

FACTORIES ACT
(CHAPTER 104)

**FACTORIES (BUILDING OPERATIONS
AND WORKS OF ENGINEERING
CONSTRUCTION) REGULATIONS**

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**FACTORIES ACT
(CHAPTER 104, SECTIONS 68 AND 77)**

**FACTORIES (BUILDING OPERATIONS AND WORKS OF
ENGINEERING CONSTRUCTION) REGULATIONS**

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[1st July 1985]

PART I
PRELIMINARY

Citation

1. These Regulations may be cited as the Factories (Building Operations and Works of Engineering Construction) Regulations.

Definitions

2. In these Regulations, unless the context otherwise requires —
- “appointed medical practitioner” means the registered medical practitioner appointed under regulation 208;
 - “approved” means approved by the Chief Inspector in writing;
 - “auditor” means a safety auditor approved by the Chief Inspector;
 - “base plate” means a plate for distributing the load from a standard in the case of metal scaffolds;
 - “bay”, in relation to scaffolds, means that portion of the scaffold between horizontal or vertical supports whether standards or supports from which the portion is suspended, which are adjacent longitudinally;
 - “brace or bracing” means a member incorporated in a scaffold or formwork structure for stability;
 - “bulkhead” means an air-tight structure separating the working chamber from free air or from another chamber under a lower pressure than the working pressure;
 - “caisson” means an air and water-tight chamber in which it is possible for men to work under air pressure greater than atmospheric pressure at sea level to excavate material below water level;

“cofferdam” means a structure constructed entirely or in part below water level or below the level of the water table in the ground and intended to provide a place in which to work that is free of water;

“compressed air” means air mechanically raised to a pressure higher than atmospheric pressure at sea level;

“contract of service” includes an apprenticeship agreement;

“contract sum” means the value of the works to be carried out by contractors undertaking building operations or works of engineering construction as stated in the contract;

“contractor” means a person who has entered into a contract for the purpose of carrying out any building operations or works of engineering construction and includes a main contractor or sub-contractor;

“contractor’s safety supervisor” means a contractor’s safety supervisor appointed under regulation 26;

“decanting” means the rapid decompression of persons in a man-lock to atmospheric pressure at sea level followed promptly by their recompression in a decant lock, where they are then decompressed according to the appropriate decompression table in accordance with approved decompression procedures;

“demolition work” means the work incidental to or connected with the total or partial dismantling or razing of a building or a structure other than a building and includes the removing or dismantling of machines or other equipment;

“designated person” means a competent person appointed by an employer to carry out any supervision or inspection or to perform any task or duty prescribed by these Regulations;

“employee” means a person who has entered into a contract of service with an employer;

“employee’s lift” means a powered car operating in guides and used primarily to carry employees in a substantially vertical direction;

- “employer” means any person who employs another person under a contract of service;
- “end to end coupler” means a coupler used to connect two tubes end to end whether of an internal or “joint pin” type or of an external or “sleeve coupler” type;
- “excavation” means the removal of earth, rock or other material in connection with construction or demolition work;
- “falseworks” means the structural supports and bracing for formworks or forms;
- “flashpoint” means the minimum liquid temperature at which a spark or flame causes an instantaneous flash in the vapour space above the liquid;
- “formwork structure” includes formwork, shores and any other support;
- “frame or modular scaffold” means a scaffold manufactured in such a way that the geometry of the scaffold is pre-determined and the relative spacings of the principal members are fixed;
- “guardrail” means a horizontal rail secured to uprights and erected along the exposed sides of scaffolds, floor openings, runways and gangways to prevent persons from falling;
- “high pressure air” means air used to supply power to pneumatic tools and devices;
- “independent tied scaffold” means a scaffold, the working platform of which is supported from the base by 2 or more rows of standards and which apart from the necessary ties stands completely free of the building;
- “ledger” means a member spanning horizontally and tying scaffolding longitudinally and which acts as a support for putlogs or transoms;
- “lift”, in relation to any scaffold, means the vertical distance between the base of the scaffold and the first ledger or level at which a platform is constructed or the vertical distance between any 2 consecutive ledgers;

- “light duty work” means operations which require men and materials to be supported by a scaffold where the maximum total loading does not exceed the weight of 2 persons plus 25 kilograms of materials or 200 kilograms on any one platform in any one bay by the scaffold;
- “lock attendant” means the person in charge of a man-lock or medical lock and who is immediately responsible for controlling the compression, recompression or decompression of persons in such locks;
- “low pressure air” means air supplied to pressurise working chambers, man-locks and medical locks;
- “magazine” means a place in which explosives are stored or kept, whether above or below ground;
- “main contractor” means a person who has entered into a contract with an owner or lessee of a property or his agent for the purpose of carrying out any building operation or work of engineering construction;
- “man-lock” means any lock, other than a medical lock, used for the compression or decompression of persons entering or leaving a working chamber;
- “material hoist” means a power or manually operated suspended platform or bucket operating in guiderails and used for raising or lowering material exclusively and operated and controlled from a point outside the conveyance;
- “materials lock” means a chamber through which materials and equipment pass from one air pressure environment into another;
- “medical lock” means a double compartment lock used for the therapeutic recompression and decompression of persons suffering from the ill-effects of decompression;
- “outrigger” means a structure projecting beyond the facade of a building with the inner end being anchored and includes a cantilever or other support;
- “plant or equipment” includes any plant, equipment, gear, machinery, apparatus or appliance, or any part thereof;

- “pressure” means air pressure in bars above atmospheric pressure;
- “professional engineer” means a person registered as a professional engineer under the Professional Engineers Act (Cap. 253);
- “puncheon” means a vertical member extending over at least 2 lifts and placed midway between standards in the longitudinal plane of the scaffold;
- “putlog” means a horizontal member on which the board, plank or decking of a working platform are laid;
- “reveal tie” means the assembly of a tie tube and a fitting used for tightening a tube between 2 opposing surfaces;
- “right angle coupler” means a coupler, other than a swivel or putlog coupler, used for connecting tubes at right angles;
- “rock bolt” means a mechanical expansion bolt or a bolt used with cementitious or resin anchoring system which is set in drilled hole in the arch or wall of a tunnel to improve rock competency;
- “roofing bracket” means a bracket used in sloped roof construction and having sharp points or other means for fastening to prevent slipping;
- “safety screen” means an air and water-tight diaphragm placed across the upper part of a compressed air tunnel between the face and bulkhead, in order to prevent flooding the crown of the tunnel between the safety screen and the bulkhead, thus providing a safe means of refuge and exit from a flooding or flooded tunnel;
- “scaffold” means —
- (a) any temporarily provided structure on or from which persons perform work in connection with operations or works to which these Regulations apply; and
 - (b) any temporarily provided structure which enables persons to obtain access to or which enables materials to be taken to any place at which such work is performed,

and includes any working platform, gangway, run, ladder or step-ladder (other than an independent ladder or step-ladder which does not form part of such a structure) together with any guardrail, toe board or other safeguards and all fixings, but does not include a lifting appliance, a lifting machine or a structure used merely to support such an appliance or such a machine or to support other plant or equipment;

“segment” includes a cast iron or precast concrete segmented structure formed to the curvature of the tunnel cross-section and used to support the ground surrounding the tunnel;

“service shaft” means a shaft for the passage of persons or materials to or from a tunnel under construction;

“shaft” means an excavation having a longitudinal axis at an angle greater than 45° from the horizontal —

(a) for the passage of persons or materials to or from a tunnel; or

(b) leading to an existing tunnel;

“shield” means a movable frame which supports the working face of a tunnel and the ground immediately behind it and includes equipment designed to excavate and support the excavated areas in a tunnel;

“site safety supervisor” means a site safety supervisor appointed under regulation 25;

“sole plate” means a member used to distribute the load from the base plate or the standard of wooden scaffolds to the supporting surface;

“standard” means a member used as a vertical support or column in the construction of scaffolds which transmits a load to the ground or solid construction;

“steel rib” includes all steel beams and other structural members shaped to conform to the requirements of a particular tunnel cross-section, used for the purpose of supporting and stabilising the excavated areas;

- “sub-contractor” means a person who has entered into a contract with another contractor for the purpose of carrying out any building operations or works of engineering construction;
- “suspended scaffold” means a scaffold suspended by means of ropes or chains and capable of being raised or lowered but does not include a boatswain’s chair or similar appliance;
- “swivel coupler” means a coupler for connecting 2 tubes at any angle other than a right angle;
- “tie” means an assembly used to connect a scaffold to a rigid anchorage;
- “toe board” means a member fastened above a working platform, access landing, accessway, wheelbarrow run, ramp or other platform to prevent men and materials falling therefrom;
- “trestle scaffold” includes a scaffold in which the supports for the platform are any of the following which are self-supporting, that is to say, split heads, folding step-ladders, tripods or movable contrivances similar to any of the foregoing;
- “transom” means a member placed horizontally and used to tie transversely one ledger to another, or one standard to another in an independent tie scaffold;
- “tubular scaffold” means a scaffold constructed from tubes and couplers;
- “tunnel” means a subterranean passage made by excavating beneath the over-burden into which a worker enters or is required to enter to work;
- “underground” means within the confines of any shaft, tunnel, caisson or cofferdam;
- “vehicle” means a vehicle propelled or driven by mechanical or electrical power and includes a trailer, traction engine, tractor and road-building machine;
- “working chamber” means the part of the construction site where work in a compressed air environment is carried out, but does not include a man-lock or medical lock;

“working platform” means a platform which is used to support workmen or materials and includes a working stage;

“working pressure” means pressure to which persons in a working chamber are exposed;

“worksite” means the premises where any building operations or works of engineering construction are being carried out.

Application

3.—(1) These Regulations shall apply —

(a) to building operations; and

(b) to works of engineering construction,

undertaken by way of trade or business, or for the purpose of any industrial or commercial undertaking, or by or on behalf of the Government or any statutory or public authority and to any line or siding which is used in connection therewith and for the purposes thereof and is not part of a railway.

(2) The provisions of these Regulations shall be in addition to and not in substitution for or in diminution of other requirements imposed by the Act.

Obligations

4.—(1) It shall be the duty of every contractor and every employer who is undertaking any of the operations or works to which these Regulations apply —

(a) to comply with such of the requirements of these Regulations as affect him or any person employed, except that such requirements shall be deemed not to affect any employee if and so long as his presence in any place is not in the course of performing any work on behalf of his employer and is not expressly or impliedly authorised or permitted by his employer; and

(b) to comply with such of the requirements of these Regulations as relate to any work, act or operation performed or about to be performed by any such contractor or employer.

(2) It shall be the duty of every contractor and every employer who erects or alters any scaffold to comply with such of the requirements of these Regulations as relate to the erection or alteration of scaffolds having regard to the purpose or purposes for which the scaffold is designed at the time of erection or alteration.

(3) Every contractor and every employer who erects, installs, works or uses any plant or equipment to which any of the provisions of these Regulations applies shall erect, install, work or use such plant or equipment in a manner which complies with those provisions.

(4) Where a contractor, who is undertaking any of the operations or works to which these Regulations apply, appoints any artisan, tradesman or other person to perform any work or service under a contract for services, it shall be the duty of the contractor to comply with such of the requirements of these Regulations as affect that artisan, tradesman or other person.

(5) For the purpose of paragraph (4), any reference in these Regulations to an employee shall include a reference to such artisan, tradesman or other person and the contractor shall be deemed to be his employer.

(6) It shall be the duty of every employee to comply with the requirements of such of these Regulations as relate to the performance of or the refraining from an act by him to co-operate in carrying out these Regulations.

(7) No employer or contractor shall permit an employee to do anything not in accordance with the generally accepted principles of sound and safe practice.

(8) No employee shall do anything not in accordance with the generally accepted principles of sound and safe practice.

(9) No person shall wilfully do any unsafe act which may cause injury to himself or to others.

PART II

GENERAL PROVISIONS

Overhead protection

5.—(1) Overhead protection shall be erected along the periphery of every building which is under construction.

(2) Paragraph (1) shall not apply to any building which is less than 15 metres in height when completed.

(3) Overhead protection shall be not less than 2 metres wide and erected at a height not more than 5 metres from the base of the building and the outer edge of the shelter shall be 150 mm higher than the inner edge or shall be erected at an angle of not more than 20° to the horizontal sloping into the building.

(4) Where no one is required to work or to pass except persons who are at work in the vicinity, any area exposed to risk of falling materials or objects shall be roped off or otherwise guarded from inadvertent entry.

Falling hazards

6. Every open side or opening into or through which a person may fall shall be covered or guarded by an effective barrier to prevent falls except where free access is required by work actually in progress.

Drowning hazards

7.—(1) Where persons are exposed to the hazard of falling into water in which they may drown, there shall be provided at all times during the exposure, adequate equipment —

- (a) for keeping persons afloat;
- (b) for promptly rescuing persons from the water; and
- (c) for resuscitating rescued persons.

(2) A manned and properly equipped boat shall be provided if the Chief Inspector considers it necessary.

Slipping hazards

8.—(1) No employer shall suffer or permit an employee to use a passageway, scaffold, platform or other elevated working surface which is in a slippery condition.

(2) Oil, grease, water and other substances causing slippery footing shall be removed, sanded or covered to provide safe footing.

Tripping and cutting hazards

9.—(1) All passageways, platforms and other places of work shall be kept free from accumulations of dirt and debris and from other obstructions that could cause tripping.

(2) Any sharp projection which could cut any employee shall be removed or otherwise made safe.

Access to workplace

10.—(1) Stairways, ramps or runways shall be provided as the means of access to working levels above or below ground except where the nature or progress of the work prevents their installation in which case ladders or other safe means shall be provided.

(2) All buildings under construction of more than 2 storeys high shall be provided with well defined access at the ground floor with adequate overhead protective cover for persons entering or leaving the building.

Dust and gases

11. Dust and gases shall be controlled by ventilation or otherwise so as to prevent concentrations tending to injure health or obstruct vision.

Corrosive substances

12.—(1) All alkalis, acids and other corrosive substances shall be so stored and used as not to endanger employees.

(2) Suitable protective equipment for the use of such substances shall be provided.

(3) A clean water supply shall be readily available for washing off any spillage of any corrosive substance on the employees.

Eye protection

13. Suitable eye protection equipment shall be provided for and shall be used by employees while engaged in welding or cutting operations or in chipping, cutting or grinding any material from which particles may fly, or while engaged in any other operation which may endanger the eyes.

Respirators

14.—(1) Where these Regulations require respirators to be provided, the employer shall provide and the employee shall use a respirator suitable for the type of operation for which it is to be used.

(2) The employer shall —

- (a) maintain such respirator in good repair;
- (b) furnish the means for its continued efficient working condition; and
- (c) provide regular inspection and cleansing of such equipment.

Protective apparel

15.—(1) Every employee required to pass or work within areas where there is danger of being struck by falling materials or objects shall be provided with a safety helmet of a type tested and approved by a testing body approved by the Chief Inspector.

(2) Every employee required to work in water, wet concrete or other wet footing shall be provided with suitable waterproof boots.

(3) Every employee required to work in rain or similar wet conditions shall be provided with a waterproof coat and hat.

(4) Every employee required to use or handle alkalis, acids or other corrosive substances shall be provided with appropriate protective apparel.

Electrical hazards

16.—(1) Before work is begun, the employer shall ascertain by inquiry or direct observation, or by instruments, where any part of an electric power circuit, exposed or concealed is so located that the performance of the work may bring any person, tool or machine into physical or electrical contact therewith.

(2) The employer shall post and maintain proper warning signs in the 4 official languages where such a circuit exists.

(3) The employer shall advise his employees of the location of such lines, the hazards involved and the protective measures to be taken and shall, if practicable, de-energize the electric power circuit.

(4) No employer shall suffer or permit an employee to work in such proximity to any part of an electric power circuit that he may contact it in the course of his work unless the employee is protected against electric shock by —

- (a) de-energizing the circuit and earthing it; or
- (b) guarding the circuit by effective insulation or other means acceptable to the Chief Inspector.

(5) In work areas where the exact location of underground electric power lines is unknown, employees using jack-hammers, bars or other hand tools which may contact a line shall be provided with insulated protective gloves and insulated protective footwear.

(6) All wiring shall be supported on proper insulators and not looped over nails or brackets.

(7) No wiring shall be left on the ground or the floor of a building unless it is unavoidable.

