraulic Equipment

(a) All cylinders, piston rods, pipes, hoses, valves and fittings must be designed to withstand a static pressure of 3 times the maximum operating pressure without permanent deformation.

Self-propelled platform with a telescoping boom.

(b) Hydraulic systems shall be so equipped that free descent cannot occur in the event of a hose or fitting failure. Platform descent velocity in the event of hose failure shall not exceed normal lowering velocity by more than 50 percent.

(c) Hydraulically positioned outriggers or stabilisers shall not retract in the event of hydraulic line failure.

5.6 Welding

Welding shall be carried out in accordance with NZS 4701:1981 *Metal Arc Welding of Steel Structures* by welders qualified to NZS 4711:1984 *Qualification tests for Manual Metal-Arc Welders*. Welding specifications must be detailed on all manufacturing drawings. Non-destructive tests shall be carried out on critical welds by suitably qualified persons employed by a Telarc registered laboratory.

5.7 Fuel and Exhaust Systems

(a) Fuel lines of internal combustion engines must be protected from engine and exhaust heat. Liquid fuel pipes shall be of metal except that flexible connections may be used to limit or isolate vibrations. LPG or CNG pipes may be either flexible or solid metal.

(b) Exhaust systems shall include mufflers and be positioned so as to exhaust engine fumes away from platform operators.

5.8 Platforms

(a) The perimeters of platforms shall be fitted with side walls, or guardrails with midrails and toe-boards, or guardrails with any other suitable barrier such as expanded metal or chain mesh. Walls and guardrails must be of a minimum height of 1 m and be able to withstand, without obvious deflection, a horizontal force of 440 Newtons or a vertical force of 690 Newtons applied separately at any position.

(b) The floor of platforms must be slip resistant and free draining.

(c) Platform gates where fitted must be able to be secured in position and open inwards or slide sideways and be self-closing.

(d) A safe means of access to the platform when it is at its lowest level should be provided. If access is by means of steps or a fixed ladder, the rise of steps or rungs must be uniform and must not exceed 300 mm. The steps or rungs must be slip resistant.

6. Machine Controls

(a) Machines must be fitted with 2 sets of controls, which are positioned:

(i) on the platform itself; and

(ii) at ground or chassis level

The ground level controls must be able to override the platform controls.

(b) All controls must be of the "deadman" type which automatically return to neutral or the off position when released or alternatively all controls may be overridden by a single deadman control.

(c) The direction of all movements of the elevating work platforms should be indicated by arrows on the control device. Where possible all controls should be positioned for logical operation.

(d) All controls must be clearly marked to show their function in permanent legible letters or symbols.

(e) Controls must be positioned and protected to prevent accidental operation or damage. They must be of robust construction and waterproof.

(f) An emergency stop control which will cut off power to all systems must be provided at each control position. It must be in a prominent position and be coloured red.

(g) An interlock shall be provided on each self-propelled work platform, which will make it impossible to raise or lower the platform while the work platform is being moved.

(h) The slewing mechanism shall be provided with effective means of controlling the slewing superstructure of the work platform over the range of slew, either at a series of positions, or at infinitely variable positions. The power-operated slewing mechanism shall be provided with a service brake or equivalent. An additional device shall be provided for positive locking of the slewing superstructure in the travelling mode.

Towed work platform with an articulating boom.

7. Safety Features

(a) Self-propelled work platforms must be fitted with an alarm or other audible warning device that will activate when the machine's base is more than 5 percent out of level. Non-self-propelled machines must be fitted with a chassis level indicator.

(b) Self-propelled machines must be equipped with a horn or audible warning device which can be used to signal that the machine is about to be, or is being, driven forwards or backwards.

(c) Rotating shafts, gears, sprockets and any other dangerous part must be guarded so that persons using the machine or are nearby are not endangered by the operation of the machinery.

