Guidance Notes on Work Safety and Health of Air-conditioning Works

Occupational Safety and Health Branch
Labour Department

Occupational Safety & Health Council

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This guide is issued free of charge and can be obtained from offices of the Occupational Safety and Health Branch, Labour Department. It can also be downloaded from website of the Labour Department at http://www.labour.gov.hk/eng/public/content2_8c.htm Addresses and telephone numbers of the offices can be found in the website http://www.labour.gov.hk/eng/tele/content.htm or by telephone 2559 2297.

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1. Introduction

1.1 Air-conditioning systems refer to heating, ventilation and air-conditioning (HVAC) systems. HVAC systems generally include window or split type air-conditioners, hermetic or semi-hermetic type air-conditioners and large chiller plant units. In the past, serious accidents did occur during the installation, maintenance or dismantling of air conditioning systems (hereafter referred to as "air-conditioning works") which led to loss of lives and properties.

1.2 The Labour Department monitors the work safety of air-conditioning works in accordance with the Factories and Industrial Undertakings Ordinance, Occupational Safety and Health Ordinance and their subsidiary regulations. Relevant regulations include the Construction Sites (Safety) Regulations, Factories and Industrial Undertakings (Electricity) Regulations, Factories and Industrial Undertakings (Dangerous Substances) Regulations, Factories and Industrial Undertakings (Protection of Eyes) Regulations, Factories and Industrial Undertakings (Gas Welding and Flame Cutting) Regulation, Factories and Industrial Undertakings (Fire Precautions in Notifiable Workplaces) Regulations, Occupational Safety and Health Regulation, etc.

1.3 To reduce work accidents, it is essential to establish a safe system of work. Employers should conduct risk assessments before the commencement of any work to identify the hazards involved and devise safety measures for eliminating or minimising the risks of accidents. Workers should be provided with the necessary information, instruction, training and supervision.

1.4 This Guide aims to provide stakeholders with safety and health guidance for carrying out air-conditioning works in workplaces. Apart from occupational safety and health law, air-conditioning plant and work are also governed by other relevant legislation. If the refrigerant used in an air-conditioning system falls within the definition of the gas regulated by the Gas Safety Ordinance (Cap. 51), the statutory requirements of the Ordinance as well as the codes of practice and guidelines issued by the Electrical and Mechanical Services Department must be followed. Besides, the storage of refrigerants may be governed by the Dangerous Goods Ordinance (Cap. 295) and its subsidiary regulations administered by the Fire Services Department.

2. Common work safety and health issues of air-conditioning works

2.1 Work at height

Work at height is common in air-conditioning works, such as installation and maintenance of window or split type air conditioners. To carry out the works, workers may need to erect truss-out scaffolds at the external walls of the buildings. Work at height without secure support may result in serious accidents of falling from height.

2.2 Electrical safety

Use of portable electrical tools such as recovery units and portable lighting devices are common in carrying out air-conditioning works. Stakeholders should be cautious that using electrical devices and equipment without taking adequate safety precautions may result in serious electrical accidents.

2.3 Refrigerants

Refrigerants used in air-conditioning systems are usually compressed gases stored in gas cylinders. Improper handling or usage may lead to leakage of refrigerant. Eye or skin contact with refrigerant could result in irritation or frostbite, and inhalation of refrigerant could be harmful. Leaked refrigerant could also cause rapid reduction in oxygen level leading to suffocation. Certain types of refrigerants (e.g. flammable refrigerants) when mixed with air reaching a specific concentration range could result in fire or explosion when come into contact with heat or ignition sources.

3. Work at height

To prevent workers from falling from scaffolds or unsafe working platforms while performing air-conditioning works, employers must take suitable safety precautions and provide suitable working platforms for workers' use so as to ensure their safety.

3.1 Safe use of suitable working platforms

Points to note:

- If a worker is liable to fall at a workplace, a suitable working platform, such as a mobile working platform, step platform or hop-up platform should be used to perform the work.

