

GUIDANCE NOTES ON THE SELECTION, USE AND MAINTENANCE OF SAFETY HELMETS



Occupational Safety and Health Branch
Labour Department



OCCUPATIONAL SAFETY & HEALTH COUNCIL

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1. Introduction

Head injury accident is one kind of the major occupational accidents in Hong Kong, particularly in the construction industry. Every year many workers injured or are even killed as a result of head injury. The main risks of head injury in the workplaces are as follows:

- where there is a possibility that a worker may be struck on his head by a falling or flying object;
- where a worker may strike his head against a protruded object or may be struck by a swinging object; and
- where a worker may strike his head against an object during or at the end of a fall.

To effectively reduce the risks of head injury, an appropriate type of safety helmets with chin straps should be provided. The safety helmet selected should satisfy certain performance requirements including shock absorption, resistance to penetration; and be adjustable to fit and make comfortable to the user. Certainly, the safety helmet can never be effective unless it is properly worn for the purpose.

The use of safety helmet, like other personal protective equipment, is always regarded as the last resort for accident prevention. In principle, reducing or controlling the risks of injury at source should be considered first. Hazards of job processes or working environments may be the root sources of head injury. Appropriate preventive measures should be taken in order to prevent head injury. Some practical examples are: provision of toe-boards to prevent objects falling from the working platform, erection of catching fans and nets to reduce the likelihood of people being struck by any falling objects, and capping of projections from structures to prevent accidental bumping, etc.

It is crucial that 'safety helmet' is not a substitute for other preventive measures of head injury accidents. Safety helmets do not prevent head injury accidents, but only reduce the severity.

2. Scope

This Guidance Notes provides guidance to all employers and employees who work in, manage or control workplaces if there are foreseeable risks of head injury.

It should be noted that safety helmets in this Guidance Notes only refer to those safety helmets primarily intended to protect the top of the heads from falling objects, striking against objects, and being struck by objects. Safety helmets only reduce the amount of force from an impact and cannot provide complete head protection from severe blow.

3. Legal Requirements

3.1 Specific Regulations

Legal obligation is imposed on the contractor responsible for a construction site under regulation 48 of the Construction Sites (Safety) Regulations (Subsidiary legislation of Chapter 59) to provide each workman employed on the site with a suitable safety helmet and to ensure that no workman remains on the site unless he is wearing a suitable safety helmet. Besides, no person shall enter a construction site unless he is wearing a suitable safety helmet. A suitable safety helmet shall include a chin strap attached either to the shell or to the headband.

Similar provisions have also been laid down on regulations (17)(1) and 36(1) of the Quarries (Safety) Regulations (Subsidiary legislation of Chapter 59) requiring proprietors to provide suitable safety helmets and workers to wear the safety helmets provided respectively.

3.2 General Duties Provisions

Every employer is required under section 6 of the Occupational Safety and Health Ordinance (Chapter 509) to ensure the safety and health at work of his employees. Therefore it is the responsibility of the employer to assess and evaluate the risks of head injury associated with the working environment and activities to be done; and decide whether safety helmets are needed to be worn. The responsibility extends to include the provision of information, instruction, training and supervision for all persons employed by him. To effectively discharge the duties, the employer should provide a safe system of work or establish a head protection programme documenting all aspects of selection, use, care and maintenance of safety helmets.

Legal obligation is imposed on every employee under section 8 of the Occupational Safety and Health Ordinance (Chapter 509) to take care for the safety and health of others and himself; and to co-operate with his employer to enable safety requirements and rules are complied with. In this respect, he must follow the rules and instructions of his employer to ensure the safety helmet provided is properly worn and taken care of. In case of doubt, advice from his employer should be sought. He should not misuse the helmet and should report any defects immediately.