(d) Work platforms shall be fitted with an effective lock-on-brake or other means to hold the unit on the maximum slope it is designed to use while loaded with its SWL. On self-propelled work platforms the brake lock or other means shall be operable from the platform.

(e) Scissors-actuated machines must include a captive chock within the scissors mechanism in order to prevent trapping of persons doing maintenance work. Placement or removal of the chock must be possible without hazard.

8. Markings and Documentation

(a) The following information shall be displayed in clearly visible permanent lettering on all power-operated mobile work platforms:

- Make, model, serial number and manufacturer's name and address;
- Safe working load;
- Maximum platform height;
- If the machine is insulated, the working voltage to which it is insulated;
- Any special warnings, cautions or restrictions necessary for safe operation, e.g. where a work platform has a variation of capacity for varying platform outreach or outrigger settings, the SWL of each must be shown;

– The instruction “read work platform manual for details on operation and servicing”.

(b) A comprehensive operating and maintenance manual must be provided by the manufacturer with each machine. The following is to be included in the manual:

– Operation instructions.
– Lubrication schedule.
– Routine checks.
– Restrictions on use of the machine.
– Advice on any matter that could affect the safe use of the machine.

(c) Where the work platform is to be made available for hire essential operation and maintenance instructions may be permanently displayed on the work platform or be issued with the machine when it is hired.

9. Stability Tests

The work platform shall be capable of withstanding the following tests without permanent distortion or failure of any of the machine components:

(a) The work platform must maintain stability while positioned on a level surface, supporting a load equal to 1.5 times its safe working load. This test load must be positioned with its centre of gravity 300 mm inside the perimeter of the platform. The platform must remain stable when taken through its entire range of operation.

(b) The work platform must maintain stability on a slope of 5° while positioned in the direction most likely to cause overturning and supporting a load equal to 1.3 times its safe working load. This test load must be positioned with its centre of gravity 300 mm inside the perimeter of the platform. During the test the platform must be taken through its entire range of operation.

(c) The work platform must maintain stability on a slope of 5° while positioned in the direction and condition most likely to cause overturning with the platform extended to its maximum height and sustaining a horizontal force of 670 Newtons or 15 percent of its safe working load, whichever is the greatest.

The test load must be applied to the upper perimeter of the platform in the direction most likely to cause overturning.

Manually-propelled vertically adjustable work platforms need not be tested for compliance with test (b), and test (c) shall be carried out on a level surface with the horizontal force applied being 220 Newtons or 15 percent of SWL, whichever is the greater. (Vehicle mounted work platforms need not be tested for compliance with this test (c).)

10. Acceptance of Work Platforms

In order to obtain acceptance of a model for use on construction work it is necessary for a registered engineer to provide a certificate stating that the work platform is capable of safely elevating, sustaining, lowering and, where applicable, slewing or transporting its designated SWL and that it meets the requirements of this code.

The provision of a satisfactory test report from a recognised testing authority will be considered proof that a model of a work platform meets the standard of this code, without further testing (see also footnote 1).

Footnote 1: Where a work platform has been designed and constructed in accordance with a reputable overseas standard or code that has requirements equal to those required here, the Chief Construction Safety Engineer may accept it for use without further testing. Overseas standards known to have equivalent requirements are:

ANS I: 92.2-1979 *American National Standard for vehicle mounted elevating and rotating aerial devices.*
92.3-1980 *American National Standard for manually-propelled elevating work platforms.*
92.5-1980 *American National Standard for boom supported elevating work platforms.*
92.6-1979 *American National Standard for self-propelled elevating work platforms.*

BS 6289: Part 1 1982 *Code of Practice for mobile scissor-operated work platforms.*

11. Modification of Work Platforms

If subsequent to acceptance for use on construction work a work platform is significantly altered or modified, the owner shall submit a certificate signed by a registered engineer, or a report from a competent testing authority, confirming that the platform still meets the requirements of this code.