(8) Where it is necessary to lay electric wiring on the ground or the floor of a building, the wiring shall —

- (a) be of the weather-proof types;
- (b) be provided with adequate mechanical protection to withstand the wear and abuse to which it may be subjected; and
- (c) be maintained in good and safe working order.

(9) No bare wires or other unprotected conductors shall be located within 4 metres of any surface where employees may work or pass, unless completely guarded by a fence or other barrier.

(10) Where electrical appliances and current carrying equipment have provisions made for earthing, they shall be properly earthed.

(11) All temporary electrical installations in building and engineering construction worksites shall be provided with earth leakage circuit breakers.

(12) Elevated power lines shall —

- (a) have a sufficient vertical clearance where they cross highways, access roads or areas travelled by trucks, cranes, shovels or other similar equipment; and
- (b) by no means be lower than 5.2 metres from the ground surface.

(13) All electrical installations in building and engineering construction worksites shall comply with the requirements of —

- (a) the Public Utilities (Electricity) Regulations (Cap. 261, Rg 2); and
- (b) the Public Utilities (Electricity Supply) Regulations (Cap. 261, Rg 3).

(14) All electrical installations shall —

- (a) be tested and approved by the Chief Electrical Engineer of the Public Utilities Board, or his representative, or by any electrical worker before they are commissioned; and
- (b) be maintained in good and safe working order.

(15) For the purpose of paragraph (14), “electrical worker” shall have the same meaning as in the Electrical Workers and Contractors Licensing Act (Cap. 89).

(16) All temporary electrical installations shall comply with the Singapore Standard CP 44, Code of Practice for Temporary Electrical Installations for Construction and Building Sites and any amendment thereto.

Power-driven saws

17.—(1) All portable power-driven hand operated saws which are not mounted with saw tables except chain saws shall be equipped with —

- (a) guards above the base plate which will completely protect the operator from contact with the saw blade when in motion; and
- (b) self-adjusting guards below the base plate which will completely cover the saw to the depth of the teeth when the saw is removed from the cut.

(2) Every power-driven saw which is mounted with a saw table shall be equipped with a guard which shall cover the saw blade to such an extent as will prevent contact with any part of the teeth which are more than 50 mm above the saw table and which are not protected by the spreader or similar device.

(3) When in operation, the guard shall —

- (a) automatically rise by pressure from the material; or
- (b) be so adjusted that as the saw cuts the material, the distance from the material to the underside of the guard does not exceed 12 mm.

(4) The exposed teeth of the saw blade beneath the table shall be effectively guarded.

(5) Every table circular saw used for ripping shall be provided with a spreader securely fastened in position and with an effective device to prevent the kicking back of material.

Public vehicular traffic

18.—(1) Whenever any work is being performed over, on or in close proximity to a highway or any other place where public vehicular traffic may cause danger to men at work, the working area shall be so barricaded and suitable warning signs and warning lights shall be set up to direct traffic away from it and, when necessary, the traffic shall be specially controlled by designated persons.

(2) All vehicles used at construction worksites shall be roadworthy and registered with the appropriate authority in accordance with the

Road Traffic Act (Cap. 276) and any subsidiary legislation made thereunder.

(3) No person shall drive a vehicle of any class or description in a construction worksite unless he is the holder of a driving licence authorising him to drive a vehicle of that class or description.

Stability of structures

19. No wall, chimney or other structure or part of a structure shall be left unguarded or unshored in such condition that it may fall, collapse or weaken due to wind pressure, vibration or any work being carried out in the vicinity.

Structures and supports to be checked

19A. Any supporting structure or foundation of a supporting structure and other support shall be checked periodically for excessive corrosion, erosion, physical deterioration or alteration to ensure that their stability is not affected and that they are suitable and sufficient to perform the function for which they are intended.

Illumination of passageways, etc.

20.—(1) Illumination sufficient for maintaining safe working conditions shall be provided wherever persons are required to work or pass.

(2) For passageways, stairways and landings, the illumination shall be not less than 50 lux.

Storage of materials and equipment

21.—(1) All building materials shall be stored or stacked in a safe and orderly manner so as not to obstruct any passageway or place of work.

(2) Material piles shall be stored or stacked in such a manner as to ensure stability.

(3) Material or equipment shall not be stored upon any floor, scaffold, runway or working platform in such quantity as to exceed its safe carrying capacity.

(4) Material or equipment shall not be stored or placed so close to any edge of a floor or platform as to endanger persons below.

(5) Any material stored inside a building which is under construction shall not be placed within 1.8 metres of any hoist way or floor openings or within one metre of an exterior wall if the wall does not extend beyond the top of the stored material.

(6) No person shall work in a silo, a hopper or a tank where materials are stored or in any other similar storage area unless he is equipped with a safety belt and a life line secured to a suitable anchorage.

(7) Any material stored in bags shall be stacked by stepping back the layers and cross-keying the bags at least once every 10 bags high.

(8) Cement bags, bricks, tiles, cement blocks or other building materials shall not be stacked more than 2.3 metres in height.

(9) Any stack of bricks or cement blocks which is higher than 1.2 metres should be stepped back every 30 cm in successive tiers.

(10) When masonry blocks are stacked, the stack shall be stepped back one-half block per tier for every tier above 1.8 metres.

(11) Cantilevered platforms erected more than 3 metres above the ground level and used for temporary storage or placement of materials shall be constructed in accordance with the design and drawings of a professional engineer.

(12) Sign boards showing the safe working load of a platform shall be prominently displayed at suitable locations at the platform.

(13) The platform shall not be loaded beyond its safe working load except by an inspector testing the platform, or by the professional engineer who designed it.

Disposal of debris

22.—(1) Debris shall be handled and disposed of by a method which will not endanger persons.

(2) Debris shall not be allowed to accumulate so as to constitute a hazard.

(3) Debris shall be kept sufficiently moist to lay the dust.

(4) Debris shall not be thrown from buildings whether under construction or completed.

Numbering and marking of floors

23. Each floor of every building under construction shall be appropriately numbered or marked at the landing of every floor of every staircase or other means of access.

Use of safety helmets

24.—(1) All persons who are performing any work or service in a worksite shall wear safety helmets according to the following colour code:

<i>Personnel</i>	<i>Colour of Safety Helmet</i>
(a) Owner, architect, engineer and their site staff	White
(b) Main contractors, site agents, foremen and other site supervisors of main contractors	White with red stripe
(c) Sub-contractors and supervisory staff of sub-contractors	Yellow with red stripe
(d) Site safety supervisors and contractor safety supervisors	Blue
(e) All other workers	Yellow.

(2) The red stripe referred to in paragraph (1) shall be 50 mm wide along the centre-line of the helmet from front to back across the crown.

Site safety supervisors

25.—(1) Any main contractor who undertakes building operations or works of engineering construction of a contract sum of \$5 million or more shall appoint a full-time site safety supervisor who shall spend at least 40 hours per week exclusively on safety supervision and on promoting the safe conduct of work.

(2) Any main contractor who undertakes building operations or works of engineering construction of a contract sum of less than \$5 million shall appoint a part-time site safety supervisor who shall spend at least 15 hours per week exclusively on safety supervision and on promoting the safe conduct of work.

- (3) The site safety supervisor shall be a person who —
- (a) is competent to perform the duties specified in paragraphs (4) and (5);
 - (b) possesses such qualifications as are approved by the Chief Inspector; and
 - (c) has a minimum of 2 years' experience as a site foreman.
- (4) The site safety supervisor shall —
- (a) ensure that the provisions of the Act and any regulations made thereunder are complied with; and
 - (b) promote the safe conduct of the work generally within the worksite.
- (5) The duties of a site safety supervisor shall include —
- (a) inspecting and rectifying any unsafe place of work;
 - (b) correcting any unsafe practice;
 - (c) checking sub-contractors' work to ensure compliance with the provisions of the Act and any regulations made thereunder; and
 - (d) liaison with contractor's safety supervisors with respect to safety of work undertaken by sub-contractors.

Contractor's safety supervisors

26.—(1) Every contractor other than the main contractor in charge of a worksite who employs more than 20 persons to carry out work on a worksite shall appoint a part-time contractor's safety supervisor.

(2) The part-time contractor's safety supervisor shall spend at least 5 hours per week exclusively on safety supervision and on promoting the safe conduct of work generally by his employees.

- (3) The contractor's safety supervisor shall be a person who —
- (a) is competent to perform the duties specified in paragraph (4); and

- (b) has a minimum of 2 years' experience as a site foreman.
- (4) The contractor's safety supervisor shall —
 - (a) ensure that the provisions of the Act and any regulations made thereunder are complied with; and
 - (b) promote the safe conduct of the work by the other employees of his employer employed on that worksite.

Safety committees

27.—(1) The main contractor of a worksite in which 50 or more persons are for the time being employed (whether by him or by other contractors) shall establish a safety committee (on which both employees and management are represented) for the purpose of keeping under review circumstances in the worksite which may affect the safety and health of the persons employed therein.

- (2) The safety committee shall consist of —
 - (a) a senior member of the main contractor's staff at the site;
 - (b) the site safety supervisor;
 - (c) all contractor's safety supervisors; and
 - (d) such other site workers who are appointed as members.
- (3) The safety committee shall meet at least once a month.

Safety management system

27A.—(1) Where the contract sum of the work to be carried out is \$10 million or more, the occupier of the worksite shall implement a safety management system for the purpose of ensuring the safety and protecting the health of all workers in the worksite.

- (2) The safety management system shall include —
 - (a) safety policy, including the allocation and delegation of responsibility for safety;
 - (b) safe work practices;
 - (c) safety training;
 - (d) group meetings;
 - (e) incident investigation and analysis;
 - (f) in-house safety rules and regulations;

- (g) safety promotion;
- (h) a system for the evaluation, selection and control of sub-contractors;
- (i) safety inspections;
- (j) a maintenance regime for all machinery and equipment;
- (k) hazard analysis;
- (l) the control of movement and use of hazardous substances and chemicals; and
- (m) emergency preparedness.

Safety audit

27B.—(1) Where the contract sum of the work to be carried out is \$30 million or more, the occupier of the worksite shall appoint an independent external auditor to audit the safety management system of the worksite at least once every 6 months.

(2) Where the contract sum of the work to be carried out is less than \$30 million, the occupier of the worksite shall conduct a review of the safety management system of the worksite at least once every 6 months.

(3) Where the contract sum of the work to be carried out is less than \$30 million, the Chief Inspector may, if he considers it necessary, direct the occupier of a worksite to appoint an independent external auditor to audit the safety management system instead of conducting a review.

PART III

CONCRETE WORK

General requirements

28.—(1) Formwork structures and reshores shall be structurally safe and shall be properly braced or tied together so as to maintain position and shape.

(2) The formwork structure shall be capable of sustaining the total dead, live and impact loads on the formwork with a minimum safety factor of 2.

(3) Where the formwork structure is of 2 or more tiers, frames or shores —

- (a) the tiers, frames or shores shall be securely and effectively connected vertically;
- (b) sufficient longitudinal and transverse bracing shall be incorporated into the formwork structure for rigidity; and
- (c) sufficient catwalks and other safe means of access shall be provided for inspection purposes.

Inspection and supervision

29.—(1) A designated person shall supervise the erection of the formwork including the shores, braces and other supports.

(2) Upon the erection of the formwork, the designated person shall make a thorough inspection to ensure that the formwork is safe.

(3) A designated person shall regularly inspect the formwork, shores, braces and other supports during the placing of concrete.

(4) Reshores shall be similarly inspected by the designated person.

(5) Any unsafe condition discovered during the inspections mentioned in paragraphs (2), (3) and (4) shall be remedied immediately.

(6) The designated person shall keep all records of such inspections at the worksite and shall produce them for examination upon the request of an inspector.

Beams, floors and roofs

30.—(1) Horizontal and diagonal bracing shall be provided in both longitudinal and transverse directions, as may be necessary, to provide structural stability.

(2) Shores shall be properly seated top and bottom and shall be secured in place.

(3) Where shores rest upon the ground, base plates shall be provided.

(4) Where the floor to ceiling height does not exceed 9.14 metres, the props to the formwork shall be of adequate size and spacing.

(5) Where —

- (a) the floor to ceiling height exceeds 9.14 metres;
- (b) the formwork deck is supported by shores constructed in 2 or more tiers; or
- (c) the dead, live and impact loads on the formwork exceed 732.3 kgf per square metre,

the formwork structure shall be designed by a professional engineer and the specification and drawings shall be kept on the job for use by an inspector and a copy of the said design and drawing shall be submitted to the Chief Inspector before work commences.

(6) A formwork structure designed by a professional engineer shall be constructed in accordance with his design and drawings.

(7) Where the formwork structure is designed by a professional engineer, he shall be responsible for the stability of the structure and ensure that its construction is properly supervised.

Stripping

31.—(1) Stripping shall not commence until the concrete is fully set.

(2) Stripped forms shall be removed or stock-piled promptly after stripping in all areas in which persons are required to work or pass.

(3) Protruding nails, wire ties and other form of accessories not necessary to subsequent work shall be pulled, cut or otherwise made safe.

Reshoring

32.—(1) Reshoring shall be provided when necessary to safely support slabs and beams after stripping, or where such members are subjected to superimposed loads due to construction above.

(2) The requirements of regulation 30 (1), (2) and (3) shall apply to reshores.

PART IV

STRUCTURAL STEEL AND PRECAST CONCRETE ASSEMBLY

Placing of structural members

33. During the final placing of structural members, the load shall not be released from the hoisting rope until the members are securely fastened in place.

Holing or cutting of structural members

34. No load bearing structural members shall be materially weakened by cutting, holing or other means except in accordance with the written instructions of a professional engineer.

Tag-lines

35. While panels or structural members are being hoisted, tag-lines shall be used to prevent uncontrolled movement.

Erection of lintels

36. Where exterior lintels are erected on steel or concrete frame buildings after the permanent floors have been installed, a suitable scaffold shall be used unless each worker engaged in the erection of such lintels wears a safety belt.

Permanent flooring — skeleton steel construction in tiered buildings

37. The permanent floors of skeleton steel construction in tiered buildings shall —

- (a) be installed as the erection of structural members progresses; and
- (b) be not more than 8 storeys between the erection floor and the uppermost permanent floor.

Temporary flooring — skeleton steel construction in tiered buildings

38.—(1) The erection floor shall be solidly planked over its entire surface except for access openings.

(2) Planking shall be of adequate strength to carry the working load and shall be laid tight and secured to prevent movement.

(3) There shall also be provided a closely boarded and substantial floor within 2 storeys or 8 metres, whichever is the less, below and directly under the portion of each tier of beams on which bolting, riveting, welding or painting is being done.

PART V

CONSTRUCTION, REPAIR AND MAINTENANCE OF STEEP ROOFS

Work on steep roofs

39.—(1) Where work is being performed on roofs having a slope greater than one in 4, there shall be provided protection against sliding, consisting of roofing brackets or crawling boards.

(2) Paragraph (1) shall not apply where every employee engaged in work upon such roofs is protected by a safety belt.

Construction and installation of roofing brackets

40.—(1) Roofing brackets shall be constructed to fit the pitch of the roof and when in use shall provide a level working platform.

(2) Roofing brackets shall be secured in place by nailing pointed metal projections attached to the underside of the bracket and securely driven into the roof or by a secure rope passed over the ridge pole and tied.

Crawling boards

41.—(1) Crawling boards shall be not less than 250 mm wide and 25 mm thick and shall have cleats at least 38 mm wide, spaced at equal intervals not more than 310 mm apart across the full width of the board and firmly nailed.

(2) Such board shall extend from the ridge pole to the eaves when used in connection with roof construction, repair or maintenance.

(3) Every crawling board shall be secured to the roof by ridge hooks or equally effective means.

(4) A firmly fastened life line of adequate strength shall be strung beside each crawling board throughout its length.

PART VI

CATCH PLATFORMS AND HOARDINGS

Use of catch platforms

42. Catch platforms shall not be used for storage of material, as working platforms or walkways.

Catch platforms

43.—(1) Catch platforms shall be at least 2 metres wide and shall be inclined so that the outer edge is 150 mm higher than the inner edge.

(2) Planks forming a catch platform shall be laid close together and shall be nailed down.

(3) The open ends of a catch platform shall be properly fenced up to a height of not less than one metre.

Hoardings

44. When the Commissioner of Building Control considers it necessary, hoardings shall be constructed in accordance with his requirements.