4. Safe System of Work

A safe system of work for head protection or a head protection programme should be provided documenting all aspects of risk assessment, control measures, proper selection, use, care and maintenance of suitable safety helmets, implementation and monitoring. This can provide a systemic and effective approach to ensure the proper use and care of safety helmets as well as the implementation of control measures for eliminating or reducing the hazards associated with head injury. The head protection programme should include but is not limited to the following:

4.1 Risk Assessment

Risk assessment should be conducted by a competent person to identify the potential hazards of head injury relating to the work to be done and the working environment, and assess the level of the risks associated with each hazard. After the result of risk assessment is documented, engineering or administrative controls encompassing anticipated changes in the task or process should be considered and documented for elimination or reduction of the risks at source. Furthermore, adequate arrangements on the selection, use, care and maintenance of safety helmets should be incorporated once the need has been identified. It is important to ensure that the roles and responsibilities of individuals are properly defined and clearly spelled out.

4.2 Selection Criteria and Procedures

One of the key elements of the head protection programme is the proper selection of safety helmets. Detailed procedures for selecting suitable safety helmets should therefore be documented. First of all, the design and performance criteria appropriate to the anticipated hazards should be thoroughly examined. Specifications of safety helmets should then be prepared accordingly. The selection procedures should also cover purchasing arrangement and inspection of safety helmets upon receipt.

4.3 Implementation of the Head Protection Programme

Employers have the ultimate responsibility and duty for the execution of the head protection programme which should also cover the provision of safety information, instruction, training and supervision. To ensure the effective implementation, an effective communicating arrangement should be established so that all managers, supervisors and workers are fully aware of the potential hazards, precautions to be adopted and their roles to play in ensuring work safety. Special attention should be paid on the operational supervision to ensure that the safety helmets are used and used properly with chin straps fastened; and a record keeping arrangement is available to monitor the performance.

4.4 Validation

The procedures laid down as well as the responsibilities established throughout the organization for the use of safety helmets should be periodically reviewed to see how and how good the programme is performing and whether adjustment or improvement is required. Particular attention should be paid to the change of any process which may render safety helmets selected ineffective and may constitute hazards for which additional control measures are required. As far as possible, feedback from workers should be sought during the review. This will certainly improve the effectiveness of the system and the users' acceptance of the safety helmets selected.

4.5 Auditing Plan

An auditing plan should be established to ensure long term adequacy of selection decisions and proper use of safety helmets. The auditing process should review new or revised standards requiring protection, injury statistics, workers' acceptance, changes in processes and the availability of alternative control measures.

5. Construction of Safety Helmets and their Accessories

5.1 Method of Protection

A safety helmet protects the top of the head from falling objects, striking against objects, and being struck by objects by absorbing energy through -

- (a) partial destruction or damage of the shell;
- (b) stretching of the harness; and
- (c) crushing of the protective padding if any.

The residual force of the impact is spread over the surface of the head thus lessening the chance of injury.

To achieve the purpose, stringent performance/test requirements apply to safety helmets.

5.2 General Design

A safety helmet consists of three primary components - (I) shell, (II) harness and (III) chin strap (Figures A & B).



Figure A: Shell



Figure B: Harness (inside the shell)

(I) The shell is a dome-shaped covering for the head and made of hard and durable materials. The outer surface of the shell should be smoothly finished. It may include:

- a brim (a rim surrounding the shell which may include a rain gutter); or/and
- a peak (a permanent extension of the shell above the eyes).

