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Safety technical specifications for using flammable refrigerants in household and similar room air conditioner industry

使用可燃性制冷剂生产家用和类似用途房间空调器安全技术规范

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Foreword

This standard was drafted in accordance with the rules of GB/T 1.1-2009.

This standard was proposed by the Federation of Light Industry.

This standard shall be under the jurisdiction of the National Household Electrical Appliances Standardization Technical Committee (SAC/TC 46).

The drafting organizations of this standard: China Household Electrical Appliances Association, Zhuhai Gree Electric Co., Ltd., Guangdong Media Refrigeration Equipment Co., Ltd., Qingdao Haier Air Conditioner Limited Company, TCL Air Conditioner (Zhongshan) Co., Ltd., Hisense Kelon Electric Co., Ltd., China Light Industry Changsha Engineering Co., Ltd., Shanghai Schenck Machinery Co., Ltd., Ulvac Eastern Vacuum (Chengdu) Co., Ltd., Ministry of Public Security Tianjin Fire Research Institute, Huazhong University of Science and Technology, Ningbo Oaks Air Conditioning Co., Ltd.

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This standard is the first release.

Safety technical specifications for using flammable refrigerants in household and similar room air conditioner industry

1 Scope

This standard specifies the safety technical requirements, operation procedures, and safety management for using flammable refrigerants in household and similar room air conditioner industry.

This standard applies to the production line design, production, transform, daily production and management of room air-conditioner products as defined in GB/T 7725, the mobile air-conditioners as defined in GB/T 22257 AND the dehumidifier as defined in GB/T 19411.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this Standard.

GB 150 Pressure vessels (all parts)

GB 3836.1 Explosive atmospheres - Part 1: Equipment - General requirements

GB 4208 Degrees of protection provided by enclosure (IP code)

GB 4706.32 Safety of household and similar electrical appliances - Particular requirements for heat pumps, air-conditioner and dehumidifier

GB/T 7725 Room air conditioners

GB/T 7778 Number designation and safety classification of refrigerants

GB/T 8163-2008 Seamless steel tubes for liquid service

GB/T 19411 Dehumidifiers

GB/T 22257 General specification for mobile air conditioner

GB 50016 Code for design on building fire protection and prevention

GB 50058 Code for design of electrical installations in explosive atmospheres

GB 50140 Code for design of extinguisher distribution in buildings

GB 50184 Code for acceptance of construction quality of industrial metallic piping engineering

GB 50235 Code for construction of industrial metallic piping engineering

GB 50243-2002 Code of acceptance of construction quality of ventilation and air conditioning

GB 50257 Code for construction and acceptance of electric equipment on fire and explosion hazard electric equipment installation engineering

JT 617-2004 The regulation of automobile transportation of dangerous goods

TSG R 7001-2013 Pressure vessels periodical inspection regulation

3 Terms and definitions

The terms and definitions as defined in GB/T 7725 and GB 4706.32 AND the following terms and definitions apply to this document.

3.1

Flammable refrigerant

The refrigerant classified into type A2 and A3 in accordance with GB/T 7778.

3.2

Lower explosive limit, LEL

Under the temperature of 23 °C and the atmospheric pressure of 101325 Pa, the minimum concentration of the flammable gas when its mixture with air can produce explosion in encountering fire source.

3.3

Mechanical ventilation

5.2.1 The ventilation equipment shall comply with the relevant requirements of GB 3836.1 AND shall have the explosion-proof certificate.

5.2.2 The fan shall be of single set double speed exhaust fan or double set single speed exhaust fan, AND the single speed exhaust fan must be one in use and one for standby.

5.2.3 The ventilation pipeline shall be of metallic pipeline, AND after installation, the test air leakage rate for 10% testing of all air pipeline shall reach to the requirements of GB 50243-2002.

5.2.4 The ventilation system shall follow the principles of “fresh air incoming from top and exhaust air from bottom”, the vent hole shall be as close to the floor and the possible leakage point as possible, AND the height from the lower edge of the vent hole to the floor shall not exceed 100 mm. The envelope room and the relatively enclosed room shall be equipped with the fresh air inlet at the upper part; AND if the inlet is within the workshop of dangerous area, the inlet shall be higher above the dangerous area for more than 1.5 m.

5.2.5 The air duct shall be beyond the roof for 1 m ~ 2 m, AND it shall install the lightning protection device as specified AND connect it to the lightning protection network of the building.