Mobile working platform, step platform and hop-up platform

- A ladder should only be used as a safe means of access and egress but not a means of support for the work.
- The working platform should be of good construction, of adequate strength and properly maintained.
- The working platform should be rested on even and solid ground.

3.2 Safe use of suitable scaffolds

Points to note:

- When bamboo scaffolds or metal scaffolds are used for carrying out air-conditioning works, the *Code of Practice for Bamboo Scaffolding Safety* or *Code of Practice for Metal Scaffolding Safety* published by the Labour Department should be followed.
- Scaffolds should be provided with suitable working platforms not less than 400 millimetres in width. The working platforms should be fitted with top and intermediate guard-rails and toe-boards.
- The top guard-rails should be fixed at a height between 900 millimetres and 1 150 millimetres.
- The intermediate guard-rails should be fixed at a height between 450 millimetres and 600 millimetres.
- The height of the toe-boards should not be less than 200 millimetres.

3.3 *Safe use of truss-out scaffolds*

Points to note:

- The design of the scaffolds and the working procedures should be devised by a competent person.
- The scaffolds should be firmly erected at suitable locations.
- Each bracket must be fixed by three or more anchor bolts.

Each bracket must be fixed by at least three anchor bolts

- After erection, the scaffolds should be inspected and certified safe by a competent person.
- Workers working on the scaffolds should wear full body harnesses and attach the fall arresting equipment of the harnesses to anchor devices which have been certified safe by a registered professional engineer/competent person[1] or to independent lifelines connected to such anchor devices.

1 "Competent Person" is a person who has attended the course of "Selection, Installation, Use, Inspection and Testing of Anchor Devices for Attachment of Personal Fall Protection Equipment for Truss-out Bamboo Scaffolds" run by the Occupational Safety & Health Council and has been awarded the certificate.

4. Electrical safety

To prevent electrical accidents, the electrical installation and equipment concerned must comply with the statutory requirements and relevant standards and be regularly maintained to ensure safety.

4.1 Safe use of electrical installation and equipment

Points to note:

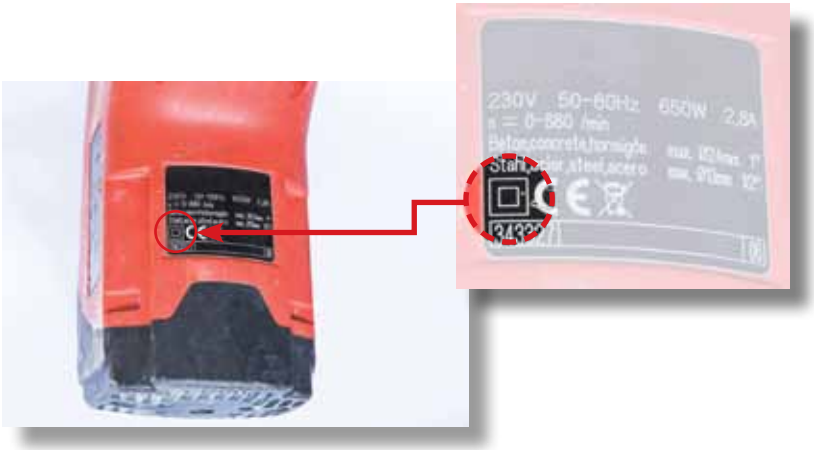
- The power supply should be installed with an effective residual current circuit-breaker and provided with overload protection.

Residual current device

- Electrical wiring or repair works must be carried out by registered electrical workers of appropriate grade.
- Before carrying out air-conditioning works, the power supply of the air-conditioning system should be turned off and isolated.
- Before carrying out air-conditioning works, the electrical tools to be used should be inspected to check for any mal-function or damage to the insulation material or casings.

Electrical tools should function properly, insulation material or casings should be intact

- Electrical equipment with double insulation should be used. Such type of equipment should bear the mark "⧈".



- Each socket outlet should be connected with a single electrical tool only.

- Cords of electrical equipment and electrical tools should be properly placed and protected, e.g. hanging them up or fixing them properly.