PART VII

CHUTES, SAFETY BELTS AND NETS

Chutes

45.—(1) Wooden or metal chutes provided for the removal of materials and which are at an angle of more than 45° with the horizontal shall be entirely enclosed on all sides, except at openings used for the receiving or discharging of materials.

(2) All openings of chutes except the top openings shall be closed when not in use.

(3) Chutes at an angle of 45° or less with the horizontal may be opened on the upper side.

Construction of chutes

46.—(1) Every chute shall be constructed of planking or sheet metal of sufficient thickness.

(2) Every chute shall have a strong bottom where the materials strike the chute and shall be rigidly supported throughout its length.

(3) A strong gate shall be constructed at the lower end of every loading chute to control the loading of materials into trucks and to close the chute at all other times.

(4) Splashboards shall be erected to prevent materials from rebounding into public thoroughfares.

(5) Chutes exceeding 12 metres in height shall be constructed in accordance with the design and drawings of a professional engineer.

(6) Where construction of a chute is in accordance with paragraph (5), certified copies of the design and drawings of the chute shall be kept available at the site for the use by an inspector.

Danger signs

47. A simple but effective warning notice in the 4 official languages shall be placed in a conspicuous position at the discharge end of every chute to warn the employees and the public.

Chute maintenance

48. Every chute shall be cleared when debris has accumulated to a height as specified by the design engineer, where applicable, but in no case less frequently than once a day.

Safety belts

49. Safety belts, life lines and all devices for the attachment of life lines shall be of adequate strength and of a type tested and approved by a testing body approved by the Chief Inspector.

Anchorage for safety belts and life lines

50.—(1) Every safety belt made available or supplied to any person for his personal protection shall be used by the person in the performance of his work.

(2) When the use of a safety belt is necessary for a person's safety, adequate and suitable means of anchorage for the safety belt shall, if practicable, be provided.

(3) Where it is not practicable to comply with paragraph (2), a life line securely attached to sufficient anchorage shall be provided.

(4) At all times during use, the safety belt shall be attached to an anchorage or to a life line securely attached to one or more points of an anchorage.

(5) The life line shall not be longer than is required to permit a worker to perform his work and the point or points of anchorage of the life line shall in no case be lower than the level of his working position.

Instruction in use

51. Every employee who is provided with a safety belt shall be instructed in the proper method of wearing and using it, as well as attaching it to the life line.

Protection of life lines

52. Padding, wrapping or similar means shall be provided to protect every life line from contact with edges or objects which may cut or severely abrade it.

Inspection of safety belts and life lines

53.—(1) Every safety belt and every life line shall be inspected by a designated person before use by an employee.

(2) No employer shall suffer or permit an employee to use a safety belt or life line which shows any indication of wear, damage or deterioration likely to affect its strength and no such safety belt or life line shall be kept on the worksite.

Safety nets

54.—(1) Every safety net shall be of a type tested and approved by a testing body approved by the Chief Inspector.

(2) Every safety net or combination of safety nets shall be of sufficient size and strength to catch any person for whose protection it is used and so located as to cover the area of possible fall.

(3) Every safety net shall be attached to sufficient anchorages or supports outside and beyond the area of possible fall and supported at a height sufficient to prevent sagging to any surface or object beneath when cushioning the fall of a person.

Storage

55.—(1) Every safety net shall be thoroughly dried before storage in a dry location.

(2) It shall be protected against mechanical damage and damage from acid or other corrosive substances.

Inspection of safety nets

56.—(1) Each safety net shall be inspected by a designated person before each installation.

(2) No safety net which shows signs of wear, damage or deterioration that will materially affect the strength of any portion thereof shall be installed.

(3) After installation, a designated person shall inspect the safety net and its supports daily.

(4) The result of the inspection as required under paragraphs (1) and (3) shall be entered in a register which shall be kept at the worksite for the use by an inspector.

PART VIII

RUNWAYS AND RAMPS

Use by vehicles

57.—(1) All runways and ramps shall be substantially constructed and securely braced and supported.

(2) Runways and ramps for the use of motor trucks or heavier vehicles shall —

- (a) have a width of not less than 3.7 metres;
- (b) be provided with timber curbs not less than 200 mm by 200 mm placed parallel to, and secured to, the sides of the runway or ramp; and
- (c) be designed by a professional engineer.

(3) The flooring thickness shall, however, be of not less than 75 mm planking and shall be laid transversely close together, butt-jointed and securely nailed.

Use by employees

58.—(1) Runways and ramps for the use of employees shall be not less than 430 mm in width and shall be constructed of not less than 25 mm thick planking, supported substantially in relation to the span and braced.

(2) Planking shall be laid close, butt-jointed and securely nailed without cantilevered ends.

(3) Runways and ramps for the use of employees and located or rising more than 3 metres above the floor or ground shall be provided on the open sides with a guardrail.

Use by wheel-barrows, etc.

59.—(1) Runways and ramps used for wheel-barrows, hand-carts or hand trucks shall be not less than one metre in width and shall be constructed of not less than 50 mm thick planking, supported substantially in relation to the span and braced.

(2) Planking shall be laid close, butt-jointed and securely nailed without cantilevered ends.

(3) Runways and ramps for the use of wheel-barrows, hand-carts or hand trucks and located or rising more than 3 metres above the floor or ground shall be provided on the open sides with a suitable guardrail of adequate strength.

Slope

60.—(1) Ramps shall have a slope not exceeding one in 4 and the total rise of a continuous ramp used by men carrying material or using wheel-barrows shall not exceed 3.7 metres, unless broken by horizontal landings at least 1.2 metres in length.

(2) If the slope is steeper than one in 8, the ramp shall be provided with cleats spaced not more than 350 mm apart, and securely fastened to the planking to afford a foothold.

(3) Spaces in the cleats may be provided for the passage of the wheels of vehicles.

PART IX

LADDERS AND STEP-LADDERS

Construction

61. Every ladder and step-ladder shall be of good construction, sound material and adequate strength for the purpose for which it is used.

Handhold to be provided

62. Where a ladder is used as a means of communication or as a working place, the ladder shall rise or adequate handhold shall be provided to a height of at least one metre above the place of landing of the highest rung to be reached by the feet of any person working on the ladder, as the case may be, or if that is impracticable to the greatest practicable height.

Exception

63. Regulation 62 shall not apply to a crawling ladder.

Loose footing

64. Ladders or step-ladders shall not stand on loose bricks or other loose packing, but shall have a level and firm footing.

Prevention against slipping or falling

65.—(1) Every ladder shall so far as practicable be securely fixed so that it can move neither from its top nor from its bottom points of rest.

(2) If the ladder cannot be so securely fixed, it shall where practicable be securely fixed at the base or if such fixing at the base is impracticable, a person shall be stationed at the base of the ladder to prevent slipping or falling.

(3) This regulation shall not apply to a ladder less than 3 metres in length and not used as a means of communication if it is securely placed so as to prevent it from slipping or falling.

Swaying and sagging

66. Every ladder shall be —

- (a) secured so as to prevent undue swaying;
- (b) equally and properly supported on each upright;
- (c) so used as not to cause undue sagging; and
- (d) placed as nearly as possible at an inclination of 4 in one.

Landing place

67.—(1) Every ladder or run of ladders rising a vertical distance of over 9 metres shall, if practicable, be provided with an intermediate landing place so that the vertical distance between any 2 successive landing places shall not exceed 9 metres.

(2) Every landing place shall be of adequate dimensions and, if a person is liable to fall therefrom for a distance of more than 3 metres, shall, except in so far as that is not reasonably practicable, be provided with sufficient and suitable guardrails to a height of at least one metre above the landing place.

(3) Where a ladder passes through an opening in the floor of a landing place, the opening shall be as small as it is reasonably practicable.

Rungs

- 68.** No ladder shall be used which has —
- (a) a missing or defective rung; or
 - (b) any rung which depends for its support solely on nails, spikes or other similar fixing.

Materials to be used for ladders

- 69.** No wooden ladder shall be used unless it is constructed with —
- (a) uprights of adequate strength made of straight-grained wood free from defects and having the grain of the wood running lengthwise;
 - (b) rungs made of straight-grained wood free from defects and mortised or securely notched into the uprights; and
 - (c) reinforcing metal ties if the tenons are not secured by wedges.

PART X

SCAFFOLDS

Construction and materials

- 70.** Every scaffold and every component thereof shall —
- (a) be of sound material, good construction and adequate strength;
 - (b) be free from patent defects; and
 - (c) be suitable and safe for the purpose for which it is intended.

Approved metal scaffolds

71.—(1) No metal scaffold shall be used unless it is of a type that has been approved in writing by the Chief Inspector.

(2) Any approval given by the Chief Inspector under paragraph (1) may be subject to such conditions as the Chief Inspector may specify.

Notification of intention to erect scaffolds

72.—(1) Any person who intends to erect a scaffold other than a mobile tower scaffold shall notify the Chief Inspector at least one week prior to the erection of the scaffold.

(2) The notification shall be in such form as the Chief Inspector may require.

(3) Upon receipt of a notification under this regulation, the Chief Inspector may impose conditions subject to which the scaffold is to be erected.

Supervision by scaffold supervisor

73.—(1) No scaffold shall be erected or be substantially added to or altered or be dismantled except under the immediate supervision of a scaffold supervisor approved in writing by the Chief Inspector.

(2) The Chief Inspector may revoke the approval of any scaffold supervisor if he is satisfied that the person has failed to discharge his duties under regulation 74.

Duty of scaffold supervisor

74. The scaffold supervisor shall ensure that the scaffold is erected, added to, altered or dismantled in accordance with these Regulations.

Scaffold erectors

75. Scaffolds shall be erected, added to, altered or dismantled by scaffold erectors who have undergone a course of training approved by the Chief Inspector.

Design of professional engineer required

76.—(1) Every metal scaffold exceeding 45 metres in height and every other scaffold exceeding 15 metres in height shall be constructed in accordance with the design and drawings of a professional engineer.

(2) A copy of the design calculations and drawings of the scaffold shall be submitted to the Chief Inspector for his records at least one week prior to the erection of the scaffold.

(3) A copy of the design drawings certified by the professional engineer shall be kept available at the worksite for use by an inspector.

Timber roller scaffold

77.—(1) Timber used for any scaffold shall —

- (a) be of a suitable quality;
- (b) be in good condition;
- (c) have the bark completely stripped off; and
- (d) not be painted or treated in any way so that defects in the wood cannot be seen easily.

(2) Timber rollers used for scaffolds shall be Bintangor or any other timber of similar strength, durability and resilience as Bintangor.

(3) Every standard of a Bintangor or other roller scaffold shall be of a size having a diameter of not less than 50 mm throughout its length.

(4) Every Bintangor or other timber roller used as a ledger or horizontal bracing, transom and putlog shall have a diameter of not less than 38 mm at the tip.

(5) Rattan strips shall be used for the lashing of Bintangor or other timber roller scaffold members.

(6) The lashing shall be done with rattan strips of not less than 1.8 metres in length with a minimum of 6 turns per strip.

(7) Every Bintangor or other timber roller scaffold with a single row of standards shall not exceed 15 metres in height.

(8) Every Bintangor or other timber roller scaffold with 2 or more rows of standards shall not exceed 15 metres in height unless it is —

- (a) erected continuously around the building without any break in the scaffold;
- (b) securely tied and braced at the corners; and
- (c) rigidly anchored to the building at regular close intervals.

(9) No Bintangor or other timber roller scaffold shall exceed 30 metres in height.

(10) Transverse and longitudinal braces of Bintangor or other timber roller scaffolds shall be securely placed and lashed to the standards.

(11) Bintangor or other timber roller scaffolds shall be tied to a building by horizontal ties which shall pass through an opening or hole in the wall in the building and secured to another pole at right angles which bears firmly in the inside of the wall.

(12) Ties made up of wires shall not be used.

Maintenance

78.—(1) Every scaffold shall be properly maintained and every part thereof shall be kept so fixed, secured or placed in position as to prevent, as far as is practicable, accidental displacement.

(2) No scaffold or part thereof shall be partly dismantled and allowed to remain in such a condition that it is capable of being used unless either —

- (a) the scaffold continues to comply and would, if used, comply with these Regulations; or
- (b) a prominent warning notice in the 4 official languages indicating that the scaffold or part thereof is not to be used is affixed near any point at which the scaffold or part, as the case may be, is liable to be approached for the purpose of use.

(3) No Bintangor roller scaffold shall be used after a period of 9 months after erection.

(4) Where ties of scaffolds to the permanent structure have to be removed, the portion from which the ties are removed shall be dismantled unless adequate measures are taken to ensure the stability of the scaffold.

Standards, ledgers and putlogs

79.—(1) Standards of scaffolds shall be —

- (a) plumb where practicable;

- (b) fixed sufficiently close together to secure the stability of the scaffold having regard to all the circumstances;
- (c) spaced not more than 1.5 metres apart in the case of Bintangor roller scaffolds; and
- (d) spaced not more than 2.5 metres apart in the case of metal scaffolds.

(2) The displacement of the foot of any standard shall be prevented by placing the standard on an adequate and secured sole plate in order that the foot shall not rest directly on the ground.

(3) In the case of metal scaffolds, the foot of the standard shall rest on a base plate secured to a sole plate and the foot shall not rest directly on the ground.

(4) Ledgers of metal scaffolds shall be spaced at vertical intervals of not more than 2 metres.

(5) Wooden ledgers shall be as nearly as possible horizontal, be spaced at vertical intervals of not more than 1.8 metres apart and be securely fastened to the standards.

Working platforms

80.—(1) Working platforms shall be provided around the edge of a building at every uppermost permanent floor under construction and at any level where work is carried out.

(2) Every working platform provided under paragraph (1) shall —

- (a) be either closely boarded, planked or constructed of metal decking;
- (b) be at least 635 mm wide if it is used to provide footing for not more than 2 persons and to support tools and materials not exceeding 25 kgf per bay;
- (c) not be used to support more than 2 persons per bay if it is less than 860 mm;
- (d) be at least 860 mm in width if the weight of tools and materials exceeds 25 kgf but not more than 100 kgf per bay;
- (e) not be used to support more than 4 persons and the total weight of tools and materials exceeding 100 kgf per bay; and

(f) be at least 1.1 metres wide if the platform is used for the support of any higher working platform.

(3) The maximum average loading on any working platform in any one bay of a scaffold shall not exceed —

(a) 220 kgf per square metre for men and materials for metal scaffolds; and

(b) 75 kgf per square metre for men and materials for timber scaffolds.

(4) Signboards showing the maximum permissible weight of tools and materials and the maximum number of persons permissible per bay shall be prominently displayed at suitable locations at the working platforms.

Boards, planks and decking

81.—(1) Boards, planks or decking used in the construction of working platforms shall be of uniform thickness.

(2) Boards, planks or decking shall be capable of supporting a load of 670 kgf per square metre with due regard to the spacing of the supports.

(3) Metal decking which forms part of a working platform shall be provided with non-skid surfaces.

(4) No board or plank which forms part of a working platform shall project beyond its end support to a distance less than 50 mm or more than 4 times the thickness of the board or plank unless it is effectively secured to prevent tipping or uplift.

(5) Boards, planks or decking shall be flushed and secured.

Only 2 levels to be used at any one time

82. Not more than 2 levels of working platforms per bay on a scaffold shall be used to support men or materials at any one time.

Removal of waste materials

83. All concrete waste or other debris shall be removed from any working platform.

Work at end of wall

84. Where work has to be done at the end of a wall or working face, the working platform at such wall or face shall, wherever practicable, extend at least 610 mm beyond the end of the wall or face.

Repair of damaged scaffolds

85.—(1) Any scaffold that has been damaged or weakened shall be immediately repaired and no person shall be permitted on such scaffold except for the purposes of repairs.

(2) Adequate safety measures shall be taken to ensure the safety of the persons carrying out the repairs.

Opening only for access

86. There shall be no opening in any working platform except to allow access to that working platform.

Ladders

87. Ladders shall be provided to enable persons to gain access from one working platform to another or from one level to another of any scaffold.

Guardrails and toe boards at working platform and working place

88.—(1) Subject to paragraphs (4), (5) and (6), every side of a working platform or working place, being a side from which a person is liable to fall a distance of more than 3 metres, shall be provided with a suitable guardrail or guardrails of adequate strength to a height of at least 1.1 metres above the platform or place and above any raised standing place on the platform, and with toe boards up to a sufficient height being in no case less than 200 mm and so placed as to prevent so far as possible the fall of persons, materials and tools from such platform or place.