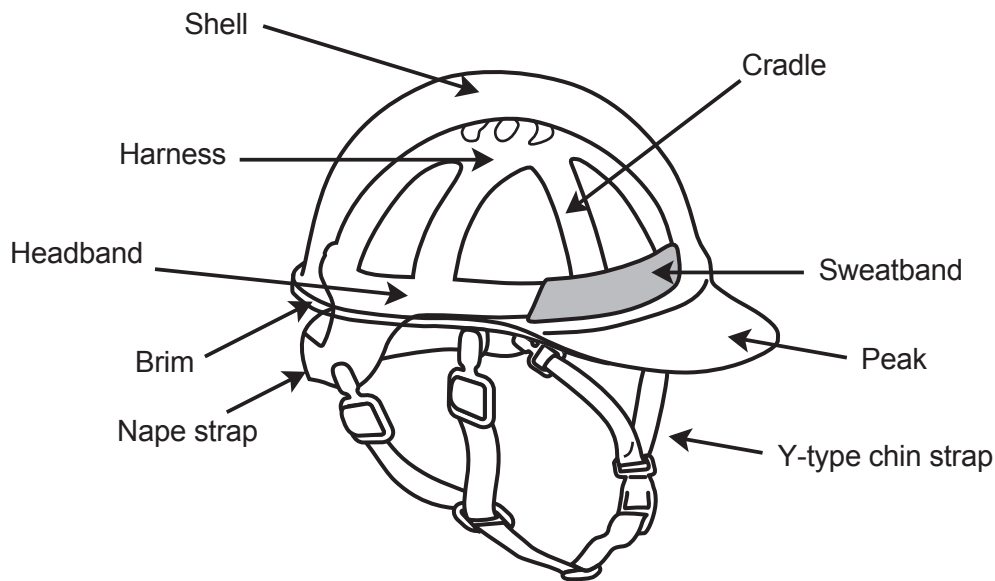


Figure C: General design

(II) The harness is the assembly that provides a means of maintaining the helmet in position on the user's head and absorbing kinetic energy within the shell during an impact.

It basically includes:

- a cradle (the assembly of the parts of the harness in contact with the head to maintain the helmet in correct wearing position and with a suspension system to absorb shock in case of an impact);
- a headband (the part of the harness surrounding the head of the user above the eyes); and
- a nape strap (an adjustable strap normally integrated with the headband to fit behind the head).

It may also include:

- a sweatband (*an integral or removable strip on the headband that contacts with the user's forehead for removing sweat*); or/and
- a protective padding (*material contributing to the absorption of kinetic energy during an impact*).

(III) The chin strap, commonly in the form of Y-type or I-type, is connected to the shell or headband as part of the retention system. The chin strap consists of a strip which fits under the chin to help secure the helmet on the head of the user and prevent the helmet from dropping off during impact or fall of person.

5.3 Constructional Features

Safety helmets have to fulfil certain mandatory requirements of international/national standards on the constructional features (refer to References). These requirements include the shell profile, the respective clearances between the shell and the harness at various locations, the requirement of chin strap, and other minor details such as the range of adjustable increments of headband and nape strap. Examples are:

- Elliptical shell configuration on horizontal sections above the headband.
- The vertical clearance between the harness and the inside of the shell should in general be not less than 25 mm and not more than 50 mm.
- The horizontal clearance between the headband and the inside of the shell should in general be not less than 5 mm and not more than 20 mm.
- The width of the chin strap should not be less than 10 mm wide when un-tensioned and should be suitably attached either to the shell or to the headband.
- Anchorages of the chin strap should be failed at a force of no less than 150 N and no more than 250 N.
- Provision should also be made by ventilation gaps between the shell and the headband.
- The length of the headband or the nape strap should be adjustable in increments of not more than 5 mm.

5.4 Materials Used

The materials for safety helmets should be of durable quality having considered the effect of aging and subjected environments such as sunlight, humidity, temperature and vibration. For those parts coming into contact with the wearer's skin, the materials used should not give rise to irritation.

For the shell, materials commonly used are:

- High density polyethylene (HDPE)
- Acrylonitrile-butadiene-styrene (ABS)
- Polycarbonate (PC)

For the harness, materials commonly used are:

- Nylon
- Vinyl
- Sponge foam for the cushioning elements

For the chin strap, materials commonly used are:

- Nylon
- Polyester

5.5 Helmet Accessories

There is a wide range of accessories which can be fitted to a safety helmet to make it more suitable for variable working conditions. Examples of accessories are faceshield, earmuffs, and headlamp (Figures D to F). Care should be taken to ensure that any addition of helmet accessories and their attachment should be compatible to the helmet. Use of original manufacturer's accessories is recommended. No modification or change of existing helmets should be carried out to fit accessories unless advice from the manufacturer has been sought.



