



《单元式空气调节机维修保养 技术规范》解读

*Interpretation of Technical Specification for Repair and Maintenance of
Unitary Air Conditioner*

中国制冷空调工业协会

China Refrigeration and Air-Conditioning Industry Association (CRAA)

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1 背景



- ❖ 中国是全球最大的制冷空调设备生产国、消费国、出口国。China is the world's largest producer, consumer and exporter of refrigeration and air-conditioning equipment.
- ❖ 制冷空调设备是当今我国经济生活中的能源消耗大户，据测算目前在用的各类制冷空调设备年耗电量占全社会电力总消费的20%以上，每年由制冷空调设备的电力消耗带来的CO₂排放当量折合超过9亿吨。Refrigeration and air-conditioning equipment is a major energy consumer in China's economy. It is estimated that currently the annual power consumption of various types of refrigeration and air-conditioning equipment in use accounts for more than 20% of the total power consumption of the whole society. The equivalent of CO₂ emissions is about more than 900 million tons.
- ❖ 中国也是当今全球最大的制冷剂消费国，年消费量超过35万吨，超过全球消费量的50%，折合CO₂当量超过5亿吨。China is also the world's largest consumer of refrigerants, with an annual consumption of more than 350,000 tons. The amount is equivalent to over 500 million tons of CO₂ emission, exceeding 50% of global consumption.

- ❖ 单元式空气调节机等直接蒸发式空调设备市场增长快，制冷剂消费量大，其制冷剂年消费量约占国内工商制冷空调行业制冷剂消费总量**50%**，采用**HCFCs**的制冷剂有**R22、R142b**，采用的**HFCs**制冷剂有**R410A、R32、R134a**等。The market of direct evaporative air-conditioning equipment such as unitary air conditioners is growing rapidly, leading to a large amount of refrigerants consumption. The annual consumption of refrigerants accounts for about 50% of the total consumption of refrigerants in the domestic industrial and commercial refrigeration and air-conditioning industry. The refrigerants used in HCFCs include R22 and R142b, and the refrigerants used in HFCs include R410A, R32, and R134a.
- ❖ 机组在维修保养过程中的不良操作、无序排放等问题，将导致制冷剂消费量和排放增加。Problems such as poor operation of the unit during repair and maintenance and disordered discharge will lead to an increase in refrigerant consumption and emissions.
- ❖ 此外，**R32**制冷剂是单元式空调机的主要替代技术之一，目前**R32**单元式空调机在中国市场占比超过**1/3**。由于**R32**制冷剂的弱可燃性等问题，机组的维修保养与**R22**制冷剂设备有较大的不同，而目前行业缺乏相关的替代制冷剂设备维修规范，对替代制冷剂设备的安全应用造成了障碍。In addition, R32 refrigerant is one of the main alternative technologies for unitary air conditioners. Currently, unitary air conditioners using R32 account for more than 1/3 of the market in China. Because R32 is weakly combustible, the maintenance of the unit is quite different from the equipment using R22 refrigerant. At present, there is no relevant maintenance specifications for the alternative refrigerant equipment in the industry, which has caused obstacles to the safe application of the alternative refrigerant equipment.