(2) Guardrails shall have sufficient strength and rigidity to withstand without permanent deformation or failure when a 50 kgf load is applied in any direction at right angles to the guardrails.

(3) Guardrails and toe boards used on a working platform or working place shall be placed on the inside of the uprights, and where the space between any toe board and the lowest guardrail above exceeds 690 mm there shall be provided another guardrail midway between the toe board and the upper guardrail.

(4) Guardrails and toe boards required by paragraphs (1), (2) and (3) may be removed or remain unerected for the time and to the extent necessary for the access of persons or the movement of materials.

(5) On the side of a suspended scaffold facing the wall —

- (a) guardrails, where required by this regulation, need not extend to a height of more than 690 mm above the platform if the work is impracticable with a guardrail at that height; and
- (b) guardrails and toe boards shall not be required if the work requires the workers to sit at the edge of the platform to work and ropes or chains affording a safe and secure handhold are provided.

(6) The requirements of paragraphs (1) and (3) relating to toe boards shall not apply to the platform of a trestle scaffold or where in so far as the provision of a toe board is impracticable on account of the nature or special circumstances of the work.

Ties

89.—(1) Every second lift of an independent tied scaffold shall be effectively tied to the building or structure by means of ties.

(2) Ties shall be located no farther than one bay from the ends of the scaffold and thereafter, at intermediate spacing of not more than 3 bays or 7.5 metres apart, whichever is the lesser.

(3) Ties other than tie tubes and couplers shall not be used without the written approval from the Chief Inspector.

(4) Ties shall conform with the following:

- (a) tie tubes shall be attached by right angle couplers to the outside ledger or standard, or in the case of an independent scaffold, to both the inside and outside standards as close as possible to the junction of the standards and ledgers; and

(b) the ends of the tie tubes shall be attached to the building or structure by one of the following methods:

- (i) the tie tubes shall form part of a yoke constructed of tubes and couplers which passes around and bears hard against the sides of a column, pier, beam or similar structural members;
- (ii) each tie tube shall pass through the wall and be secured with 2 pieces of tube of minimum length of 300 mm and shall be attached one on each side of, and bear hard against the wall;
- (iii) each tie tube shall be attached to a reveal tie not greater than 1.5 metres in length but reveal ties shall not be used where a horizontal diagonal plan bracing is used; or
- (iv) each tie tube shall pass through ring bolts which shall be secured by casting in or being anchored in the wall.

(5) Tie tubes shall be perpendicular to the longitudinal plane of the scaffold and where this is not practicable, the deviation from the perpendicular shall not exceed 15°.

(6) Every tie shall be capable of withstanding a force of 1,000 kgf applied in either direction along the length of the tie.

Bracing

90.—(1) Scaffolds shall be effectively braced by means of longitudinal and transverse bracing systems which shall extend from the base to the top of the scaffold.

(2) Joints in bracing members shall be lapped or spliced.

(3) Longitudinal bracing members shall be continuous and fixed at approximately 45° to the horizontal.

(4) Each lift shall be crossed by at least one longitudinal bracing member in every 10 metres length of the scaffold.

(5) A transverse bracing system shall be provided at each end of the scaffold and at intervals of not more than 10 bays apart except that the transverse bracing system may be omitted where —

- (a) vertical transverse frames are provided for the full height of the scaffold and at each pair of standards; and
- (b) the frames are of a type which have been approved by the Chief Inspector.

(6) Frame scaffolds shall be provided with horizontal bracings or lacings at intervals of not more than every 5 lifts.

Transoms

91. Modular scaffolds or tube and coupler scaffolds shall be provided with transverse horizontal members or transoms for each lift at or near the intersection of the standards or ledgers.

Spigots, jointpins, etc.

92.—(1) Spigots, jointpins or sleeves shall be used to connect one standard to another.

(2) Where spigots, jointpins or sleeves are used to locate and connect one standard to another they shall —

- (a) permit full bearing over the whole bearing area at the ends of the standards; and
- (b) have such external or internal dimensions that the maximum difference of mating diameters in any part between the spigot, jointpin or sleeve and the other standard does not exceed 1.6 mm.

(3) Spigots and jointpins shall engage in the ends of the standards by not less than 70 mm.

(4) Sleeves shall cover the end of the standard by not less than 70 mm.

(5) The standards shall be securely held if they are connected by the spigots, jointpins or sleeves.

Adjustable base plates

93. Where an adjustable base plate is used on a standard and the adjustment exceeds 150 mm, the standard shall be tied longitudinally to the adjacent standard or standards at a height of not more than 460 mm above the supporting surface by right angle or swivel couplers.

Certain scaffolds erected in one plane

94. Frame or modular scaffolds shall be erected such that each lift is horizontal and in one plane.

Foundation of scaffolds

95.—(1) Scaffolds shall be constructed upon solid foundations.

(2) Where scaffolds are to be founded on soil, the soil shall be well-consolidated.

(3) In the case of scaffolds exceeding 15 metres in height or being erected on a poorly drained site, metal base plates shall bear upon sole plates of strength not less than 670 kgf per square metre and of a length suitable to distribute the load.

(4) There shall be no cavities under the sole plates immediately below the standards.

Scaffolds not to be overloaded

96.—(1) A scaffold shall not be overloaded and, as far as practicable, the load thereon shall be evenly distributed.

(2) When any material is transferred to or from a scaffold, it shall be moved or deposited without imposing any violent shock.

Scaffolds used by workmen of different employers

97.—(1) Where a scaffold or part of a scaffold is to be used by or on behalf of an employer other than the employer for whose workmen it was first erected, the first-mentioned employer shall, before such use, and without prejudice to any such obligations imposed upon him by these Regulations, take immediate steps, either personally or by a competent agent, to satisfy himself that the provisions of these Regulations have been complied with.

(2) When any defect on the scaffold is discovered by the first-mentioned employer, he shall notify the main contractor who shall take immediate steps to rectify the defect.

Precautions against dangerous equipment, etc.

98. All necessary and practical precautions shall be taken to prevent and guard any person working on a scaffold from coming into contact with electric wires or dangerous equipment.

Inspection of scaffolds

99.—(1) Subject to this regulation, no scaffold shall be used unless —

- (a) it has been inspected by a scaffold supervisor within the immediate preceding 7 days;
- (b) it has been inspected by a scaffold supervisor since exposure to weather conditions is likely to affect its strength or stability or to have displaced any part; and
- (c) the results of such inspections are entered by the scaffold supervisor in a register containing details as required by the Chief Inspector and the register shall be kept available at the site for inspection by an inspector.

(2) Paragraph (1) (a) shall not apply to —

- (a) a scaffold, no part of which has been erected for less than 7 days;
- (b) a trestle scaffold; and
- (c) a scaffold, from no part of which a person is liable to fall more than 3 metres.

Overlay and screening nets

100. Where a scaffold is erected in an area where the construction activities may pose hazards to pedestrian or vehicular traffic in the form of falling objects, overlay or screening nets shall be used to envelope the scaffold.

Tower scaffolds

101.—(1) The height of a tower scaffold erected in the form of an independent tower shall not exceed 8 times the lesser of the base dimensions.

(2) A tower scaffold shall be tied to the building or structure except where the height of the scaffold excluding hand rails and the support does not exceed 3 times the lesser of the base dimensions.

(3) No more than 2 working platforms shall be used on a tower scaffold at any one time.

(4) Any tower scaffold which can be moved on casters shall —

- (a) be constructed with due regard to the stability, and if necessary adequately weighted at the base;
- (b) be used only on a firm and even surface; and
- (c) have the casters provided with a positive locking device to hold the scaffold in position.

(5) No tower scaffold shall be moved except by applying force at or near the base and no person shall remain on the tower scaffold when it is being moved.

Gear for suspension of scaffolds

102.—(1) Chains, ropes and lifting gear used for the suspension of scaffolds shall be of sound material, adequate strength, suitable quality and in good condition.

(2) No rope other than a galvanised wire rope shall be used for the suspension of a scaffold.

(3) Chains, wire ropes and metal tubes used for the suspension of a scaffold other than a suspended scaffold shall be —

- (a) properly and securely fastened to safe anchorage points and to the scaffold ledgers or other main supporting members;
- (b) approximately vertical and be kept taut; and
- (c) so positioned as to ensure stability of the scaffold.

(4) Every scaffold suspended by means of chains or wire ropes shall be secured to prevent undue horizontal movement while it is used as a working platform.

Trestle, cantilever, jib, figure and bracket scaffolds, etc.

103.—(1) No trestle scaffold shall be used —

- (a) if constructed with more than 3 tiers; or
- (b) if it has a working platform more than 4.5 metres above the ground or floor or other surfaces upon which the scaffold is erected.

(2) Paragraph (1) shall not apply to trestle scaffolds constructed in accordance with the design and drawings of a professional engineer.

(3) No trestle scaffold shall be erected on a scaffold platform unless —

- (a) the width of the platform is such as to leave sufficient clear space for the transport of materials; and
- (b) the trestles or uprights are firmly attached to the platform and adequately braced to prevent displacement.

(4) No trestle scaffold shall be erected on a suspended scaffold.

(5) No cantilever or jib scaffold shall be used unless —

- (a) it is adequately supported, fixed and anchored on the opposite side of the support;
- (b) it has outriggers of adequate length and cross-section; and
- (c) it is, where necessary, sufficiently and properly strutted or braced to ensure rigidity and stability.

(6) No working platform resting on bearers let into a wall at one end and without other support shall be used unless the bearers are of adequate strength, pass through the wall and are securely fastened on the other side.

Scaffolds supported by buildings

104.—(1) No part of a building shall be used as support for part of a scaffold unless it is of sound material, sufficiently stable and of sufficient strength to afford safe support.

(2) Overhanging eaves gutters shall not be used as such supports unless they have been specially designed as walkways and are of adequate strength.

Suspended scaffolds

105.—(1) Suspended scaffolds shall not be used unless —

- (a) the outriggers or other supports are —
 - (i) of adequate length and strength and properly installed and supported;
 - (ii) securely fixed to the building by anchor bolts or other equivalent means, or where such fixing is not reasonably practicable, adequately and securely anchored at the inner ends; and
 - (iii) provided with rope guards of adequate strength at the outer ends to prevent the rope from being displaced from the outriggers;
- (b) the points of suspension are at adequate horizontal distances from the building face;
- (c) the suspension ropes are —
 - (i) of good construction, sound material, adequate strength and free from patent defects;
 - (ii) securely attached to the outriggers or other supports and if winch drums are used, to the winch drums; and
 - (iii) of such length that the platform shall be capable of being lowered to the ground, and in the case of winches, there are at least 2 turns of rope on each winch drum;
- (d) the platform is —
 - (i) not less than 635 mm in width and not more than 750 mm in width unless measures have been taken to prevent transverse tilting of the platform; and
 - (ii) so arranged or secured that, at each working position, the edge of the platform (whether of the normal platform or of an extension thereof towards the building face, as the case may be) is as close as practicable to the building face, but so that where employees sit at the edge of the platform to work, the edge shall not be more than 460 mm from such face;

(e) boards, planks or decking used as platforms shall be capable of supporting a load of 670 kgf per square metre with due regard to the spacing of the supports; and

(f) the climbers or winches have been properly maintained.

(2) Paragraph (1) (a) (iii) shall not apply when the primary suspension wire-ropes are suspended from the outer end of the outriggers or other supports by means which preclude the displacement of the wire-rope from its point of suspension.

(3) In the case of climbers referred to paragraph (1) (f), these shall be opened for inspection and servicing at least once in every 12 months to ensure that the drive mechanisms are in safe working order.

(4) Records of such inspection and servicing under paragraph (3) shall be kept for each climber and winch.

Suspended scaffolds raised or lowered by winches or climbers

106.—(1) No suspended scaffold raised or lowered by winches or climbers shall be used unless —

(a) it has been designed and constructed in accordance with a Code or Standard acceptable to the Chief Inspector; and

(b) it has been tested by an approved person after installation.

(2) In the case of a suspended scaffold manufactured outside Singapore, the design of the suspended scaffold shall be endorsed by a professional engineer or a third-party inspection agency approved by the Chief Inspector.

(3) Where the working platform of a suspended scaffold is supported by wire ropes, the outriggers or other overhead supports for the suspended scaffold shall be constructed in accordance with the design of a professional engineer.

(4) The outriggers or overhead supports shall be spaced at not more than 3.2 metres apart measured from the longitudinal centre line of one outrigger or support to such centre line of the adjacent outriggers or support, unless prior written approval has been obtained from the Chief Inspector.

(5) Wire ropes used to suspend the working platform shall be vertical and taut.

(6) The winches or climbers shall be synchronised so that the working platform of the suspended scaffold is maintained level at all times.

Suspended scaffolds counter-balanced by counter-weights

107. Suspended scaffolds counter-balanced by counter-weights shall comply with the following:

- (a) water or other liquids, earth, clay, sand, chippings or other aggregates shall not be used as counter-weights;
- (b) every portable counter-weight shall have its weight permanently and distinctly stamped, engraved or embossed thereon; and
- (c) all counter-weights shall be securely attached at the inner end of the outriggers to prevent tampering by any person.

Weight of counter-balance

108. The counter-balancing weights on any outriggers shall not be less than 3 times the weight necessary to balance the load on the projecting part of the outriggers when the suspended scaffold is fully loaded.

Prevention of sway

109. The working platform of a suspended scaffold shall be securely fastened to the building or structure in such a manner and at such intervals as to prevent the platform from swaying.

Age limit of operator

110.—(1) No person below the age of 18 years shall operate a climber, winch or mechanism used for raising or lowering a suspended scaffold.

(2) No person shall permit, instruct or direct any person below the age of 18 years to operate a climber, winch or mechanism used for raising or lowering a suspended scaffold.

Loading

111. Suspended scaffolds shall not at any time be loaded beyond the safe working load except in a test in the presence of an inspector or approved person.

Safety device for suspended scaffold

112.—(1) Every suspended scaffold raised or lowered by climbers or winches shall be provided at each suspension point with a safety rope with an automatic safety device mounted on it, such that the safety rope with the automatic safety device will support the platform in the event of the failure of the primary suspension rope, the winch, climber or any part of the mechanism used for raising or lowering the suspended scaffold.

(2) Paragraph (1) shall not apply if —

- (a) the platform is supported on 2 independent suspension wire ropes at or near each end such that in the event of the failure of one suspension wire rope, the other wire rope is capable of sustaining the weight of the platform and its load and preventing it from tilting; or
- (b) a system is incorporated which operates automatically to support the platform and its load in the event of the failure of the primary suspension rope.

PART XI DEMOLITION

Preparation of demolition work

113.—(1) Before commencing any demolition work —

- (a) all glass in exterior openings shall be removed; and
- (b) all gas, electric, water, steam and other supply lines shall be shut off and capped.

(2) In each case, the relevant authorities involved shall be notified in advance.

(3) Where it is necessary to maintain any power, water, gas or electric lines during demolition, such lines shall be so re-located or

protected with substantial coverings so as to protect them from damage and to afford safety to the employees.

Protection of adjacent structures

114.—(1) During the demolition of any structure, the employer performing the demolition shall examine the walls of all structures adjacent to the structure which is to be demolished.

(2) Such examination shall include a determination of the thickness and method of support of the walls of all the adjacent structures.

(3) Where there is reason to believe that an adjacent structure is unsafe or will become unsafe because of demolition operations, no demolition shall be performed at this point until there has been provided sheet piling, shoring, bracing or such other means as may be necessary to ensure the stability of the adjacent structure and to prevent the structure or other property from collapsing.

Demolition of walls, partitions, etc.

115.—(1) Demolition of walls and partitions shall proceed in a systematic manner and all work above each tier of floor beams shall be completed before the safety of its supports is impaired.

(2) Masonry shall neither be loosened nor permitted to fall in such masses as to endanger the structural stability of any floor or structural support.

(3) No wall, chimney or other structure or part of a structure shall be left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration.

(4) In the demolition by hand of exterior walls, safe footing for the employees shall be provided in the form of sound flooring or scaffolds.

(5) Walls or partitions which are to be demolished by hand shall not be left standing more than one storey high above the uppermost floor on which persons are working.

Inspection

116.—(1) During demolition, continuing inspections shall be made by a designated person as the work progresses to detect any hazard resulting from weakened or deteriorated floors or walls, or loosened material.