5.2.6 The ventilation system shall be equipped with air pressure or air flow switches; it shall not be able to start the relevant equipment when the ventilation system does not run; AND when the ventilation system fails during production, it shall issue alarm and cut off the relevant power supplies AND stop the running of relevant equipment after time delay.

5.2.7 The branch pipe of air duct and each vent hole shall be installed with the air volume regulator valve, AND clearly indicated of the valve switch.

5.2.8 All the flange connections of all air ducts shall be connected to a grounding line of cross sectional area not less than 6 mm^2, by the copper screw or stainless-steel material, the grounding branch line shall be kept continuous, AND the grounding line junction shall use copper busbar, with the grounding resistance of not more than 10 Ω.

5.2.9 The refrigerant room, supply pump room, filling area, sealing area, leakage testing area, repair area, inspection room, and laboratory shall be equipped with reliable ventilation system, each ventilation system shall be independent from each other, AND the ventilation system shall be at working state for 24 h.

room, filler, sealing area, repair area, inspection room, and laboratory, etc., it shall install the flammable gas detector.

6.1.3 The height from the bottom of the flammable gas detector to the floor shall not be more than 200 mm. AND the detector installed in dangerous area shall have corresponding explosionproof level.

6.1.4 The flammable gas detector shall, before being put into use, be subjected to configuration inspection, test and calibration. AND it shall be calibrated at least once a year after being put into use, AND it shall be checked based on actual conditions within the calibration period. Inspections shall be made once finding abnormalities. AND if it still fails to comply with the testing requirements after calibration, it shall replace the detector or relevant component.

6.2 Technical requirements of alarm system

6.2.1 The alarm system shall run continuously for 24 h.

6.2.2 The alarm system shall, except for the detection and alarming of flammable gas, also include the pneumatic pressure switch, emergency shutdown switch, and the linkage with ventilation system and firefighting.

6.2.3 The alarm receives the feedback signals from the flammable gas detector, differential pressure switch, and emergency shutdown switch, AND interlocks with the workshop ventilation system to control the power and refrigerant supply to the dangerous area equipment (such as refrigerant filler, etc.).

6.2.4 When the alarm system cuts off the power supply of a certain region, the cut off signal of the trip switch shall be feedback to the alarm system.

6.2.5 The alarm system shall use reliable power supply; AND when the power fails, it shall be able to automatically switch to another circuit of standby power.

6.2.6 The control power of the alarm cabinet is equipped with uninterrupted power supply (UPS), the capacity of which shall be able to supply power independently for at least 1 h ~ 2 h. When the power supply to the safety system is interrupted, that is, when the UPS starts working, the system shall issue alarm to notice the staff to perform power failure inspection AND to restore the power supply to the safety system as soon as possible.

8.2.2.2.3 The firefighting facilities in the tank yard shall be configured in accordance with relevant standards AND it shall be configured with special tools.

8.2.2.2.4 It is prohibited to unloading the materials in lightning weather.

8.2.2.2.5 The unloading area shall be equipped with the anti-static grounding electrode and grounding line which are used for the unloading tank car, AND the tank car and the grounding electrode must be connected during unloading.

8.2.2.2.6 The unloading personnel must wear the anti-static clothing, AND it is prohibited to take communication equipment such as cellphone.

8.2.2.2.7 The tank car head shall be so oriented as able to ensure the smooth entry and exit along the channel.

8.2.2.3 Unloading considerations

8.2.2.3.1 Before the tank car enters the tank yard, the exhaust pipe must be equipped with spark extinguisher, AND the unloading operation can only be started after shutdown of the tank car engine AND cutting off the power supply.

8.2.2.3.2 The tank car grounding device shall be reliably connected to the storage tank grounding electrode, AND after the tank car is connected to the electric static discharge line, it shall discharge static for over 10 min.

8.2.2.3.3 Make trial unloading for 5 min, AND if finding the leakage point, it shall immediately stop unloading and eliminate the leakage point.

8.2.2.3.4 During unloading, the flow rate of the refrigerant in the pipeline shall be not more than 1.2 m/s upstream the pump AND not more than 3 m/s downstream the pump.

8.2.2.4 Emergency measures in case of large leakage or fire of tank car

8.2.2.4.1 When the tank car is suffered from large leakage, it shall take measures to stop leakage in time, it is prohibited to start up the vehicle, AND meanwhile it shall notice the firefighting institute of the local public security organ, establish the guarding zone, AND organize personnel to evacuate to upwind direction.