2 主要内容



起草单位

- ❖ **本文件主要起草单位：The main drafting units of this document involve**青岛海信日立空调系统有限公司、青岛海尔空调电子有限公司、广东美的制冷设备有限公司、宁波奥克斯电气股份有限公司、吉荣空调（揭阳）有限公司、合肥通用机械研究院有限公司、中国制冷空调工业协会制冷空调工程工作委员会。**Qingdao Hisense Hitachi Air Conditioning System Co., Ltd., Qingdao Haier Air Conditioning Electronics Co., Ltd., Guangdong Midea Refrigeration Equipment Co., Ltd., Ningbo Aux Electric Co., Ltd., Jirong Air Conditioning (Jieyang) Co., Ltd., Hefei General Machinery Research Institute Co., Ltd. Company, Refrigeration and Air-Conditioning Engineering Working Committee of China Refrigeration and Air-Conditioning Industry Association.**
- ❖ **本文件参加起草单位：珠海格力电器股份有限公司、广东美的暖通设备有限公司、大金空调技术（中国）有限公司、广东TCL智能暖通设备有限公司、江森自控日立万宝压缩机（广州）有限公司、浙江国祥股份有限公司、沈阳中航机电三洋制冷设备有限公司。Participating drafters of this document: Zhuhai Gree Electric Appliances Co., Ltd., Guangdong Midea HVAC Equipment Co., Ltd., Daikin Air Conditioning Technology (China) Co., Ltd., Guangdong TCL Intelligent HVAC Equipment Co., Ltd., Johnson Controls Hitachi Wanbao Compressor (Guangzhou) Co., Ltd., Zhejiang Guoxiang Co., Ltd., Avic Electromechanical (Shenyang) Sanyo Refrigeration Equipment Co., Ltd.**

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❖ 1 范围Scope

- ✓ 本文件规定了单元式空气调节机维修、保养、报废、制冷剂回收与再利用的基本技术要求。 **This document specifies the basic technical requirements for the repair, maintenance, scrapping, refrigerant recovery and recycling of unitary air conditioners.**
- ✓ 本文件适用于采用A1和A2L类制冷剂的单元式空气调节机。多联机、风管机等直接蒸发式空调设备可参照执行。 **This document applies to unitary air conditioners using A1 and A2L refrigerants. Direct evaporative air-conditioning machines such as multi-connected and duct conditioners could be implemented by reference.**

❖ 3 术语和定义 Terms and Definitions

- ✓ 3.1 制冷剂循环系统refrigerant cycle system
- ✓ 3.2 制冷剂回收refrigerant recovery
- ✓ 3.3 制冷剂再循环（refrigerant recycling），也可称之为**制冷剂净化**（Refrigerant purification）
- ✓ 3.4 制冷剂再生refrigerant reclamation
 - 将已经使用过的制冷剂进行处理以符合新品的技术要求。

❖ 5 维修Repair

- ✓ 5.1 维修准备Preparation for Repair
- ✓ 5.2 故障现象检测和分析Detection and Analysis of Fault Phenomenon
- ✓ 5.3 维修方案实施和验收Implementation and Acceptance of Repair Plan
- ✓ 5.4 维修记录Repair Records
- ✓ 5.5 维修服务质量要求Quality Requirements for Repair Services

❖ 6 保养Maintenance

- ✓ 6.1 一般要求General Requirements
- ✓ 6.2 日常维护保养的要求Requirements for Daily Maintenance
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❖ 7 报废Scrapping

- ✓ 7.1 报废条件Scrapping Conditions
- ✓ 7.2 报废要求Scrapping Requirements

❖ 8 制冷剂回收与再利用 **Refrigerant Recovery and Recycling**

- ✓ 8.1 一般要求 **General Requirements**
- ✓ 8.2 回收安全要求 **Requirements for Recycling Safety**
- ✓ 8.3 回收技术要求 **Technical Requirements for Recycling**
- ✓ 8.4 制冷剂的贮存与运输 **Storage and Transportation of Refrigerant**
- ✓ 8.5 数据记录 **Data Records**

3 关键要求 Basic Requirements



- ❖ **企业：** 获得行业或设备厂家资格认定的维修保养服务企业

The Enterprise refers to a repair and maintenance service enterprise that has obtained the qualification recognition of the industry or equipment manufacturer

- ❖ **从业人员： The Professional**

- ✓ 应经过得到认可的厂家或专业技术培训机构的培训 **refers to the personnel trained by recognized manufacturers or professional technical training institutions**
- ✓ 从事制冷剂处理、监管的人员还应掌握制冷剂管理相应的专业知识和技能 **Professionals engaged in refrigerant processing and supervision should also master the corresponding professional knowledge and skills of refrigerant management**
- ✓ 特种作业的从业人员需持证上岗 **Professionals in special operations should work with corresponding certificates.**