(2) No person shall be permitted to work where such hazards exist unless they are corrected by shoring, bracing or other effective means.

Method of operation

117. Debris, bricks and other materials shall be removed —

- (a) by means of chutes;
- (b) by means of buckets or hoists; or
- (c) through openings in the floors.

Access to floor

118. There shall be provided at all times safe access to and egress from every building in the course of demolition by means of entrances, hallways, stairways or ladder runs which shall be so protected as to safeguard the persons using them from falling material.

Floor openings

119.—(1) Every opening used for the removal of debris on every floor which is not closed to access, except the top or working floor, shall be provided with an enclosure from floor to ceiling.

(2) Alternatively, the opening shall be so barricaded that no person shall have access to within a horizontal distance of 6 metres from any opening above through which debris is being dropped.

(3) The aggregate area of openings in the floor immediately beneath the floor being demolished shall not exceed 25% of the total area of the floor.

Demolition of structural steel

120.—(1) All steel structures shall be demolished column length by column length and tier by tier.

- (2) Every structural member which is being dismembered shall —
- (a) not be under any stress other than its own weight; and
 - (b) be chained or lashed in place to prevent any uncontrolled swinging or dropping.

(3) Large structural members shall not be thrown or dropped from the building but shall be carefully lowered.

(4) Where a derrick is used in the demolition of buildings of skeleton steel construction, the floor on which the derrick rests shall be completely planked over and the floor shall be of adequate strength for such operation.

Storage of materials

121.—(1) Materials shall not be stored on catch platforms, floor or stairways of the building being demolished.

(2) The floor of a building may be used for the temporary storage of materials when the floor is of such strength as to support safely the load to be super-imposed.

(3) Storage spaces shall not interfere with access to any stairway or passageway, and suitable barricades shall be provided so as to prevent materials from sliding or rebounding into any space used by the employees or the public.

Barricades, catch platforms and warning signs

122.—(1) Along every sidewalk or thoroughfare bordering demolition operations, there shall be erected a substantial barricade to prevent unauthorised persons from entering the site of such operations.

(2) During the demolition of an exterior masonry wall or a roof from a point more than 12 metres above the adjoining ground level, if persons below are exposed to falling objects, catch platforms which meet the requirements of regulation 43 shall be provided and maintained at a level not more than 6 metres below the working level except where an exterior built-up scaffold provides equivalent protection.

(3) Suitable warning signs shall be put up at conspicuous positions.

Mechanical method of demolition

123. The use of a swinging weight, clamshell bucket, power shovel, bulldozer or other mechanical contrivance for the purpose of demolition shall be in accordance with the following requirements:

- (a) the building or structure or remaining portion thereof shall be not more than 24 metres in height;
- (b) where a swinging weight is used, a zone of demolition having a radius of at least one and a half times the height of the structure or portion thereof being so demolished shall be maintained around the points of impact;
- (c) where a clamshell bucket is being used, a zone of demolition shall be maintained within 8 metres of the line of travel of the bucket;
- (d) where other mechanical contrivances are being used to effect total or partial collapse, there shall be maintained in the area into which the affected portion may fall a zone of demolition at least one and a half times the height of the structure or remaining portion thereof; and
- (e) no person other than employees essential to the operation of the equipment shall be permitted to enter a zone of demolition which shall be provided with substantial barricades.

PART XII**EXCAVATION AND TUNNELLING WORKS****Notification of intention to carry out excavation and tunnelling work**

124.—(1) No person shall carry out any excavation or tunnelling work without first notifying the Chief Inspector.

(2) Such notification under paragraph (1) shall be submitted not less than 30 days prior to commencement of work.

(3) Every notification shall be accompanied by detailed layout plans, sectional plans of the excavation and method of construction with projected schedules of work.

(4) Where compressed air is to be used to pressurise a work environment, technical details and drawings of all man-locks and medical locks, together with the names and addresses of all appointed medical practitioners, shall also accompany the notification.

(5) Every contractor shall submit to the Chief Inspector particulars of persons directly responsible for safety on the site, their duties and an organisation chart showing the relationship of these persons.

Site superintendent

125.—(1) Every contractor undertaking tunnelling work shall appoint a site superintendent who shall be the project manager, the project engineer or such other person as the Chief Inspector may approve.

(2) The site superintendent shall exercise overall control of all operations and activities and be responsible for the safety and health of all persons employed at the site.

Site safety supervisor for tunnelling work

126. Notwithstanding regulation 25, every contractor undertaking tunnelling work shall appoint a site safety supervisor who shall possess such qualifications as are approved by the Chief Inspector and who shall —

- (a) spend at least 44 hours a week exclusively on safety supervision and on promoting the safe conduct of work generally within the site;
- (b) inspect and rectify any unsafe place of work;
- (c) correct any unsafe practice; and
- (d) ensure that the provisions of the Act and any regulations made thereunder are complied with.

Warning notices

127.—(1) Warning notices shall be displayed at all points of entry to a tunnel and to every cut-and-cover excavation which is more than 5 metres in depth.

(2) Where compressed air work is carried out in any tunnel or excavation, the notices required to be displayed under paragraph (1)

shall also inform persons of —

- (a) the danger of not undergoing proper compression and decompression;
- (b) fire and explosion hazards; and
- (c) the evacuation procedure in case of an emergency.

Control of personnel

128. The main contractor shall —

- (a) exercise proper control of ingress and egress of persons to and from any tunnel which is under construction; and
- (b) display and update a chart listing the names of persons working in the tunnel and their location of work.

Tampering with fittings

129. No person shall tamper with fittings, valves or other controls regulating air supply, lighting, electricity or any monitoring system used in connection with work in the tunnels.

Illumination level

130.—(1) All work areas in a tunnel shall be adequately illuminated at not less than 100 lux.

(2) Emergency generators shall be provided to ensure adequate illumination of the tunnels and work areas in the event of a failure in the power supply.

Stability of structures

131. Where there is any doubt as to the stability of structures adjoining or over areas to be excavated, the structures shall be supported where necessary by underpinning, sheet piling, shoring, bracing or other means made or erected according to the design of a professional engineer to prevent injury to any person.

General requirements

132.—(1) No person shall be permitted to enter any excavated area unless sheet piling, shoring or other safeguards that may be necessary for his protection are provided.

(2) Where any person in an excavation is exposed to the hazard of falling or sliding materials from any bank or side more than 1.5 metres high above his footing, adequate piling and bracing shall be provided against the bank or side to eliminate such hazard.

(3) The excavation and its vicinity shall be checked by a designated person after every rain storm or other hazard-increasing occurrence and the protection against slides and cave-ins shall be increased, if necessary.

(4) Temporary sheet piling installed to permit the construction of a retaining wall shall not be removed until the wall has developed its design strength.

(5) Where banks are undercut, adequate shoring shall be provided to support the overhanging material.

(6) Excavated material and other superimposed loads shall —

- (a) be placed at least 610 mm back from the edge of open excavations and trenches; and
- (b) be so piled or retained that no part thereof can fall into the excavation, cause the banks to slip or cause the upheaval of the excavation bed.

(7) Banks shall be stripped of loose rocks or other material which may slide, roll or fall upon persons below.

(8) Open sides of excavations where a person may fall more than 3 metres shall be guarded by adequate barricades and suitable warning signs shall be put up at conspicuous positions.

(9) No person shall be permitted to work where he may be struck or endangered by an excavating machine or by material dislodged by it or falling from it.

Piling, shoring and bracing

133.—(1) Planks used as sheet piling shall be at least 50 mm thick.

(2) The maximum spacing between horizontal stringers or wales shall be such as to keep the planks within their safe bending stress.

(3) Shores and braces shall be of adequate dimensions for stiffness and shall be so placed as to be effective for their intended purposes.

(4) Each end of each stringer piece shall be separately braced.

(5) Earth supported shores or braces shall bear against a footing of sufficient area and stability to prevent their shifting.

Access to excavation

134.—(1) In every excavation exceeding 1.2 metres in depth, there shall be provided ladders, stairways or ramps to furnish safe access to and egress from such excavation.

(2) Such ladders, stairways or ramps shall comply with the provisions of these Regulations and shall be installed in sufficient numbers and in such locations as to be readily accessible.

Trench excavation

135.—(1) Piling, shoring and bracing used in a trench excavation to protect persons against falling or sliding material shall be of adequate strength.

(2) Where the trench to be excavated exceeds 4 metres in depth, such protection shall be constructed in accordance with the design and drawings of a professional engineer.

(3) Where trenching of more than 1.5 metres in depth is done by a mechanical digger, the protection required by paragraphs (1) and (2) shall follow the jib as closely as possible.

Deep trenches

136.—(1) Where the trench depth requires 2 lengths of sheet piling, one above the other, the lower piling shall be set inside the bottom stringers or wales of the upper piling and shall be driven down and braced as the excavation continues.

(2) Where metal sheet piles are used, these may be welded end to end and secured by other means approved by the Chief Inspector.

Positioning of machinery

137. No person shall be permitted to position or operate machinery in a manner likely to endanger himself or others in the vicinity of excavations.

Training

138.—(1) No person shall be employed in any work in a tunnel unless he has undergone a training course which is designed to acquaint him with the hazards associated with tunnelling work and which is approved by the Chief Inspector.

(2) No person shall be employed in a compressed air environment unless he has —

- (a) undergone a training course which is designed to acquaint him with the hazards associated with work in compressed air and which is approved by the Chief Inspector;
- (b) been issued with written information on the hazards of work in a compressed air environment; and
- (c) received training in the use of breathing apparatus.

(3) No person shall be employed to operate mechanical equipment underground or in shafts unless he has been trained in the safe operation of such equipment.

Rescue team

139.—(1) Where 25 or more workers have to work underground at any one time, the main contractor shall ensure that at least 5 out of such workers are persons who have been trained in rescue procedures, resuscitation, the use, care and limitations of breathing apparatus and the use and maintenance of fire fighting equipment.

(2) Where more than 4 but not more than 24 workers have to work underground at any time, the main contractor shall ensure that at least 2 such workers are persons who possess the training specified in paragraph (1).

Breathing apparatus

140.—(1) Breathing apparatus suitable for use in a compressed air environment shall be provided at all worksites where work in compressed air is carried out.

(2) The breathing apparatus shall be maintained in an efficient working order at all times.

Tunnelling safety measures

141.—(1) Where any person in a tunnel is liable to be injured by falling or sliding material from the roof, face or wall of the tunnel, adequate measures such as shoring, shot-creting, supports by means of rock bolts, segments or steel sets, or other measures shall be taken to ensure the safety of the persons.

(2) All shores, segments, rock bolts and steel sets including horse-shoe shaped or arched or rib steel sets shall be designed and installed to ensure the stability of the excavated areas.

(3) The roof, face and walls of the work area in a tunnel shall be examined and tested before the commencement of work and thereafter at regular intervals not exceeding 8 hours to ensure that it is safe for the persons employed therein.

(4) The portal areas of a tunnel shall be protected and supported where there is loose soil or rock which might cause injury.

Underground air

142. Air that has passed through underground oil or fuel storage areas shall not be used to ventilate any place in which persons are working.

Supply lines

143. Supply lines to pneumatic tools used within a tunnel shall be fitted with water traps and —

- (a) with safety chains where the lines are 20 mm or more in diameter; or
- (b) fitted with a safety wire secured at each connection where these lines are of 50 mm or more in diameter.

Shafts

144.—(1) All shafts shall be properly lined to prevent collapse or the inflow of water.

(2) Any opening at the top of a shaft shall be above the highest foreseeable water level or 300 mm above the highest recorded water level to prevent inflow of flood water.

(3) In areas liable to flooding, surrounding protective banks shall be provided and maintained at a safe level and protected to prevent the banks from being washed away.

(4) Every shaft shall be provided with a steel casing, concrete piping, timber shoring or other material of adequate strength to support the surrounding earth where persons are required to enter the shaft.

(5) Casing and bracing provided under paragraph (4) shall be for the depth of the shaft or according to engineering design.

(6) A reinforced concrete raft or beams shall be provided around the opening of a shaft if the ground around the opening is unstable.

Lifts for shafts

145. Where persons have to descend in a shaft which exceeds 50 metres in depth, a lift shall be provided for the transport of men and materials.

Communications

146.—(1) Effective and reliable means of communication, such as a telephone network, shall be maintained at all times and such means of communication shall connect the following locations:

- (a) the working chamber at the face of an excavation;
- (b) at intervals of 100 metres along the tunnel;
- (c) the working chamber side of the man-lock near the door;
- (d) the interior of each chamber of the man-lock;
- (e) the lock attendants' station;
- (f) the compressor plant;
- (g) the first-aid station; and
- (h) outside the portal or at the top of the shaft.

(2) Bells and whistles shall also be made available at all times at all such locations.

Code of signals

147. Any code of audio and visual signals used shall be conspicuously displayed near entrances to the workplaces and such other locations as may be necessary to bring it to the attention of all persons concerned.

Clearances

148.—(1) A minimum lateral clearance of 500 mm shall be maintained between any part of a vehicle and any fixture or equipment after allowing for throw and swing.

(2) The overhead clearance for locomotive drivers shall not be less than 1.1 metres above the seat of the driver and not less than 2 metres above the platform where the driver stands.

(3) The requirements of paragraphs (1) and (2) relating to clearances may be deemed to have been complied with if alternative measures acceptable to the Chief Inspector are provided.

Refuge areas

149.—(1) Elevated working platforms shall be provided as refuge areas where persons are liable to be struck by locomotives or other mobile equipment in a tunnel.

(2) Where it is not practicable to provide working platforms as refuge areas as required under paragraph (1), recesses shall be provided at suitable intervals of not less than 18 metres for workers to take refuge in.

Use of internal combustion engines

150.—(1) No petrol driven internal combustion engine shall be used underground.

(2) No diesel engine shall be used underground unless it is so constructed that —

- (a) no air enters the engine without first being cleaned; and
- (b) no fumes or sparks are emitted by the engine.

Hydraulic oils

151. Hydraulic oils for hydraulic plants with flashpoints which are below working temperatures likely to be encountered shall not be used underground.

Hoses and couplings

152. Only high pressure hydraulic hoses and coupling shall be used on hydraulic plants underground and such hoses shall be properly protected.

Installations for hoses

153. Hydraulic lines for hydraulic plants working at temperatures exceeding 70°C shall be protected by insulation or other screening against accidental human contact.

Fire resistant hoses

154. Fire resistant hydraulic hoses shall be used in hydraulically activated machinery and equipment used in tunnels.

Flameproof equipment

155. Flameproof equipment shall be used whenever there is danger of the presence of flammable or explosive gases.

Oil and fuel stored underground

156. Oil, grease or fuel stored underground shall be kept in tightly sealed containers in fire resistant areas at safe distances from explosives, magazines, electrical installations and away from the bottom of shafts.

Gases used underground

157.—(1) Gasoline or liquefied petroleum gases or other highly flammable substances shall not be stored or used underground without the approval of the site superintendent.

(2) All gasoline or liquefied petroleum gases or highly flammable substances used underground shall be removed immediately after use.

(3) No oxy-acetylene shall be used in a compressed air environment.

Water for fire-fighting

158.—(1) Water for fire-fighting shall be made available throughout a tunnel and the outlets for the water shall be located so as to be readily accessible.

(2) Water supplies shall be sufficient in volume and pressure for the operation of fire hoses and other equipment.

Fire-fighting facilities

159.—(1) Air locks shall be equipped with adequate fire-fighting facilities.

(2) Fire service connections through the tunnel shall include the following:

- (a) a line of 75 mm diameter water supply pipes through a lock within the tunnel with standard fire service 65 mm instantaneous couplings with male couplings on the outside of the lock and female couplings on the inside of the tunnel;
- (b) water mains in the tunnels with fire service outlets at 50 metres intervals, attached to a line of 30 metres length of 40 mm diameter hose or hose reels of sufficient length complete with suitable branch or nozzle;
- (c) a fire alarm system connected to the ground level; and
- (d) an adequate number of dry chemical fire extinguishers.

(3) All hoses, couplings and other fittings shall comply with British Standard 336.

(4) Vaporising liquid extinguishers shall not be used in tunnels or other confined spaces unless the approval of the Commissioner of Civil Defence of the Singapore Civil Defence Force has been obtained.