8.2.2.4.2 When then tank car catches fire due to large leakage, it shall take measures to stop leakage and extinguish fire in time. AND meanwhile it shall notice the firefighting institute of the local public security organ, AND take measures to control fire spreading and enhance cooling of the storage tank.

8.3.2.4 The electrical control part and actuating part of the equipment shall be separated from each other, AND the electrical control part shall comply with GB 50058, otherwise it shall not be installed within the dangerous area.

8.3.2.5 In case of equipment power failure, it shall automatically cut off the input and output of refrigerant.

8.4 Refrigerant delivery pipeline

8.4.1 The refrigerant delivery pipeline shall be designed and constructed in accordance with the relevant provisions of national pressure pipeline design and construction standards.

8.4.2 The refrigerant delivery pipeline shall comply with the relevant provisions of GB/T 8163-2008.

8.4.3 The pipeline passing through walls shall be equipped with sleeve, the pipeline section in which shall not have weld, AND it shall use nonflammable material and waterproof material to fill in between the pipeline and the sleeve; the pipeline weld and other connection piece shall be so positioned as facilitating overhauling, AND they shall not be close to walls, floor slabs, or pipe racks.

8.4.4 During pipeline installation, it shall use standard pipeline clamp, AND the support and hanging bracket shall be correctly positioned, the installation shall be flat and firm, and in good contact with the pipeline.

8.4.5 The outdoor pipeline shall have necessary thermal insulation measures.

8.4.6 Except that the pipeline system connections within the supply pump room and filling area can use flanges, all the rest is welded. After installing the pipeline, it shall be subjected to non-destructive testing as specified in GB 50235 and GB 50184 before the pressure and airtightness test.

8.4.7 The pipeline shall be well protected to avoid from being impacted by vehicles or other mobile equipment.

8.4.8 It shall clearly indicate the refrigerant types and flow directions on the pipeline.

8.4.9 The valve switch signs on the pipeline shall be correct and clear.

9 Filling

9.1 General technical requirements

9.3.2 The filling equipment mechanical cabinet is installed with the flammable gas detector, which is under the monitoring of the gas detection system, AND it shall have the corresponding ventilation device. AND the flammable gas detector is installed nearby the vent hole.

9.3.3 The internal pipeline of the filling machine shall be installed with the safety valve.

9.3.4 The filling machine shall be interlocked with the safety detection and exhaust system, AND the equipment shall not be able to be started up when the exhaust system does not run or fails.

9.3.5 After installing the internal refrigerant pipeline and element in the filling machine, they shall be detected by the leakage detector having a leakage detection rate less than 5 x 10^{-6} Pa • m^3/s, AND it shall be free from leakage.

9.3.6 In case of power failure of the filling machine, it shall automatically cut off the input and output of the refrigerant.

9.3.7 During filling, if the filled workpiece is filled with the refrigerant, the equipment shall be able to detect it and issue alarm.

9.4 Considerations in filling

9.4.1 It shall ensure that the refrigerant is not contaminated by other refrigerants before being filled.

9.4.2 The filling amount shall strictly follow the process requirements.

10 Sealing

10.1 The sealing environment refers to the environment in which the air-conditioner which had been filled with refrigerant is sealed at the sealing workstation, it belongs to area II, AND it meanwhile complies with the requirements of 9.2 for the filling area.

10.2 It is prohibited for using open fire or high temperature operation for sealing purposes.

10.3 The maximum allowable temperature produced by sealing operation shall not be higher than the result of the self-combustion temperature of the refrigerant minus 100 °C, AND the relevant information is as shown in Appendix B.

11.8 The leakage detection room shall be equipped with human body electric static discharge device.

11.9 The leakage detection room shall be equipped with apparent warning signs.

11.10 The refrigerant leakage as found during detection must be drained into the local ventilation system, the apparent fault mark shall be made, AND then the product is sent to the repair area.

12 Product operation test room

12.1 The production line drive motor within the product operation test room shall comply with the requirements of GB 3836.1.

12.2 The electrical control system shall adopt the strong current and weak current separation design, the strong current part in the test room shall comply with the relevant provisions of GB 3836.1, AND the weak current part shall be installed in the positive pressure operation box, the protection degree of which shall be not less than IP54 as specified in GB 4208.

12.3 The product operation test room shall be installed with the ventilation system, AND each workstation shall be provided with the vent hole.