- When carrying out electrical work at height, insulated working platforms in compliance with the relevant requirements should be used.

- Notices on “Electric Shock” should be displayed to alert workers to the electrical hazard and advise them on the correct way of handling workmates receiving electric shocks.

5. Refrigerants

Refrigerants are usually stored in gas cylinders. When handling and using refrigerants, suitable safety precautions should be taken to prevent accidents.

5.1 Safety in transport and storage of refrigerants

Points to note:

- Gas cylinders (refer to gas cylinders containing refrigerants in this guidance notes) should be handled with care to avoid bumping.
- Do not drag or roll the gas cylinders on the ground.
- Gas cylinders should be placed in an upright position and stored in a well-ventilated and cool place. They should be kept away from direct sunlight.
- Gas cylinders should be kept away from sources of ignition or corrosive substances.
- Gas cylinders exceeding the statutory exempted quantity should be kept in a suitable licensed dangerous goods store.
- Refrigerants should be stored in gas cylinders approved by the relevant authorities.

5.2 Safe use of refrigerants

Points to note:

- A risk assessment should be carried out before the commencement of work with reference made to the relevant Material Safety Data Sheet (MSDS) of the refrigerant to be used so as to devise a work method that is safe and without risk to health. Specific precautions should also be formulated in respect of hazardous refrigerants to be used.

- Work in connection with refrigerants should be carried out in a well-ventilated place to avoid suffocation, poisoning or accumulation of flammable gases. If a flammable refrigerant is to be used, it must be ensured that the design of the air-conditioning system is suitable for such refrigerant. Appropriate air monitoring equipment, such as portable gas detectors, should also be provided.

Portable gas detectors

- Forced ventilation should be provided when necessary. A mechanical ventilation system with explosion-proof design should be used for work involving flammable refrigerants.

Air blower

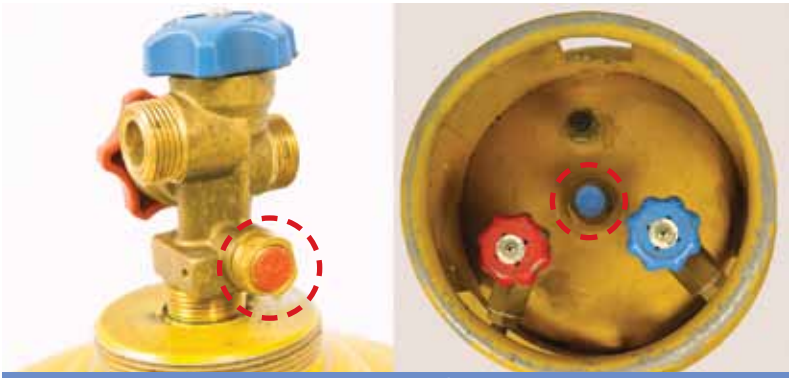
- Gas cylinders should be placed in a suitable licensed dangerous goods store before and after use.
- Suitable personal protective equipment should be used to avoid eyes and skin coming into contact with the refrigerants.

Eye protector and protective gloves

- Besides, suitable respirators should be used to avoid inhalation of chemical substances.

Half-face respirator

- Suitable refillable gas cylinders equipped with an appropriate pressure relief valve and/or excess flow valve should be used for recovery of refrigerants.



Pressure relief valve

- During recovery, recycling, evacuation or charging of refrigerants, it should be ensured that all hoses are properly connected and a suitable apparatus with automatic stop function is used, or a suitable weighing device is used to monitor the total and increased weights of the cylinder being filled to ensure the maximum allowable capacity is not exceeded throughout the filling process.

Refrigerant recovery equipment

- If a different kind of refrigerant is to be used, the manufacturer of the air-conditioning system should be consulted first to ensure the safety of the system.

- If welding work has to be carried out to an air-conditioning system, the refrigerant therein must first be completely removed, followed by nitrogen purging of the system before welding.