Fire-fighting procedure and fire control

160. The main contractor shall ensure that —

- (a) the procedure that is to be followed in the event of an outbreak of fire, as approved by the Commissioner of Civil

Defence of the Singapore Civil Defence Force is displayed at prominent positions both inside and outside every tunnel;

- (b) every person employed in a compressed air environment has received instruction on the procedure referred to in paragraph (a); and
- (c) a fire drill is held at least once in every 3 months.

Flooding

161.—(1) To prevent flooding, water-tight bulkhead doors shall be installed at the entrance of each tunnel where more than one tunnel is driven from a shaft.

(2) All measures shall be taken to ensure that no person is trapped in an isolated section of a tunnel when the bulkhead doors are closed.

(3) The Chief Inspector may, in his discretion, waive the requirements of paragraph (1) if in his opinion flooding is not likely to occur.

Air-tight steel curtains

162. In areas liable to flooding, especially in the case of a descending tunnel, air-tight steel curtains shall be provided in the top half of the tunnel at appropriate intervals to ensure the retention of pockets of air for rescue purposes.

Resting and other facilities

163.—(1) Where persons employed in a compressed air environment are required to remain at the work site for one hour or more after decompression from pressures exceeding one bar, adequate and suitable facilities shall be provided for the persons to rest.

(2) Where meals are taken in a working chamber or medical lock, cupboard space shall be provided for the storage of food and drink and all drinks shall be kept in covered containers.

(3) Every man-lock, medical lock and the equipment in them shall be maintained in a clean state.

(4) A first-aid room shall be provided and be readily available at the site.

(5) Each man-lock attendant station shall be provided with a first-aid box.

Air-borne contaminants

164.—(1) The air in any free air tunnel or shaft in which any person is to work shall not contain any of the substances set out in the First Schedule in concentrations exceeding the appropriate permissible levels specified in that Schedule.

(2) Where any of the substances listed in the First Schedule is liable to be present in the air of a free air tunnel or shaft, suitable instruments shall be provided to test the levels of the substances quantitatively to ensure that the permissible levels as specified in that Schedule are not exceeded.

(3) Tests shall be conducted before the commencement of any work for the day and thereafter at least once in every 8 hours or more frequently, where necessary, to ensure that the permissible levels as specified in the First Schedule are not exceeded.

(4) A record of all such tests shall be maintained and be kept available for inspection by an inspector.

(5) Where dust is emitted from any work carried out in any tunnel or shaft, exhaust ventilation systems and wet methods of dust suppression shall be installed and used to minimise the effects of the dust emission.

Ventilation

165.—(1) All work areas in a free air tunnel shall be provided with ventilation systems approved by the Chief Inspector.

(2) The supply of fresh air shall be not less than 5.7 cubic metres per minute for each employee underground.

(3) The average linear velocity of the air flow in a free air tunnel shall be not less than 9 metres per minute where —

- (a) blasting or rock drilling is carried out; or
- (b) there are other conditions that are likely to produce dust, fumes, vapours or gases in harmful quantities.

(4) All measures shall be taken to ensure that air in all work areas underground contains at least 20% oxygen by volume.

(5) All work areas underground shall be tested for oxygen deficiency before commencement of any work for the day and thereafter at least once in every 4 hours.

(6) Records of every test carried out under paragraph (5) shall be made and kept available for inspection by an inspector.

Appointment of competent person for compressed air works

166. The main contractor shall appoint a suitably qualified and experienced person who shall at all times be in control of the air supply plant and be in attendance at the site when any person is employed in a compressed air environment.

Gauge attendants

167.—(1) An experienced and competent person shall be appointed as a gauge attendant who shall at all times be —

- (a) in control of the control valves; and
- (b) in attendance at the site whenever any person is employed in a compressed air environment.

(2) Except as provided in paragraph (3), no gauge attendant shall take charge of the air control valves of more than one heading.

(3) Where gauges and control valves of 2 headings are in one location, the gauge attendant may take charge of the air control valves of 2 headings.

(4) The air controls of each caisson shall be under the charge of a gauge attendant.

Air supply plant

168.—(1) The air intake for all air compressors of the air supply shall be located, as far as possible, at a place where there are no fumes, exhaust gases or other air contaminants.

(2) Gauges indicating the pressure in a working chamber shall be installed near the air compressor and at the site office of the main contractor.

Valves

169.—(1) All high and low pressure air supply lines shall be equipped with check valves.

(2) Provisions shall be made to ensure that low pressure air is maintained and regulated automatically.

(3) Low pressure air shall be provided with manually operated control valves.

Low pressure air compressor

170. The total capacity of the low pressure air compressors shall be sufficient to maintain the pressure in the air locks and working chambers to cater for emergencies.

Power source

171.—(1) Every low pressure air compressor shall be provided with at least 2 independent and separate sources of power supply and each source shall be capable of operating the air compressor and its ancillary systems.

(2) Alternate use from one independent source of power supply to the other shall be made once fortnightly to ensure that the equipment may be operated from either source of supply.

Air mains

172.—(1) Every air main supplying the working chamber or air locks shall be protected against accidental damage and where it is not practicable to provide such protection, an additional air main shall be provided.

(2) At least 2 low pressure feedlines with regulating valves shall be provided for every working chamber and at least one of them shall extend to within 30 metres of the working face of the tunnel.

Bulkheads and air locks

173.—(1) All bulkheads and air-tight diaphragms retaining compressed air within a tunnel or shaft shall be —

- (a) constructed to withstand the full thrust of the compressed air at its maximum pressure; and
- (b) tested to 1.2 times the maximum envisaged working pressure.

(2) Every bulkhead shall be tested at working pressure immediately after its installation.

(3) The anchorage of a bulkhead in a tunnel wall shall be adequate to withstand the air pressure.

(4) Any air lock or other sealed aperture shall be secured onto the bulkhead.

Diaphragms

174. Diaphragms which are in the form of horizontal decks across a shaft shall be securely anchored.

Electrical equipment

175.—(1) The voltage of electrical supply for lighting and hand held tools shall be 110 volts CTE (centre tapped earth) at 50 cycles per second.

(2) Portable electric hand tools and inspection lamps and lights used underground or in a confined space shall be operated at a voltage not exceeding 55 volts between the conductor and earth.

(3) The supply cable for 400 volts 3-phase, 4-wire system or a 230 volts single phase system shall comply with the requirements set out in the Second Schedule.

(4) All earthing requirements shall comply with Singapore Standards CP16 — 1980 — Code of Practice for Earthing.

Circuit breakers

176.—(1) Current operated earth leakage circuit breakers shall be installed for every electrical distribution board and its final sub-circuits.

(2) The sensitivity of such earth leakage circuit breakers shall be in accordance with the requirements set out in the Second Schedule.

(3) Every earth leakage circuit breaker installed in accordance with paragraph (1) shall be of a moulded case or a miniature type with the appropriate rating.

(4) Semi-enclosed fuse units shall not be used.

Transformers

177. No transformer shall be used in any section of a tunnel under compressed air unless the transformer is of the dry type.

Lighting

178.—(1) General lighting shall be powered where available by the Public Utilities Board alternating current supply.

(2) Emergency stand-by lighting of a reduced level of illumination shall be provided and shall be powered by stand-by generators for use in the event of power failure at the Public Utilities Board source.

(3) Emergency exit lights powered by battery packs shall be provided.

(4) Battery packs used for emergency exit lights shall be —

- (a) of nickel-cadmium type or such other types as may be approved by the Chief Inspector; and
- (b) of sufficient capacity to provide power for the emergency exit lights for at least 2 hours in the event of the failure of the general lighting and emergency stand-by lighting.

Live conductors

179. There shall be no exposed live conductors in areas which are accessible to workers other than those authorised to work on such conductors.

Welding sets

180.—(1) All welding sets shall be fitted with a voltage limiting device or shock preventor.

(2) PCB (polychlorinated biphenyl) or a similar insulating medium shall not be used for such devices.

Minimum air supply

181.—(1) The supply of compressed air to a working chamber shall be sufficient to provide, at the pressure in the working chamber, not less than 0.3 cubic metre per minute per person in the working chamber.

(2) A reserve supply of compressed air shall be made available at all times for all man-locks and medical locks.

Air quality

182. Where work is carried out in a compressed air environment, the air in any working chamber, man-lock and medical lock, if any, shall be of the quality specified in the Third Schedule.

Temperature

183.—(1) The temperature in any working chamber, man-lock or medical lock shall not exceed 29°C.

(2) A wet and dry bulb thermometer, in good working order, shall be provided in every working chamber.

(3) The lock attendant in charge shall record the readings of the thermometer once in every 8 hours in the lock attendant's register as set out in the Fourth Schedule.

Man-locks

184.—(1) Man-locks shall be sufficiently strong to withstand any air pressure, internal or external, to which the structure may be subjected in use and in an emergency.

(2) Doors of man-locks shall be made of steel.

(3) The man-lock shall be of adequate size to accommodate all persons likely to use the lock at any one time.

(4) Anchorage of the lock shall be designed to withstand the thrusts exerted by air pressure on the lock.

(5) The lock shall be air-tight and devices shall be provided to seal the doors when the lock is under pressure.

Capacity of man-locks

185.—(1) Where work is carried out in any compressed air tunnel, a man-lock approved by the Chief Inspector shall be provided for each tunnel.

(2) The man-lock shall have a volume of not less than 1.2 cubic metres of clear space per person.

(3) The internal diameter of the man-lock shall not be less than 1.5 metres.

(4) Each person in the man-lock shall be provided with a sitting space of not less than 0.6 metre in width and each sitting space shall be provided with a back support.

(5) The internal fixtures of the man-lock shall be suitably arranged so that persons in the man-lock are not in a cramped position.

Equipment in man-locks

186. Every man-lock shall be provided with —

- (a) valves or taps to control the flow of air into and from the man-lock for the purpose of compression and decompression;
- (b) a clock or clocks so positioned that the lock attendant and any person in the man-lock can readily ascertain the time;
- (c) pressure gauges to indicate —
 - (i) to the lock attendant the pressure in the man-lock and in each working chamber to which the man-lock affords direct or indirect access; and
 - (ii) to persons in the man-lock the pressure in the man-lock; and
- (d) a pressure recording gauge accurate to within 0.05 bar where the working pressure exceeds one bar.

Notices in man-locks

187. A notice which can be easily read and understood by persons employed shall be affixed in each man-lock to indicate —

- (a) the precautions to be taken during their compression or decompression and after decompression; and

- (b) the maximum number of persons who may be accommodated in the man-lock.

Compression and decompression procedure and use of man-lock

188.—(1) Except in an emergency, compression of persons before they enter a working chamber and decompression of persons who are leaving a working chamber shall be carried out only in a man-lock.

(2) In an emergency, a materials lock may be used for the compression and decompression of persons and a record of such use and particulars of the emergency shall be made and produced for inspection by an inspector.

(3) Where it is impracticable to install both a man-lock and a materials lock, the Chief Inspector may permit compression and decompression of persons to be carried out in a materials lock.

(4) Compression of all persons shall be carried out according to the compression procedure set out in the Fifth Schedule.

(5) Decompression of all persons to atmospheric conditions shall be in accordance with a decompression procedure approved by the Chief Inspector.

(6) A man-lock shall not be used for any purpose other than for the compression or decompression of persons.

Decanting

189. Except in an emergency, no decanting shall be carried out without prior written approval from the Chief Inspector who may impose any condition he thinks necessary.

Persons taken ill during decompression

190. Where a person in a man-lock collapses or is taken ill during decompression, the lock attendant in charge shall —

- (a) raise the pressure in the man-lock until it is equal to the maximum pressure which that person was exposed to in the working chamber prior to the decompression; and
- (b) immediately report the matter to the medical lock attendant on duty or the appointed medical practitioner.

Persons without experience

191. No person who has not worked in a compressed air environment previously shall be employed in compressed air work unless he is accompanied by a person who has previously worked in a compressed air environment.

Work in pressures exceeding one bar

192.—(1) No person who has undergone 3 decompressions from a pressure exceeding one bar in any 24-hour period preceding the time he is to enter a compressed air environment shall be required or permitted to work in compressed air except for the purpose of carrying out rescue work.

(2) This regulation shall not apply to any person who is a supervisor or who is engaged in maintenance work provided that —

- (a) the person shall not be so employed on more than 5 occasions in any 24-hour period;
- (b) the employment is not for more than half an hour on any one occasion;
- (c) there is an interval of not less than 1½ hours between each such employment; and
- (d) the maximum pressure at which that person is so employed does not exceed 2 bars.

Time to be spent at atmospheric pressure

193. The main contractor shall ensure that every person who is employed in a compressed air environment spends not less than 12 consecutive hours at atmospheric pressure in any 24-hour period.

Pressure exceeding 3.4 bars

194. No person shall be required or permitted to be employed in a compressed air environment at a pressure exceeding 3.4 bars unless the prior written approval of the Chief Inspector has been obtained.

Maximum period of employment

195.—(1) No person who has not been employed in a compressed air environment for more than 14 consecutive days shall be required

or permitted to be employed in a compressed air environment exceeding one bar for more than 4 hours in one day.

(2) The total period which the person spends in a compressed air environment shall not in any subsequent day be increased by more than one hour on each day.

Period of employment

196. For the purpose of regulations 193 to 195, the period of employment of a person shall include the time spent by the person in the man-lock for compression and decompression.

Identification badges

197.—(1) Identification badges shall be given to all persons who are employed in a compressed air environment indicating that the wearer is employed in a compressed air environment.

(2) The badge shall contain —

- (a) particulars of the employees' name, location of the medical lock, the telephone number of the medical practitioner appointed under regulation 208; and
- (b) instructions that in case of illness of unknown or doubtful causes, the wearer shall be rushed to the medical lock.

(3) A record shall be kept of all identification badges issued.

(4) Every person who has been issued a badge under this regulation shall wear the badge at all times whether or not he is at the worksite.

Exit in case of emergency

198.—(1) Provision shall be made to enable any person inside a man-lock or working chamber to control the doors of the man-lock or working chamber in order to leave the man-lock or working chamber in the case of emergency.

(2) Except in the case of an emergency, no person shall operate the controls for the opening and closing of the doors of man-locks and working chambers unless he has been authorised by the lock attendant.

Consumption of alcohol and smoking

199.—(1) No person shall consume alcohol or smoke whilst he is employed in a compressed air environment.

(2) No person shall carry cigarettes, cigarette lighters, matches or other sources of ignition into a compressed air environment.

(3) No person who has consumed alcohol shall be allowed to undergo compression in any lock other than in a medical lock.

Duty to follow instructions of lock attendant

200. No person shall wilfully obstruct, delay, refuse to follow or carry out any instructions given by a lock attendant in the course of his employment.

Medical locks

201.—(1) Subject to paragraph (2), where persons are employed in a working chamber at a pressure exceeding one bar, a suitably constructed medical lock shall be provided and maintained.

(2) Where more than 100 persons are employed in a compressed air environment exceeding one bar at a construction site, a medical lock shall be provided for every 100 persons or fewer than 100 persons.

(3) Every medical lock shall be situated as near as possible to the man-lock.

(4) In any medical lock —

- (a) wiring shall be in conduits and lamp fittings shall be of an implosion-proof type;
- (b) electrical supplies shall be not more than 24 volts and the switches shall be located outside the chamber; and
- (c) no electric motor shall be used in the lock unless it is intrinsically safe.

(5) Every medical lock shall —

- (a) have an internal diameter of not less than 1.8 metres;
- (b) comprise at least 2 compartments so that one of the compartments can be entered into whilst the other is under pressure;

- (c) be provided with an efficient means for verbal communication and means of giving non-verbal signals between persons inside and outside the medical lock and between persons in the compartments of the medical lock;
 - (d) be provided with one or more windows through which persons in any of the compartments of the medical lock can be observed from the outside;
 - (e) be adequately ventilated;
 - (f) be protected from the weather; and
 - (g) be provided with adequate lighting.
- (6) Every medical lock shall be provided with —
- (a) a pressure recording gauge which shall be accurate to within 0.05 bar;
 - (b) a fire resistant couch which shall be not less than 1.8 metres in length; and
 - (c) blankets or dry garments which are fire resistant.
- (7) Where a circular recording chart is used, the speed of rotation shall not be less than once in 4 hours.

Use of medical locks

202. A medical lock shall not be used for any purpose other than —

- (a) for a therapeutic purpose in accordance with these Regulations; and
- (b) for the training and testing of persons without previous experience of work in a compressed air environment.

Facilities and medicines in medical lock

203. A medical lock shall be equipped with such facilities and medicines in readiness for use at any time.

Man-lock and medical lock attendants

204.—(1) Every man-lock and medical lock shall be under the charge of an attendant.