12. Work Platform Maintenance

The following checks are to be made:

12.1 Daily Checks by Operator:

- tyre pressure, if pneumatic tyres are fitted, and that tyres are undamaged.
- that brakes are working efficiently.
- fuel, water and oil levels in work platforms powered by internal combustion engines.
- that the battery is charged (in battery-operated units). - hydraulic lines for leaks and damage.
- that the supporting structure is sound and free from distortion or cracking.
- that the powered mechanism for operating the platform is working properly.
- that any communication system between the platform and the ground functions correctly.
- that emergency controls function correctly and any safety equipment (e.g. safety belt) is in good condition.

The operator must bring any faults to the employer's notice, so he can ensure that these are fixed before the work platform is used again.

12.2 Periodic General Check

Work platforms should be checked by a competent person at least once a month, and in the case of a hired machine provided without an operator, at the termination of each hire. The procedure should include:

- all the daily checks listed above.
- an operational check of the work platform.

- a check of the condition of the chassis, support structure, powered mechanism and the platform.
- lubrication.
- where a machine is electrically insulated check that all fibreglass components are clean.

Any faults discovered must be corrected or the working platform withdrawn from service.

12.3 6-Monthly Testing

(a) *Operational Test and Check*

The work platform must be thoroughly examined and load tested after an accident, major repair or modification, or otherwise at least once every 6 months by a competent person* experienced in the maintenance and repair of power-operated mobile work platforms.

(b) *Test Procedure*

The load test shall be the designated maximum SWL for the work platform. It shall be hoisted and moved through the full operating range and the functions of all operating devices shall be checked. It must withstand the test without permanent distortion or failure.

Any faults discovered during the examination and test must be corrected before the work platform is used again.

Attached to every work platform, in a transparent weatherproof envelope, shall be a certificate which states:

"I certify that this work platform has been load tested and thoroughly examined by me and it is in good working order and can be safely used through its full operating range with a load of ..... kg".

Make ..... Signed.....
Model ..... Position. .....
Serial No ..... Company .....
Telephone No .....
Date .....

(c) Electrical Test

Where a platform is designated as electrically insulated, electrical insulation tests shall be carried out in order to validate the working voltage at intervals of 6 months.

*A competent person in terms of these requirements could be a certificated motor mechanic, a registered mechanical engineer or a trained fitter or serviceman who specialises in work platforms.

If the test is not satisfactory, the unit must not be used as an insulated work platform and work must not be carried out from the platform on conductors that are live or could become live during the period that the worker is on the platform. A record of all tests shall be kept and be available for inspection.

13. Machine Operation

13.1 Setting Up

(a) Before use ensure that the work platform is set up with. stabilisers or outriggers fully extended and levelled as specified by the manufacturer, and any stabilisers actuated. Where necessary use suitable metal or timber spreaders to provide a firm base.

The stated SWL of the work platform assumes that it is set up on firm ground and that the chassis of the machine has been levelled. It may overturn at a lesser load if these conditions are not met. Don't take chances with soft ground and an unlevelled machine!

(b) When parking the machine apply the parking brake. Use the brake lock where this is provided.

(c) Where the working area is on a vehicle right of way ensure that the work platform is protected by cones and warning signs. Ensure that pedestrians do not have to walk under the platform. Exclude the public from the working area by the use of barriers where necessary.

(d) Where the work area is close to fixed obstructions, the operator should check, that outrigger settings are appropriate for the load to be carried, that clearances are adequate and that there is no danger of any part of the work platform coming into contact with live electrical conductors or other obstructions.

13.2 Operation

(a) Never allow the SWL to be exceeded – you risk overturning the machine.

(b) Never position the machine over persons or allow workers to go under the working platform unless it is essential to the operation and on these occasions take special safety precautions. Don't start moving it unless the way is clear and will remain clear.

Towed truck-mounted work platform with an articulating boom.

(c) Wear a safety harness or safety belt attached to the platform where you have to stretch out over the platform's perimeter. It should meet the requirements of NZS 5811:1981.