Oxy-acetylene welding set

- For welding work involving electric arc welding, the safety precautions as stipulated in the *Code of Practice : Safety and Health at Work for Manual Electric Arc Welding* published by the Labour Department should be taken.

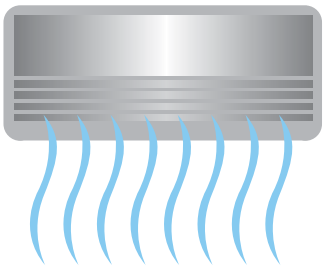
- For gas welding work such as gas welding and flame cutting with the use of oxy-acetylene, the safety precautions as stipulated in the *Code of Practice : Safety and Health at Work for Gas Welding and Flame Cutting* published by the Labour Department should be taken.
- Keep refrigerants, especially flammable ones, away from ignition sources to prevent fire or explosion or formation of toxic substances.
- Sufficient and suitable fire extinguishers should be provided.

Different types of fire extinguishers

- Never discharge refrigerants directly into the atmosphere. Refrigerants should be properly recovered to facilitate disposal or recycling. For this purpose, suitable equipment must be used and operated according to the manufacturer's instructions.
- When disposal of refrigerants is required, the statutory requirements stipulated in the Waste Disposal Ordinance (Cap. 354) must be complied with. Disposed refrigerants are chemical wastes which are required to be registered with the Environmental Protection Department (EPD) prior to disposal and be handled properly by licensed waste collectors. For information on the handling of chemical wastes, please refer to the homepage of EPD at http://www.epd.gov.hk.
- In case the number of compressed cylinders to be conveyed or stored is over the exempted quantities, it is required to apply for a licence from relevant authority. Information on dangerous goods licence application and related matters can be found by visiting the homepage of Fire Services Department at http:///www.hkfsd.gov.hk.

6. Notes to workers

- A suitable working platform should be used for work at height;
- When working on truss-out scaffolds, wear full body harnesses and attach them with fall arresting equipment to anchor devices certified safe by a registered professional engineer/competent person or to independent lifelines connected to such anchor devices;
- Electrical wiring or repairing work must be carried out by registered electrical workers of appropriate grade;
- Gas welding and flame cutting work must be performed by workers holding a valid gas welding safety training certificate;
- Work related to the handling and replacement of refrigerants must be carried out by workers with relevant training and experience;
- Suitable personal protective equipment such as eye protectors, gloves and respirators should be used in performing refrigerant handling and replacement work; and
- Be cautious of the fire and explosion hazards when handling flammable refrigerants.



7. References

1. Occupational Safety and Health Ordinance (Cap. 509)
2. Factories and Industrial Undertakings Ordinance (Cap. 59)
3. Gas Safety Ordinance (Cap. 51)
4. Dangerous Goods Ordinance (Cap. 295)
5. Ozone Layer Protection Ordinance (Cap. 403)
6. Waste Disposal Ordinance (Cap. 354)
7. Guidance Notes to Renovation Safety published by the Labour Department of Hong Kong
8. Code of Practice for Bamboo Scaffolding Safety published by the Labour Department of Hong Kong
9. Code of Practice for Metal Scaffolding Safety published by the Labour Department of Hong Kong
10. Code of Practice : Safety and Health at Work for Gas Welding and Flame Cutting published by the Labour Department of Hong Kong
11. Code of Practice : Safety and Health at Work for Manual Electric Arc Welding published by the Labour Department of Hong Kong
12. Five Steps to Risk Assessment published by the Labour Department of Hong Kong

Publications issued by the Labour Department of Hong Kong could be found at http://www.labour.gov.hk/eng/public/content2_8.htm

Enquiries

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Information on the services offered by the Labour Department and on major labour legislation can also be found by visiting our Homepage at http://www.labour.gov.hk.

For information on the various services provided by the Occupational Safety & Health Council, please call its hotline at 2739 9000.

Complaints

Complaints about unsafe workplaces and practices can be made through the occupational safety and health complaint hotline of the Labour Department at 2542 2172. All complaints will be treated in the strictest confidence.

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