(2) No person shall be employed as a man-lock or medical lock attendant for more than 12 consecutive hours in any period of 24 hours.

(3) No person shall be employed as a man-lock or medical lock attendant unless he —

- (a) has been certified to be medically fit;
- (b) has been trained in first-aid; and
- (c) has completed a course approved by the Chief Inspector which is designed to familiarise him with the problems associated with compression, decompression and compressed air illness and with the keeping of records under these Regulations.

Attendance at man-lock

205. The man-lock attendant shall be in attendance at the man-lock at all times when any person is in the man-lock or in a working chamber to which the man-lock affords direct or indirect access.

Attendance at medical lock

206.—(1) The medical lock attendant shall be in attendance at the medical lock —

- (a) when any person is employed in a compressed air environment at a pressure exceeding one bar;
- (b) when any person is being treated in the medical lock; and
- (c) during the period of 24 hours immediately after the last decompression of a person in a man-lock from a pressure exceeding one bar has taken place.

(2) Arrangements shall be made to ensure that all records of pressures and other relevant information regarding conditions in the man-lock and working chamber are accessible to the medical lock attendant at any time when the records and information are required by him.

Duties of man-lock attendants

207.—(1) The man-lock attendant shall —

- (a) maintain a lock attendant's register which shall be in the form set out in the Fourth Schedule;
- (b) carry out the compression of persons in accordance with the procedure specified in the Fifth Schedule; and
- (c) carry out the decompression of persons who have worked in a compressed air environment in accordance with a decompression procedure approved by the Chief Inspector.

(2) The man-lock attendant shall keep in his custody the lock attendant's register and the man-lock decompression chart, if any, at all times while on duty.

(3) The man-lock attendant shall hand over the lock attendant's register and the man-lock decompression chart, if any, to any person who takes over his duties for the day.

(4) Where any person has been employed in a compressed air environment at a pressure exceeding one bar on more than one occasion in any 12-hour period, the lock attendant in charge shall complete the compressed air worker's transfer record as prescribed in the Sixth Schedule and hand the transfer record to such person.

(5) Any person who has been issued with a transfer record under this regulation shall carry such record with him for a continuous period of 12 hours from the time it was first issued to him.

Appointment of medical practitioner

208.—(1) Where any work is carried out in a compressed air environment, the main contractor shall appoint a medical practitioner for the purpose of —

- (a) supervising medical lock attendants; and
- (b) attending to and treating persons suffering from compressed air illness and other conditions arising from work in a compressed air environment at all times.

(2) No medical practitioner shall be appointed under this regulation unless he —

- (a) is suitably qualified and familiar with the problems associated with work in a compressed air environment and the medical aspects of that work; and
- (b) has been registered with the Chief Inspector as a designated factory doctor in accordance with the Factories (Medical Examinations) Regulations (Rg 6).

Notification of barotrauma and compressed air illness

209.—(1) The appointed medical practitioner shall notify the Chief Inspector if he has reason to believe that any person who has been treated or attended to is suffering from barotrauma or compressed air illness.

(2) Every notice under paragraph (1) shall be in such form as the Chief Inspector may require.

Persons suffering from cold, chest infection, etc.

210. Any person suffering from a cold, chest infection, sore throat or earache shall report his condition to the site superintendent who shall ensure that the person is not employed in a compressed air environment until he has been medically examined and certified fit.

Maintenance of records

211.—(1) The main contractor shall prepare and keep a register showing the name, identity card number, passport number, work permit number, date of birth, nationality, home address and occupation of each employee employed in a compressed air environment.

(2) A copy of every lock attendant's register maintained under regulation 207 and notice under regulation 209 shall be kept by the main contractor for a period of 5 years, or such shorter period as the Chief Inspector may approve in any particular case.

PART XIII

MATERIAL HOISTS AND EMPLOYEE'S LIFTS

Maintenance and operation of material handling and hoisting equipment

212.—(1) All material handling and hoisting equipment shall at all times be maintained in good and proper operating condition and sufficient inspections shall be made to ensure that the equipment is properly maintained.

(2) Defects upon discovery shall be corrected immediately either by necessary repairs or by replacement.

(3) All equipment shall be operated in a safe manner.

(4) Operators of such equipment shall remain at the controls while the load is suspended.

Loading of material handling equipment

213.—(1) Material handling equipment shall not be loaded in excess of the safe working load specified by the approved person who has tested the equipment.

(2) Where there is any hazard to persons, all loads shall be properly trimmed to prevent the dislodgment of any part during transit.

(3) Suspended loads shall be securely slung and properly balanced before they are set in motion.

Operations and signalmen

214.—(1) No person except a designated person shall operate material handling or hoisting machinery.

(2) Operators and signalmen must be able to comprehend signals readily and to execute them properly.

Signals for hoisting engine operation

215.—(1) Hoisting machines shall be operated in response to manual signals, telephone communications or according to any other visible or audible signal.

- (2) Any of these may be used separately or in combination.
- (3) Manual signals may be used only where —
 - (a) the signalman has a clear and unobstructed view of the hoisting operation; and
 - (b) the hoist operator has a clear and unobstructed view of the signalman and is at not more than 24 metres distance from the signalman.

Protection of operator of material handling machinery and hoists

216.—(1) Where an overhead hazard exists, the operator of material handling machines other than a hoisting engine shall be provided with overhead protection against the hazard.

(2) Where an overhead hazard exists, the operator of a hoisting engine shall be provided with overhead protection equivalent to tight planking or other material of adequate strength, supported to develop its full strength.

Protection of moving parts

217. Gears, belts, sprockets, drums, sheaves and points of contact between moving parts of power driven machines shall be securely guarded or railed off unless they are in such positions as to be as safe to every person employed thereat as they would be if securely guarded.

Refuelling

218.—(1) Open lights, flames or spark producing devices shall be kept at a safe distance while refuelling internal combustion engines and no person shall smoke or carry lighted smoking material in the immediate area.

(2) An internal combustion engine shall be stopped during refuelling.

Material handling machinery at rest

219. Material handling machines while not in operation shall not be left with the load suspended.

Tag-line for loads

220. Loads which have a tendency to swing or turn freely during hoisting shall be controlled by a tag-line.

Riding

221. Riding on the loads, buckets, skips, cars, slings or hooks of hoisting, material handling or excavating machinery is prohibited.

Hoist brakes

222.—(1) Where hoist brakes are provided, they shall be capable of stopping and holding 150% of the rated hoisting capacity.

(2) In addition, a ratchet and pawl shall be provided on the drum to hold the load.

(3) Every power driven hoist shall be provided with automatic brakes or an electrical or mechanical device to hold the load automatically in case of power failure.

Power driven material handling machines

223. All power driven material handling machines shall be serviced and maintained by or under the direct supervision of a designated person.

Repairs and lubrication of machines

224. No repairing, cleaning or lubricating of machines shall be carried out when the machines are in motion.

Anchorage for hoisting machines

225. Hoisting machines shall be so constructed and so secured in position as to prevent tipping or dislodgment.

Chutes and hoppers

226. Every chute and hopper shall be barricaded where necessary to prevent persons from being struck by material or from falling into the chute or hopper.

Duty of operator

227. The operator of a material handling machine shall not move a suspended load over the head of any person as far as possible.

Material of hoisting rope

228. Only wire rope of sound material, adequate strength and free from patent defect shall be used with power driven hoisting machinery.

Fibre rope

- 229.**—(1) A fibre rope shall be of first quality Manila hemp.
- (2) Means to prevent chafing shall be provided where necessary.
 - (3) Proper size blocks to accommodate the rope shall be used.
 - (4) A fibre rope shall be protected where acid or any other harmful or corrosive agent is used.
 - (5) A fibre rope shall be kept dry and stored in a dry place.
 - (6) A fibre rope that is unsound in any way or that shows the effects of severe wear or abrasion shall not be used.

Wire rope

- 230.**—(1) A wire rope shall be so handled and stored as to prevent kinks and shall be maintained and lubricated to prevent corrosion.
- (2) The end of the wire rope shall be securely attached to the hoist drum and at least 6 turns shall remain on the drum at all times.
 - (3) No rope shall be used for the purpose of raising or lowering men or materials when —
 - (a) it is kinked;
 - (b) the total number of visible broken wires exceeds 5% of the total number of wires in the rope in any length of 10 diameters of the rope;
 - (c) the wires on the crown of the strands are worn down to less than 60% of their original cross-sectional area;
 - (d) by visual inspection, the rope shows marked signs of corrosion; or

- (e) any combination of broken wires and abrasions have reduced the original strength of the rope to 80% or less.
- (4) Where clips are used as rope fastenings, they shall conform with the following:
 - (a) at least 2 clips for ropes having a diameter of 12 mm or less;
 - (b) at least 3 clips for ropes having a diameter of 19 mm or less;
 - (c) at least 4 clips for ropes having a diameter of 25 mm or less;
 - (d) at least 5 clips for ropes having a diameter of 32 mm or less;
and
 - (e) at least 6 clips for ropes having a diameter of 76 mm or less.
- (5) Clip spacing shall be at least 6 times the diameter of the rope.
- (6) The U-bolt of clips shall be placed over the short end of the rope.
- (7) Means shall be provided to prevent accidental contact with or damage to hoisting ropes and such means shall consist of substantial covering, fencing or location beyond reach.

Sheaves

- 231.**—(1) Load-bearing sheaves for wire rope shall be of proper diameter and grooving to accommodate the rope but in no case shall the diameter be less than 20 times that of the rope.
- (2) Sheaves and rope shall be properly lubricated.
 - (3) Sheaves and blocks that are so badly worn, damaged, or otherwise defective, as to cause failure of equipment or damage to the rope shall not be used.
 - (4) Sheaves intended for use with fibre rope shall not be used with wire rope.

Fittings

- 232.**—(1) All hooks, shackles and other fittings subjected to tension or shear shall be drop-forged or manufactured by a process approved by the Chief Inspector.
- (2) No deformed hooks, shackles, chains or other fittings shall be used.

Use of chains

233.—(1) Chains shall not be used as slings in hoisting operations.

(2) Chains shall not be knotted nor shall they be shortened or spliced by the use of nails or bolts.

(3) Defective chains shall not be used.

Construction of material hoist towers

234.—(1) Material hoist towers shall be constructed of strong sound timber, structural steel, steel pipes, wrought iron or other structural metal.

(2) They shall be supported by a firm foundation of such dimensions as to adequately distribute the load and so as not to exceed the safe bearing capacity of the ground upon which they stand.

(3) Material hoist towers shall be plumb and shall be securely braced to ensure stability and rigidity.

(4) All timber material hoist towers shall have bolted connections throughout.

(5) Towers shall be anchored to the building at intervals of not more than 7.6 metres or shall be properly guyed by means of wire rope not less than 13 mm diameter securely fastened to adequate anchorages.

(6) Material hoist towers shall be erected and dismantled only under the direct supervision of designated persons.

(7) Material hoist towers shall be erected only to a height necessary for immediate needs and extended in height only when construction work has progressed sufficiently to provide for the anchorage and bracing required.

(8) A catch platform shall be constructed securely around the material hoist tower not less than 3 metres from the base of the hoist tower so as to catch any accidental discharge of materials from the confines of the tower.

(9) The specification for this catch platform shall be in accordance with regulation 43.

(10) There shall be at least 1.2 metres of clearance between the cat-head sheave and the hoisting rope fastening on the car or bucket when the conveyance is at the uppermost terminal or landing.

Lifts for employees

235.—(1) All employee's lifts within a building site before being used shall be tested and examined by an approved person.

(2) Subsequently, the testing and examination of the employee's lifts shall be done at least once in every period of 6 months.

Maintenance and use of lifts

236.—(1) Lifts shall be maintained in proper and safe operating conditions.

(2) They shall be periodically inspected and lubricated as may be necessary for such maintenance.

(3) Necessary repairs or replacement of parts shall be promptly made.

(4) No lift shall be loaded in excess of the load for which it is designed.

(5) There shall be marked conspicuously on every lift the safe working load specified by the approved person and no load greater than that load shall be carried on any lift.

Lift car construction

237.—(1) All sides except landing sides of a lift car shall be provided with substantial enclosures not less than 2 metres high.

(2) The top of the car shall be covered with adequate solid protective covering to protect passengers from falling materials.

(3) The top of the car shall be provided with an opening with a hinged hatch cover not less than 458 mm in its smallest dimension.

(4) Each landing side of the car shall be provided with a door or gate not less than 2 metres high and of construction equivalent in strength to that of the car enclosure.

(5) The distance between the landing side of the lift car and the landing shall not exceed 15 centimetres.

(6) The car shall be equipped with a suitable electrical contact so arranged that the car cannot be operated unless each door or gate is shut.

(7) Efficient devices shall be provided and maintained which will support the car with its maximum working load in the event of a breakage of the rope, chains or cable or any of its attachments.

Lighting

238.—(1) If natural lighting is insufficient inside the lift car or at each landing, means for artificial lighting shall be provided.

(2) The inside of the car and all landings of the lift shall at all times be properly lighted.

Springs or buffers

239. Springs or other suitable type of buffers shall be provided under the car to absorb the impact force in the event of the safety devices failing in an emergency.

Electrical wiring

240.—(1) Wiring and other electrical equipment shall be of proper quality and properly installed.

(2) Installations shall be carried out in accordance with the requirements of the Public Utilities Board.

(3) All wiring and other electrical equipment which may be exposed to the weather shall be weather-proof.

Initial inspection and lubrication

241.—(1) Before each installation of an employee's lift, the lift shall be thoroughly inspected and subjected to trial runs by a designated person experienced in the installation of such equipment.

(2) The inspection shall include but not be limited to an examination of the entire length of each guide rope and hoisting rope,

all rope connections, sheaves and their supports, and trial of the governor, the linkage of the car safety devices and the limit stops.

(3) Initial lubrication of running parts and all linkage shall be done during such inspection and under the direct supervision of the designated person.

Tests

242.—(1) After erection and before use, every employee's lift shall be tested.

(2) The test shall be made by an approved person and shall be performed as follows:

- (a) the car shall be loaded to maximum carrying capacity and run at least twice to both limits of travel to test the action of the speed governor, the operation of the upper automatic limit devices and the operation of the hoisting machine brake at various levels of the hoist way and employees shall not be used as load in this test; and
- (b) with such loads in place, the car safety devices shall be made to actuate with the car travelling downwards at a speed slightly greater than that for which the lift is designed.

(3) The test shall be repeated at least once every 6 months while the lift is in use.

(4) A complete written report of every test including the date, the test loads and speeds involved and the test results shall be kept at the worksite for use by an inspector.

(5) The report shall be signed by the person making the test.

Operation of lift car and attendant

243.—(1) No lift car shall be operated in service unless it is in the charge of a designated person stationed in the car as its attendant.

(2) No person other than the lift car attendant shall cause the car to move or open any car door or gate.

(3) The attendant shall not cause the lift car to move unless he is satisfied that the load is prepared for movement.

(4) No person below 18 years of age shall be designated as an attendant.

Thoroughfare

244. There shall be no thoroughfare through or under any hoistway or liftway.

PART XIV

CRANES AND DERRICKS

Strength and stability

245.—(1) Cranes and derricks shall be so constructed, positioned and operated as to be stable.

(2) No crane or derrick shall be loaded beyond the safe working load except by an approved person or an inspector for the purpose of testing such machine.

(3) No cranes or derricks shall be moved unless all measures are taken to prevent toppling or overturning.

Inspection

246.—(1) Every crane and derrick, including all blocks, shackles, sheaves, wire rope and the various devices on the mast and jib, shall be thoroughly inspected by an approved person at intervals not exceeding 12 months.

(2) Cranes and derricks shall also be inspected before being first erected or operated on each job or after any major repair.

(3) Inspection and repair of a crane jib shall be made only when the jib is lowered and adequately supported.

Footing

247.—(1) Firm and uniform footing shall be provided for cranes and derricks.

(2) When such a footing is not otherwise supplied, it shall be provided by substantial timbers, or other structural members, sufficient to distribute the load so as to ensure the stability and safe operation of the crane.

Brakes and locking devices

248.—(1) Every power-operated crane and derrick shall be provided with efficient brake or brakes or other locking devices which will prevent the fall of the load when suspended and by which the load can be effectively controlled whilst being lowered.

(2) Hand or foot-operated brakes shall be provided with a substantial locking device to lock the brake in engagement.