12.4 The product operation test room shall be installed with the corresponding number of flammable gas alarming device.

12.5 Before the first installation of the product operation test system as related to the flammable refrigerant pipeline system, it shall use the leakage detector having a leakage detection rate less than 5×10^{-6} Pa • m^3/s for leakage detection to ensure leakage free. AND all connections must be equipotential grounded.

12.6 The product operation test room shall be equipped with the human body electrical static elimination device at the entrance.

12.7 The product operation test room shall be equipped with the emergency switch.

12.8 The product operation test room shall have apparent safety signs, at least including “No open fire”, “No wireless communication equipment”, and “Authorized person only”.

15 Plant

15.1 The plant design shall comply with the relevant provisions of GB 50016, AND the fire rating of the production plant shall be not less than level II.

15.2 The flammable refrigerant filling production line shall not be in the building basement or semi-basement, it shall be kept away from the plant beam, column, or other load bearing members, AND the floor shall be free from ditches.

16 Safety management

16.1 Personnel

16.1.1 All the production line personnel shall be subjected to special training before going to post. The personnel at special posts such as flammable refrigerant storage, filling, sealing, leakage detection, running test, and repair, etc., shall pass the assessment and hold certificate before going to post, AND it shall be registered in the enterprise.

16.1.2 It is prohibited for the irrelevant personnel to enter the flammable refrigerant working area. When the workers not belonging to this area enters the operation area, they must follow the safety provisions and requirements of this operation area.

16.1.3 Personnel entering into the flammable refrigerant working area shall wear the anti-static clothing.

16.1.4 The production line shall be equipped with one safety officer to be responsible for the safety management affairs of the production line.

16.1.5 The production line personnel shall be subjected to the evacuation drill at least once every six months.

16.1.6 It is prohibited for the production line personnel to use radio equipment in the production line area.

16.2 Normal operation

The operators shall finish the following procedures at the end of production and shift handover:

a) The flammable gas detection and alarm system are in intact state;

The enterprise shall establish the refrigerant safety production responsibility system at each level, AND define the obligations of each department. AND the safety management provisions and requirements shall include at least the following items:

a) Safety region division of work area AND the safety management provisions of each safety region;

b) The process management provisions and work guidance;

c) Equipment operation guideline and maintenance specifications;

d) Safety operation specifications;

e) Hazard source identification and emergency procedures and plans for each post (it may make reference to Appendix C);

f) Fire protection and explosionproof safety management;

g) Safety management of dangerous goods storehouse and storage area;

h) Operation and maintenance instructions on flammable gas detection system, ventilation system, and grounding system;

i) Regular safety inspection system;

j) Safety training system;

k) Safety management of special equipment and special jobs;

l) Warning sign management.

16.5 Training

16.5.1 It shall provide corresponding safety training for the personnel at different posts, AND the training shall at least contain the following items:

a) The characteristics and hazards of flammable refrigerant;

b) Normal operation procedures ensuring safe production;

c) Operation procedures under special emergency conditions;

d) Use of firefighting facilities;

e) Interpretation and drill of emergency plan.

Appendix C

(Informative)

Emergency measures

C.1 General measures

C.1.1 When inhaling flammable refrigerant, the person shall be moved away from the site to an area with fresh air, kept smooth breathing, or supplied oxygen if he/she is breathing hard; mouth-to-mouth breathing shall be performed and doctor be sought if breathing stops.

C.1.2 In case of eye exposure, it shall lift up the eye lid AND use flowing clean water to rinse it, for at least 15 min, AND seek doctor as soon as possible.

C.1.3 In case of skin exposure, it shall take off the dirty cloth AND use soap water to thoroughly rinse the skin, for at least 15 min. In case of skin freezing, it shall seek doctor as soon as possible, AND it is prohibited for warming by fire or soaking in hot water.

C.2 Serious leakage of pipeline and equipment

C.2.1 In case of serious leakage of pipeline and equipment, it shall press down the emergency button AND close the manual valve of the refrigerant general valve.

C.2.2 It shall report to the safety department in time AND dial 119 if necessary.

C.2.3 It shall evacuate the personnel nearby the leakage source in time AND establish the guarding zone to prohibit the access of all motor vehicles and personnel.

C.2.4 If the leakage amount is large, it may use the firefighting gun or water cannon to perform dilution and temperature reduction of the leakage region, to avoid the further extension of the hazards.

C.2.5 When the flammable gas concentration at the leakage point reduces below the safety line, the safety technicians may start overhauling, during which they shall wear anti-static clothing and flammable gas alarm.

C.3 Accidental fire alarm or fire hazard

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