Figure D: Faceshield



Figure E: Earmuffs



Figure F: Headlamp

(Chin straps are deliberately omitted on the safety helmets for clear demonstration of accessories.)

6. Selection of Safety Helmets

6.1 Factors in Selection

If there is a need for use of safety helmets, the next step is to ensure the safety helmet provided is appropriate to minimize the effects of the hazards. The helmet chosen should offer the desired protection and comfort and not create any additional safety problems.

During the selection process, the following factors are needed to be taken into account:

Potential hazards anticipated

Apart from the primary hazard due to falling objects, additional potential hazards of head injury may also exist in the workplace. It is therefore important to choose a correct type or class of helmets which can also offer protection against those additional hazards anticipated. In construction work, the safety helmet should offer protection against lateral impact as well, because of the presence of common hazards of striking against protruded objects (e.g. projections from scaffolds, etc.) or being struck by swinging objects (e.g. crane hooks). For electrical work, the safety helmet should be adequately electrically insulated. For an extremely cold working environment, the safety helmet should be so designed that it can still offer the intended protection at such an extra low temperature.

The style of the helmet

- The cap style (Figure G) is generally lighter and the peak will provide shade to the eyes. This style is more suitable for working in restricted or



Figure G: The Cap Style



Figure H: The Hat Style

narrow places and for the wearing of accessories such as earmuffs, welding screens, etc.

- The hat style (Figure H) generally provides better protection to the face and neck from the weather, dirt and water, etc.
- Whenever possible, the safety helmet should be selected on the basis that it will not hinder the work to be done. For example, a safety helmet with little or no peak is helpful to have an unrestricted upward vision for a scaffold erector at work.
- The design of the safety helmet selected should be compatible with other necessary accessories or personal protective equipment so that they all remain effective.

The colour of the helmet

- Safety helmets with lighter colour will provide better heat reflection and good conspicuity. White helmets are therefore suitable for working environments with poor lighting conditions.
- In working places where maximum conspicuity is required such as tunneling work, the colour of safety helmets should be conspicuous against the background or at least part of the exterior surface of the helmet should be retroreflective, or have retroreflective material adhered to it, at all sides. However, before any application of adhesive tape, advice from manufacturer should be sought to ensure that the adhesive tape will not degrade the shell material.

Appropriate accessories for the working environment

- Safety helmets selected should suit the actual working environment. For example, if the work is to be done at night and the workplace is in poor lighting conditions, the helmet shell should be equipped with head lamp.

Comfort and fitness

Wearing comfort and fitness of safety helmets should also be considered during selection:

- Safety helmets should be as comfortable as possible. Comfort can be improved by: use of light material for the shell without affecting the design strength; a flexible headband of adequate width to fit the forehead; a sweatband that is easy to clean or replace; and textile cradle straps, etc.
- Fitness is one of the important elements for ensuring the proper functioning of safety helmets in case of an impact. A properly fitting safety helmet should have the right shell size for the wearer and an easily adjustable headband, nape and chin strap.

6.2 International/National Standards

Safety helmets should satisfy certain performance/test requirements, including resistance to penetration, shock absorption, electrical insulation, resistance to flame and various working temperature, etc. Each design should have its own specifications to suit the working environment and the work to be done.