- ❖ **法规和标准：** 严格遵守GB/T 9237、GB/T 17758、GB 25130等中相关的安全要求：**Regulations and Standards: Strictly abide by the relevant safety requirements in GB/T 9237, GB/T 17758, GB 25130, etc.**

维修良好操作



- ❖ **数据记录：**可追溯性，记录应包括业主信息、产品信息、服务信息。**Data records should include owner information, product information, and service information, with traceability.**
 - ✓ a) 业主信息包括用户姓名、地址、联系电话。**The owner information includes the user name, address, and contact number.**
 - ✓ b) 产品信息应包括产品型号、编号、名称。**Product information should include product model, serial number and name.**
 - ✓ c) 服务信息应包括服务单位、操作人员的身份信息、服务提供日期、故障描述、使用材料清单、收费信息以及用户确认情况。**Service information should include service unit, operator's identity information, service provision date, fault description, list of materials used, charging information and user confirmation.**
 - ✓ d) 系统检漏情况。**System leakage detection.**
 - ✓ e) 被回收的制冷剂数量、再利用或处置情况，相关回收设备的名称、型号。**The quantity, recycle or disposal of the recovered refrigerant, and the name and model of the relevant recovery equipment.**
 - ✓ f) 每次充注制冷剂的名称、数量和种类（新的、再利用的或再生的），再利用制冷剂的来源。**The name, quantity and type (new, recycled or regenerated) of refrigerant for each charge, and the source of the recycled refrigerant.**
 - ✓ g) 应在制冷剂钢瓶上贴标签（包括制冷剂编号、化学式、危险和警示）并按照国家规范用颜色记号标示。**Refrigerant cylinders should be labelled with information (including refrigerant number, chemical formula, hazards and warning information) and marked with color codes in accordance with national regulations.**
 - ✓ h) 记录应至少保存5年，记录文件应保持整洁、清晰。**Records should be kept for at least 5 years, and the record files should be kept clean and clear.**

❖ **禁止制冷剂混用**：不允许在同一系统中混用不同的制冷剂。如需改变系统的制冷剂，应执行GB/T 9237的规定。 **Prohibition of mixing refrigerants** means that it is not allowed to mix different refrigerants in the same system. If the refrigerant of the system needs to be changed, the provisions of GB/T 9237 shall be implemented.

❖ **配额或备案管理**：制冷剂的使用应每年按照国家生态环境部门的规定申请配额或备案管理，并向行业协会报送使用数据。 **Quota or record management**: The use of refrigerants should be applied for quota or record management in accordance with the regulations of the national ecological environment department every year, and the use