(3) Electrically driven cranes or derricks shall be provided with a device to hold the load automatically in case of power failure.

Attachment of loads

249.—(1) Where a sling is employed to hoist long materials, a lifting beam shall be used to space the sling legs for proper balance.

(2) When a load is suspended at 2 or more points with slings, the eyes of the lifting legs of the slings shall be shackled together and this shackle or the eyes of the shackled slings shall be placed on the hook.

(3) Alternatively, the eyes of the lifting legs may be shackled directly to the hoisting block, ball or balance beam.

(4) The eyes may be placed on the lifting hook without shackles if the hook is of the safety type.

(5) Every container or receptacle used for raising or lowering stone, bricks, tiles, slates or other objects shall be so enclosed, constructed or designed as to prevent the accidental fall of such objects.

Limitations on modifications of cranes and derricks

250.—(1) No load-bearing part of any crane or power-driven derrick shall be replaced by another part.

(2) No such machine shall be modified by the addition thereto or removal therefrom of any load bearing part, unless the replacement or modification shall be certified either by the manufacturer or by the approved person who tested the crane or derrick.

Cranes, outriggers and counter-weights

251.—(1) Outriggers and counter-weights shall be provided and used as specified by the manufacturer of the crane or by an approved person.

(2) Counter-weights shall be properly placed and secured.

(3) Levelling jacks or other suitable means shall be provided and used with outriggers of truck-mounted mobile cranes.

Cranes construction — jib

252.—(1) The jib of every crane shall be of suitable steel.

(2) The crane shall be capable of lifting its jib by its own power when the outer end is at the level of the surface on which the crane rests, without placing undue strain on either the jib or the tackle.

(3) Jib stops shall be provided to prevent over-topping.

(4) Any jib extension not provided by the manufacturer of the machine shall be designed by a professional engineer and tested by an approved person.

(5) Where jib extensions are used, reductions in the capacity chart ratings shall be posted.

(6) In addition to the brakes required by these Regulations, every crane shall be provided with —

- (a) an adequate braking mechanism for the jib hoist;
- (b) a swing lock or swing brake capable of preventing rotation; and
- (c) a brake or other device adequate to bring the crane to a stop from any travel for which it is designed, together with a means of locking the crane so as to hold it stationary.

(7) Cast iron shall not be used for members or parts subject to tension or torsion.

Capacity chart

253.—(1) A capacity chart shall be provided for every crane.

- (2) Such chart shall —
 - (a) be posted and maintained in a place clearly visible to the operator; and
 - (b) set forth the safe loads for various lengths of jib at various jib angles and radial distances.
- (3) Where outriggers are provided, the loads shall be set forth with and without the use of outriggers.
- (4) Unless furnished by the manufacturer or builder of the crane, a capacity chart shall be prepared and certified by an approved person.
- (5) A crane shall not be used to lift any load that exceeds the corresponding safe working load specified by its capacity chart.

Radius and safe working load indicator

254. Every crane having a jib shall be provided with an accurate indicator which shows, clearly to the operator, the radius of the jib and the safe working load corresponding to that radius at all times and gives a warning signal when the radius is unsafe.

General operation

- 255.**—(1) Before hoisting any load at a new job site, the jib shall be test-operated to its maximum height.
- (2) Crane loads are to be raised vertically so as to avoid swinging during hoisting.
 - (3) No crane shall travel with a suspended load except upon a safe runway.
 - (4) During travel without load, crane falls shall be secured or placed so as to prevent accident or damage by swinging.
 - (5) Crane cabs shall be locked when the operator is not present and no unauthorised person shall enter the crane cab or remain immediately adjacent to any crane in operation.
 - (6) If locking of a crane cab is impracticable, the operating mechanism shall be so locked as to prevent the crane from being operated by an unauthorised person.

Operation with demolition ball

256. In addition to the general requirements for mechanical methods of demolition under regulation 123, the operation of cranes with a demolition ball shall be subject to the following requirements:

- (a) the weight of the demolition ball shall not exceed 50% of the safe working load used as its maximum angle of operation;
- (b) during operation with a demolition ball, the swing of the jib shall not exceed 30° from the centre line front to back of the crane mounting;
- (c) crane cab windows shall be of shatter-proof glass or protected by adequate metal screens; and
- (d) truck cranes shall not be used to swing a demolition ball unless they are fitted with and are using outriggers.

Operation near power line

257. If a crane is operated in such a location that any part of the crane or of its load in any position of jib or swing may come within 3 metres of a live power line —

- (a) the power line shall be de-energized; or
- (b) the crane shall be effectively earthed.

Construction of derricks

258.—(1) The mast, jib, frame and similar parts of a derrick shall be of suitable steel or of selected wood of proper strength and durability.

(2) On derricks which have a jib longer than the mast, the gudgeon pin, mast top and goose-neck shall be securely fastened to the top of the mast to prevent the pulling out of these parts when the jib is raised.

(3) Cast iron shall not be used for members or parts subject to tension or torsion.

Foot blocks of derricks

259. The foot blocks of derricks shall be securely supported and firmly anchored against movement in any direction.

Guy derricks

260.—(1) The top of a guy derrick mast shall be steadied by sufficient number of wire rope guys of adequate strength so spaced as to make the angles between adjacent guys approximately equal.

(2) Wire rope guys shall be secured by either weldless steel sockets, thimble and splice connection, thimbles with proper size and number of rope clips, or cast steel guy plates having grooved bearing surfaces of the same shape and size as the wire rope thimbles, using a spliced or wire rope clip attachment.

(3) Guys shall be attached to strong permanent construction or to substantial dead weight securely anchored in the ground.

Capacity chart for derrick

261.—(1) A capacity chart shall be provided for every derrick.

(2) The charts shall be kept on the job site. Unless furnished by the manufacturer or builder of the derrick, the chart shall be prepared and certified by an approved person.

Overloading

262. No load shall be lifted by any derrick that exceeds the corresponding safe working load specified by its capacity chart.

PART XV

PILING

Stability of adjacent structures

263. Where there is any question of stability of structures adjoining areas to be piled, the structures shall be supported where necessary by underpinning, sheet piling, shoring, bracing or other means in accordance with the design of a professional engineer to prevent injury to any person.

Inspection

264.—(1) All pile driving equipment shall be inspected daily by a designated person before the start of work and every defect shall be immediately corrected before pile driving commences.

(2) Every piling frame and its attachments shall be thoroughly examined by an approved person at least once in every period of 12 months.

Protection of operator

265. The operator of every pile driver shall be protected from falling objects, steam, cinders and water by a substantial covering.

Instructions

266. Each member of the pile driving crew shall be properly instructed in the work he is to do and the operation shall be in the charge of a designated person, who shall personally direct the work and give the operating signals.

Handling of piles

267.—(1) The preparation of the piles shall be done at a safe distance from the driving operation.

(2) During the hoisting of piles, all persons not actually engaged in operating the equipment and handling the piles shall be kept out of the area.

Pile driver not in use

268. When the pile driver is not in use, the hammer shall be choked or blocked in the leads or lowered to the ground.

Ladders

269. A ladder extending from the bottom of the leads to the overhead sheaves shall be permanently attached to the structure supporting the leads.

Working platforms on piling frames

270.—(1) Where a structural tower supports the leads, suitable working platforms of adequate strength shall be provided on levels of the leads at which it is necessary for men to work.

(2) The platforms shall be provided with a safety railing and toe board on all sides, except on the hammer or lead side of the platform.

(3) Where such platform cannot be provided, a safety belt shall be provided.

Piles

271. All concrete piles shall have attained the required strength before being hoisted or being subject to piling stresses.

Pile testing

272.—(1) The testing of piles shall be conducted under the direct supervision of a designated person.

(2) Reasonably practicable measures shall be taken to warn persons not to approach within 50 metres of a pile under test.

(3) Under no circumstances shall any one be permitted to approach a test pile while the process of increasing or decreasing test loading is being carried out.

(4) While the process of increasing or decreasing test loading is not in progress, anyone approaching a test pile for any purpose shall only be permitted to do so under the specific instruction of the designated person who shall take reasonably practicable measures to ascertain that the kentledge is in a stable condition and is safe for approach.

Footing

273.—(1) Before placing or advancing a pile driver, the ground shall be inspected by a designated person and, where necessary for firm and level footing, timber shall be placed.

(2) After placing or advancing a pile driver, inspection and correction of the footing shall be made, when necessary, to maintain stability.

PART XVI EXPLOSIVES

Handling of explosives

274.—(1) Explosives shall not be handled or used except in accordance with the manufacturer's instructions, if any, and by or

under the immediate control of a designated person with adequate knowledge of the dangers connected with their use.

(2) Steps shall be taken to see that, when a charge is fired, all persons are in positions in which, so far as can reasonably be anticipated, they are not exposed to risk of injury from the explosion or from flying materials.

Smoking and open lights

275. Smoking, open lights and flame or spark producing devices are prohibited in or around any explosive magazine or storage enclosure and there shall be posted and maintained proper warning signs in the 4 official languages.

Opening packages

276.—(1) Packages of explosives shall not be opened at any point less than 15.5 metres distance from any magazines.

(2) Metallic instruments shall not be used for opening packages of explosives.

Deepening holes

277. Drilling in any hole that has at any time contained explosives is strictly prohibited.

Size of holes

278.—(1) All drilled holes shall be of sufficient size.

(2) Cartridges of explosives of proper size shall be selected so that the cartridges of explosives can be easily inserted to the bottom of the holes without forcing or ramming.

Removing cartridge wrappers

279. Dynamite shall not be removed from its original wrapper before being loaded into bore holes.

Loading near other operations

280.—(1) The loading of holes shall be carried out under the direct supervision of the blaster.

(2) Holes shall not be loaded in dangerous proximity to drilling or any other operations.

Loading and tamping

281. In loading and tamping explosives, only a hardwood rod free from any metal part shall be used.

Warning and retreat

282.—(1) Before firing, the blaster shall sound a warning distinctly audible to all persons within the danger zone and all such persons shall retire to a safe distance or to a safe shelter.

(2) No blast shall be fired while any person is in the danger zone as determined by the blaster.

Return to blast area

283. No person shall return from such safe distance or shelter until permitted to do so by the blaster as announced by audible or visible signal.

Misfires

284.—(1) Immediately following the blast, the area shall be examined by the blaster for evidence of misfired charges.

(2) Immediately on learning of a misfire, every person in the danger zone shall retire to a safe distance or a safe shelter.

(3) The misfire shall be reported at once by the blaster to the person present in charge and control.

(4) The latter shall designate the necessary personnel to dispose of the misfire and shall determine the safe and proper method of its disposal.

(5) No person except those designated to effect the disposal shall enter the danger zone until the misfire has been disposed of.

Operations during thunderstorm

285. Upon the approach of a thunderstorm —

- (a) all use of explosives and any handling thereof shall be stopped immediately; and
- (b) all personnel in the area shall immediately seek a place of safety in a proper location designated by the person in charge of the job.

FIRST SCHEDULE

Regulation 164

**PERMISSIBLE LEVELS IN
FREE AIR TUNNELS AND SHAFTS**

<i>Substance</i>	<i>*ppm</i>
(1) Carbon dioxide	5,000
(2) Carbon monoxide	50
(3) Hydrogen sulphide	10
(4) Nitric oxide	25
(5) Nitrogen dioxide	3
(6) Ozone	0.1
(7) Sulphur dioxide	2

*Parts of vapour or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg.

SECOND SCHEDULE

Regulations 175 and 176

SENSITIVITY OF EARTH LEAKAGE CIRCUIT BREAKERS

1. Sensitivity of earth leakage circuit breakers.
Apparatus.

(a) Portable/hand-held tools	30 mA
(b) Portable lighting and inspection lamps	30 mA
(c) Fixed lighting	100 mA
(d) Mobile equipment and apparatus	300 mA
2. Requirements of supply cable for 400 volts 3-phase, 4-wire system and 230 volts single phase system —
 - (a) Wiring for semi-permanent parts of the site installation such as site offices and ancillary buildings shall comply with Singapore Standards C.P.5.
 - (b) For all other parts of the installation, the following additional precautions shall be taken:
 - (i) Underground cables shall be of a type having a continuous and earthed metal sheath and/or armour. In the case of flexible or trailing cables, the earthed metal sheath and/or armour shall be in addition to the earth core in the cable. Metal sheath and/or armour shall not be used as the sole earth conductor.
 - (ii) Except for situations where the risk of mechanical damage is slight, armoured cables having an over-sheath of polyvinyl chloride (p.v.c.) or an oil-resisting and flame-retardant o.f.r. compound shall be used.

For resistance to the effects of sunlight, overall non-metallic covering of cables shall preferably be black in colour.
 - (iii) Overhead lines shall be fully insulated and supported at suitable intervals and where necessary suspended by catenary wires at a height not less than 5 metres from the ground, at vehicular crossings.
 - (iv) All cables which are likely to be frequently moved in normal use shall be flexible cables or cords. Flexible cables or cords of conductor size smaller than 32/0.20 mm (1.0 mm²) shall not be used. The current rating of flexible cables or cords shall be not less than that of the associated protective device and such cables or cords shall be of the circular type having general purpose tough rubber of polychloroprene (p.c.p.) sheath or h.o.f.r. sheath and complying with BS 6500. Where trailing cables are required

SECOND SCHEDULE — *continued*

by the nature of the work, they shall have proper mechanical protection so that they are not liable to mechanical damage.

- (v) All joints shall be mechanically and electrically sound, fully insulated, inaccessible to workmen or others and clear of all materials.

THIRD SCHEDULE

Regulation 182

QUALITY OF COMPRESSED AIR IN WORKING CHAMBER,
MAN-LOCK AND MEDICAL LOCK

- | | |
|---------------------------|--|
| (1) Carbon monoxide | Not more than 50 parts per million (50 ppm). |
| (2) Carbon dioxide | Not more than 5,000 parts per million (5,000 ppm) divided by the absolute pressure in bars of the compressed air environment when the air is tested at atmospheric pressure. |
| (3) Oil | Not more than one milligram per cubic metre of air (one mg/m ³). |
| (4) Odour and cleanliness | As far as is practicable, the air shall be free from all odour and contamination by dust, fumes and other toxic substances. |

FOURTH SCHEDULE

Regulations 183 and 207

LOCK ATTENDANT'S REGISTER

Date:

Dry bulb temperature:

Wet bulb temperature:

Construction Site:

Name of lock attendant:

Record all times as a.m. or p.m.

Name of worker	NRIC/ Work permit number	Date and time of last decompression	Compression		Maximum working pressure	Time in working chamber		Decompression			
			Time of entry into working chamber	Working pressure		Hours	Mins	Time decompression commenced	Time decompression finished	Decompression time	Remarks

Note: The time recorded on this Form must be taken from the clock provided for the use of the man-lock attendant.

FIFTH SCHEDULE

Regulations 188 and 207

COMPRESSION PROCEDURE

(1) Every person going under air pressure for the first time shall be instructed on the precautions to take during compression.

(2) During the compression of persons, the pressure shall not be increased to more than 0.2 bar within the first minute.

(3) The pressure shall be held at 0.2 bar and again at 0.5 bar sufficiently long to determine if any person is experiencing discomfort.

(4) After the first minute, the pressure shall be raised uniformly and at a rate not exceeding 0.7 bar per minute.

(5) If any person complains of discomfort, the pressure shall be held to determine if the symptoms are relieved.

(6) If after 5 minutes the discomfort does not disappear, the man-lock attendant shall gradually reduce the pressure until the person signals that the discomfort has ceased.

(7) If the person does not indicate that the discomfort has ceased, the man-lock attendant shall reduce the pressure to atmospheric and the person shall be released from the lock and required to report to the medical lock attendant or the appointed medical practitioner.

SIXTH SCHEDULE

Regulation 207

COMPRESSED AIR WORKER'S TRANSFER RECORD

Date:

This record is to be retained by the person to whom it is issued. Entries are to be made by the man-lock attendant who shall also make the necessary entries in the lock attendant's register (Fourth Schedule).

Name of Worker:

NRIC/Work Permit No.:

Lock number or description	Pressure	Time of entering working chamber	Time of leaving working chamber	Time spent in working chamber		Total decompression time in minutes	Lock attendant's Signature
				Hours	Mins		

[G.N. Nos. S 174/85; S 377/94]

Cap. 104, Rg 8]

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[1999 Ed. p. 115