(d) Ensure the gate is closed and secured before the platform is elevated.

(e) Avoid pressurised oil or air which escapes from a ruptured line or fitting. Make no attempt to slow or stop a leak by using your hands, feet or other part of your body. The pump engine or compressor should be stopped as soon as the leak is detected. Do not attempt a repair yourself. Leave this to qualified persons.

(f) Do not adjust or alter any safety device (such as a pressure relief valve).

(g) Do not use the platform as a prop, tie or crane. It was not designed to be used in this way and the machine may overturn.

(h) Never move the platform closer than 4 m to overhead electric lines unless the electrical supply authority has permitted a closer approach in writing.

(i) If any fault in the control system is suspected, stop operations and report the matter (after first ensuring the safety of workers).

(j) If a work platform comes in contact with live electrical lines or equipment, persons in the personnel bucket should remain on the work platform. Only as a last resort should they attempt to jump clear. They should:

(i) Operate the controls to break contact, if this is possible;

(ii) Otherwise warn all other persons to keep clear and call for assistance to de-energise the lines; or

(iii) If contact cannot be broken, and assistance is unavailable, as a last resort, leave the platform thus:

- switch off the motor and apply brakes;
- remove any loose clothing;
- climb to a point about a metre above ground from where they can safely jump to the ground;
- JUMP so that they clear the platform BEFORE any part of them touches the ground;
- fall forwards, not backwards.

13.3 Travel

Never move a manually-propelled work platform while the platform is elevated. Lower it to the cradle position before moving it.

Where it is proposed to move a self-propelled or vehicle-mounted work platform while the platform is elevated, ensure that the route chosen is firm and level before starting travel. During travel keep a safe distance from changes in slope, depressions, debris, buildings, overhead power lines and other obstacles. Workmen on the platform must wear safety harnesses fixed to the platform.

14. Electrical Supply Authorities Guide

Any user who follows the operating and maintenance instructions of the Electric Supply Authorities Engineers Institute of N.Z. Inc. guide: *GUIDE for the OPERATION & MAINTENANCE OF ELEVATING PLATFORM VEHICLES*, dated 1 October 1984, shall be deemed to. also comply with this Code of Practice.

Personnel buckets temporarily fitted to truck-mounted hydraulic lifting appliances, owned and operated by an electrical supply authority and which conform with the above guide, need not have controls fitted on the platform itself, notwithstanding Section 6 above, provided that:

- the operator of the truck-mounted lifting appliance has had at least 40 hours prior experience in the operation of the lifting appliance and that he remains at the controls for the whole time the platform is occupied; and
- there is clear communication between the operator and the platform worker, either by two-way radio, or the use of standard crane hand signals.

APPENDIX A. Construction Act 1959 Section 2 – Interpretation.

1. Construction Work

Work carried out by an employer on the site by way of trade or business, or in the exercise of his functions, or for the purpose of any industrial or commercial undertaking.

Construction work is defined as any work in connection with construction, erection, installation, carrying out, repair, maintenance, cleaning, painting, renewal, removal, alteration, dismantling or demolition of:

(a) Any building, erection, edifice, structure, wall, fence, or chimney whether constructed wholly or partly above or below ground level.

(b) Any road, waterway, harbour works, railway, cable way, tramway, canal, or aerodrome.

(c) Any drainage, irrigation, or river control work.

(d) Any electricity, water, gas, telephone, or telegraph reticulation.

(e) Any bridge, viaduct, dam, reservoir, earthworks, pipeline, aqueduct, culvert, driver, shaft, tunnel or reclamation.

(f) Any scaffolding.

(g) Any such work carried out under water, including work on ships, wrecks, buoys, rafts and obstructions to navigation; also including any inspection of other work carried out for the purpose of ascertaining whether construction work should be carried out.

2. Employer

Means any person who is liable for the payment of wages of persons employed on the work or who would be so liable if persons were so employed and includes:

(a) A subcontractor engaged on the work.