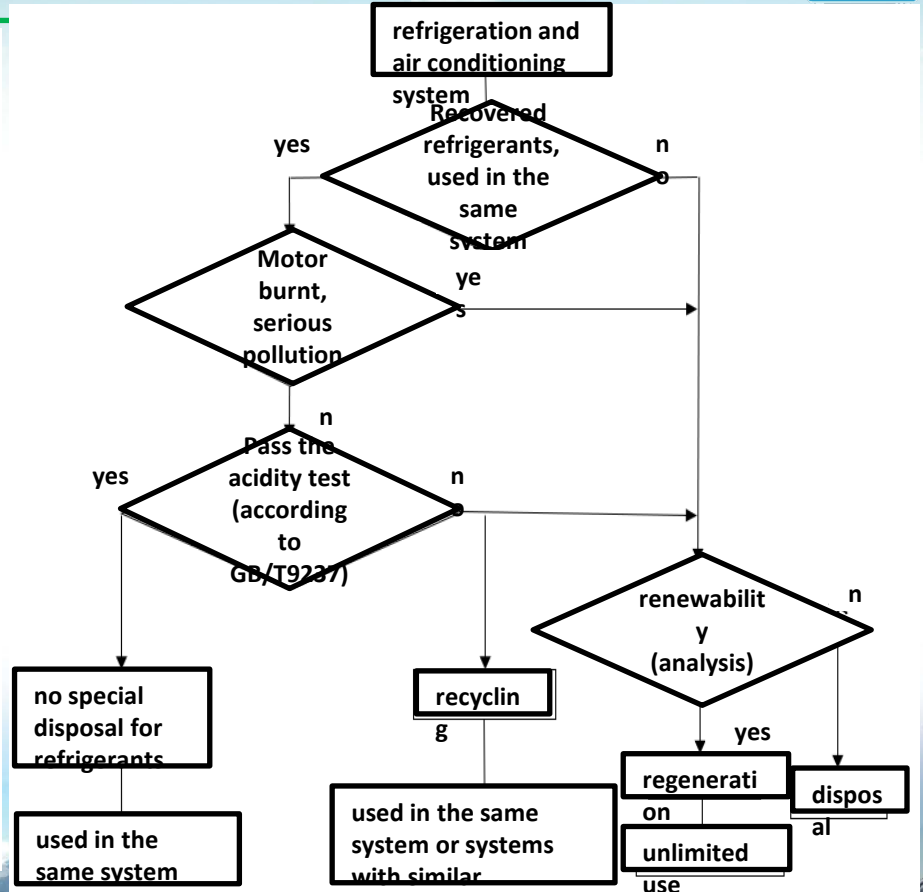
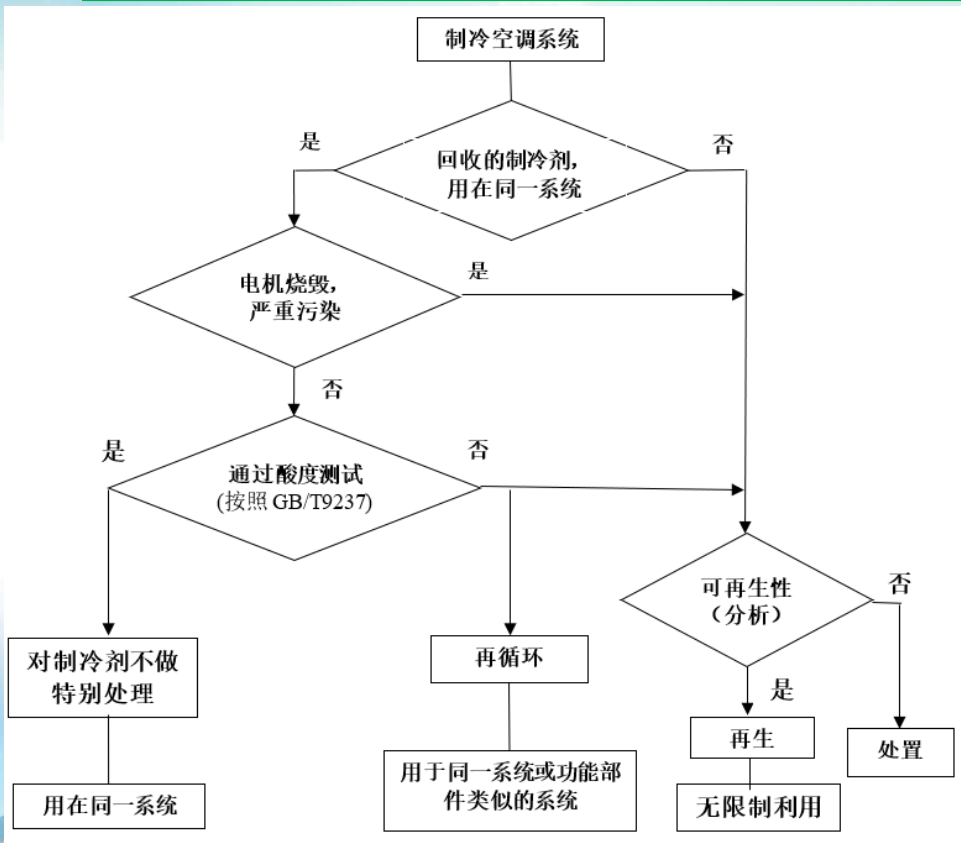
- ❖ **减少制冷剂的泄漏和排放： Reduction of refrigerant leakage and emissions:**
- ✓ **操作人员应采取预防措施防止制冷剂的无意排放或泄漏，采取一切技术和经济上的可行措施减少制冷剂泄漏。 Operators should take precautions to prevent unintentional discharge or leakage of refrigerant and take all technically and economically feasible measures to reduce refrigerant leakage.**
 - ✓ **当维修涉及系统的密封性时，经维修后的制冷空调设备在充入制冷剂前应抽真空，并进行泄漏试验。 When the repair involves the airtightness of the system, the repaired refrigeration and air-conditioning equipment should be evacuated and tested for leakage before charging the refrigerant.**
 - ✓ **设备和系统内的制冷剂严禁直接向大气排放。 The refrigerant in the equipment and system is strictly prohibited to be directly discharged into the atmosphere.**
 - ✓ **严禁使用制冷剂清洁系统和零部件。 Using refrigerant to clean the system and parts is strictly prohibited.**