A suitable safety helmet will mean one which is conforming to international/national standards. Some of commonly used standards are as follows:

- American National Standard - For industrial head protection (ANSI Z89.1)
- Australian/New Zealand Standard - Occupational protective helmets (AS/NZS 1801)
- Canadian Standard - Safety helmets (CSA Z94.1)
- European Standard - Specification for industrial safety helmets (EN 397)
- International Standard - Industrial safety helmets (ISO 3873)
- Japanese Industrial Standard - Industrial safety helmets (JIS T 8131)
- People's Republic of China National Standard - Safety helmets (GB 2811)

- Singapore Standard - Specification for industrial safety helmet (SS 98)

A safety helmet should bear appropriate marking indicating the conformity to certain international/national standards. For example, every safety helmet complying with the requirements of the European Standard (EN 397) should carry moulded or impressed marking giving the following information:

- number of this standard;
- name or identification mark of the manufacturer;
- year and quarter of manufacture;
- type of helmet (manufacturer's designation) - this should be marked on both the shell and the harness; and
- size or size range (in centimetres) - this should be marked on both the shell and the harness.

In addition, a label/sheet should be attached to/accompany each helmet giving additional information on the usage and safe practices, etc.

International/national standards only set out the minimum requirements of various types/classes of safety helmets. It should be noted that different brands of safety helmets may not be of the same quality even though they all complied with the same standard.

In addition to complying with international/national standards, design features, performance, application and quality matters should also be carefully considered for selecting the most suitable safety helmet.

Specifications of different brands/types of safety helmets available in the markets can be obtained from the personal protective equipment manufacturers. Employers or contractors are advised to seek all relevant information for analysis before making the final decision.

7. Use of Safety Helmets

7.1 Provision

Safety helmets should be provided for the use of workers in the workplace where there is a foreseeable risk of head injury. Records for the receipt of safety helmets should be kept.

Sufficient safety helmets should be available at the workplace for necessary replacement and the use of visitors too.

7.2 Manufacturer's Instructions

Manufacturer's instructions are normally supplied with each safety helmet indicating the method of fitting and adjustment, care and maintenance, etc. These instructions should be brought to the attention of users. Special attention should be taken to the inspection before use, maintenance procedures, proper storage techniques in accordance with the manufacturer's recommendations and instructions.

7.3 Training

Proper training should be provided to each user. Records of training should be kept. The scope of the training should include the following:

- The risks of head injury in workplaces;
- Preventive measures for head injury;
- Why safety helmets are necessary;
- When should it be worn;
- Importance of chin strap;
- Legal obligations;
- Basic principle on how the safety helmet provides protection;
- Proper methods of wearing;

- Use of accessories and their attachment methods;
- Safe practices (e.g. check before use);
- Care and maintenance; and
- Service life and replacement.

Users should be reminded that the safety helmet is only the last resort and appropriate preventive measures should be taken in order to prevent head injury.

7.4 Safe Practices

- Safety helmets should be free from defects. The safety helmets if damaged must be handed over to a responsible person for replacement and discarded. The helmets should be marked 'defective'.
- Safety helmets should be checked before use. All parts of the safety helmet must be operational and undamaged, in particular the correct assembly of the shell, harness and chin strap as specified by the manufacturer. In case of any doubt, the manufacturer should be consulted.
- Harness and chin strap of safety helmets should be properly adjusted to fit the size of the users' heads for adequate protection.
- Applying paints, solvents or adhesives may weaken the shells without any visual damage. Where names or other markings are to be applied on the safety helmets, advice from the manufacturer should be sought.
- Where accessories are being used, they should be fully compatible to the safety helmet worn. Use of original manufacturer's accessories is recommended.

- Safety helmets should be worn in the correct way - In summer time, some workers wear straw hats between safety helmets and their heads in order to reduce the exposure of sunlight. Such practice however significantly reduces the protection of safety helmets and should be prohibited.
- Safety helmets should not be transferred by throwing as the helmet may accidentally fall on the floor receiving a severe impact that weakening its strength as a result.
- Safety helmets should not be used for other purpose than that they are designed, such as seats, receptacles and steps, etc.
- After use, the users should place their safety helmets in a safe place that may be provided by the employers or contractors.
- The shell, harness and chin strap should be periodically cleaned to remove dirt, dust, grease or mud, etc. The sweatband should also be cleaned regularly or replaced.