(b) A labour-only contractor engaged on the work.

(c) Any person engaged on the work for reward other than wages and in respect of the work of mechanical plant, also includes a trustee of the plant, notwithstanding that the bailee is not liable for the payment of wages of the plants operator.

APPENDIX B. Parts of Construction Act and Regulations

1. Section 14 Safety of Mechanical Plant – in part:

"The following rules shall be observed in respect of mechanical plant used in connection with construction work:

(a) All such mechanical plant shall be constructed of suitable and sound materials, shall be maintained in good order and condition, and shall be of adequate strength having regard to the purpose for which it is to be used:"

2. Section 30 Regulations–in part:

"The Governor-General may from time to time, by Order in Council, make regulations for all or any of the following purposes:

(a) Providing for the health, safety and welfare of persons engaged in construction work, and regulating and controlling the operation and maintenance of plant, machinery, tools and equipment used in construction work.

(i) Regulating and controlling the construction and use of scaffolding, working platforms and ladders;

(7) Requiring compliance with any Code of Practice or any part or parts of any Code of Practice that has been issued under Section 18A of this Act".

(b) Construction Regulations 1961, Regulation 34B Machine Lifted Platforms.

"With respect to the use of a small working platform which is moved into any working position by a power-operated machine to which it is attached, and subject to such additional conditions as the Chief Construction Safety Engineer may require, the following provisions shall apply:

(a) Where the platform is in use for the support of workmen, the total live load shall not exceed a weight which gives a factor of safety of 2 for the lifting mechanism and a factor of safety of 1.5 against overturning at the extreme radius in the most unfavourable position or such other factors of safety that the Chief Construction Safety Engineer shall specify in writing, having regard for the conditions of use and the safety of workers using the platform;

(b) Means shall be available on the lifting machine for positive locking of the means of support to prevent inadvertent movement unless there is independent support to the platform while in use;

(c) The operator of the lifting machine shall remain on duty at the controls while the platform is in use unless the lifting machine is controlled from the platform or the platform is independently held in position and there is direct access to the platform;

(d) Where the platform is supported from overhead, provision shall be made to prevent spinning during movement;

(e) When the platform is firmly attached to a lifting machine, effective means shall be taken to prevent the platform from tilting during the raising or lowering;

(f) Where a machine supports a platform which is in use by workmen, provision shall be made to prevent the machine moving on its wheels unless the surface on which it moves and the conditions of mounting are such as to ensure its stability against overturning in accordance with paragraph (a) hereof;

(g) Except where movement of the lifting machine and platform is controlled from the platform, an efficient system of signals between workmen and machine operators shall be provided;

(h) That all machine-lifted platforms, regardless of operating heights, to which this regulation applies shall be fitted with toeboards, midrails and guardrails on all sides, or be totally enclosed or fenced between decking and guardrail.

SAFETY IN CONSTRUCTION PUBLICATIONS

Obtainable from any Department of Labour office:

No. 1 *A Short Guide to the Construction Act 1959*
No. 3 *Scaffolding Code of Practice*
No. 4 *Blasting Code of Practice*
No. 5 *Excavation Code of Practice*
No. 7 *Falsework Guide*
No. 8 *Power-Operated Elevating Work Platforms*
No. 15 *Underwater Diving Code of Practice*
No. 16 *Powder-Powered Tool Guide*
No. 17 *Roll Over Protective Structures for Earthmoving Machines*
No. 18 *Work in Compressed Air Code of Practice*
No. 19 *Safety Supervisor's Guide*
No. 20 *Safe Use of Electricity*
No. 21 *Portable Mechanically-Powered Nailers and Staplers Guide*
No. 22 *Asbestos Guide*
No. 23 *Safety in Demolition Work*
No. 24 *Code of Practice for Cranes and Lifting Appliances*
No. 25 *Road Works Safety Guide*
No. 26 *Code of Practice for Rigging Work*

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