8. Care and Maintenance of Safety Helmets

Proper care and maintenance of safety helmets are very important in providing the intended protection to workers over their intended service life. Procedures for care and maintenance should be adhered to in accordance with manufacturer's instructions. Responsibilities for care and maintenance of safety helmets should be clearly established within the workplace/organization.

Care and maintenance of safety helmets include storage, cleaning, inspection and replacement.

8.1 Storage

Safety helmets should be properly stored in a safe place with no direct sunlight, no excessive heat and a non-humid condition. Long-term exposure of extreme environmental conditions can reduce the strength and efficiency of the helmets. For example, the safety helmet should not be kept on the rear-window shelf of a vehicle. Sunlight and high temperature may cause degradation and the helmet might also become a hazardous missile in an emergency stop.

Adequate storage rooms, containers or pegs should be provided for storing safety helmets to protect against contamination, loss or damage. These storage areas should preferably be located at the entrance of the workplace so that every person can put on his helmet once he enters the site. Users have the responsibility to place their safety helmets in the safe places when not in use.

8.2 Cleaning

Cleaning is the process for removal of soiling or surface contamination such as dirt, dust, grease, mud or body oils, etc.

Regular cleaning should be carried out in accordance with the manufacturer's instructions. General cleaning method using soapy water and a soft cloth is acceptable. Use of cleaning solvents should be avoided as it may deteriorate the plastic of the shell without any visual damage.

The sweatband should also be cleaned regularly or replaced where necessary.

8.3 Inspection

Before issuing safety helmets to workers for use, each helmet should be inspected to ensure it is in good condition.

Daily inspection of safety helmets should be conducted to ensure that they are in a serviceable state without any defect. All components including shells, harnesses, chin straps and accessories should be checked for signs of dents, cracks, penetration, brittleness or deterioration which may reduce the strength and efficiency of safety helmets. The shells, harnesses and chin straps should also be checked for proper fitness.

Periodic inspection, such as quarterly inspection, is required to determine the need for disposal and replacement.

8.4 Lifetime and Replacement

Safety helmets should have a limited lifetime because of material degradation that can take place due to sunlight, heat or material self-degradation. Suppliers or manufacturers should be consulted for acquiring the lifetime of safety helmets where necessary.

Service life of safety helmets is a function of several factors including materials used, quality control, usage conditions, care and maintenance. It is very difficult to accurately determine as helmets are used in various conditions, ranging from the very harsh to the very light.

Under normal services, most helmet shells can provide adequate protection for about 2 to 3 years. Plastic components of harnesses may deteriorate more rapidly in service and so harnesses should be replaced at intervals not longer than 2 years, unless otherwise specified by the manufacturer. It should be noted that signs of damage or deterioration may be observed in a much shorter service life. Should such be a case, the safety helmet should be immediately withdrawn from service and discarded.

Safety helmets cannot be repaired. It is therefore important that replacement of the safety helmet is required if it has been subjected to a severe impact regardless of the service life and whether there is any physical damage to the helmet or not, since the design strength and effectiveness have been greatly reduced.

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Enquiries

If you wish to enquire about this Guidance Notes or require advice on occupational safety and health matters, please contact the Occupational Safety and Health Branch of Labour Department through:

Telephone : 2559 2297 (auto-recording service available outside office hours)

Fax : 2915 1410

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation is also available on our website at <https://www.labour.gov.hk>.

For details on the services offered by the Occupational Safety and Health Council, please call 2739 9000.

Complaints

If you have any complaints about the unsafe workplaces and work practice, please call the Labour Department's occupational safety and health complaint hotline at 2542 2172. All complaints will be treated in the strictest confidence.