❖ 涉及制冷剂的安全通用要求: **General safety requirements involving refrigerants:**

- ✓ 检测制冷剂有无泄漏并采取相应措施。 **Check for refrigerant leakage and take appropriate action.**
- ✓ 设备或部件拆卸前应确认拆卸部位已泄压。严禁在有余压或制冷剂的情况下对设备、管路及元件进行火焰切割、施焊等操作。 **Before disassembling the equipment or components, it is necessary to make sure that the parts have been depressurized. It is strictly forbidden to perform flame cutting or welding operations on equipment, pipelines and components under the condition of excess pressure or refrigerant.**
- ✓ 维修区域内禁止出现明火。 **Open flames are prohibited in the maintenance area.**

❖ 制冷剂回收与循环再利用： **Refrigerant recovery and recycling:**

- ✓ 鼓励对回收的制冷剂进行再循环利用。经检测不能再循环利用的回收制冷剂，应送交持有认定资质的单位进行再生利用或无害化处理。
Recycling of recovered refrigerants is encouraged. Recovered refrigerants that cannot be recycled after testing shall be sent to units with recognition qualifications for recycling or harmless disposal.
- ✓ 设备维修需更换制冷剂循环系统零部件或若需打开和制冷剂连通的部分，应先回收制冷剂或者将制冷剂全部隔离在远离泄漏点的部位（使用截止阀）：压缩机电机烧毁、焊接、报废时。
For the equipment maintenance that requires to replace the parts of the refrigerant circulation system or open the part connected to the refrigerant, the refrigerant should be recovered first or all the refrigerant should be isolated in the part far from the leakage point (using the stop valve), which refers to the situation that the compressor motor is burned, or needs to be welded, or scrapped.





❖ A.1 采用A2L制冷剂单元式空调机的储存安全要求A.1 Storage Safety Requirements for Unitary Air Conditioners Using A2L

储存场所应满足: **The storage site should,**

- ✓ 通风良好、避免阳光直射**Be well ventilated, avoid direct sunlight,**
- ✓ 采用防爆灯、防爆插座, 安装泄漏检测装置。配电线路宜采取穿金属管、采用封闭式金属线槽或难燃材料的塑料管**Be equipped with explosion-proof lamps, explosion-proof sockets, and leakage detection devices. Distribution lines should be made of metal pipes and closed metal trunking or plastic pipes made of flame retardant materials.**
- ✓ 防火、防雷、配备消防装置**Be equipped with fire protection, lightning protection, and fire-fighting devices**

❖ A.2 采用A2L制冷剂单元式空调机的运输安全要求 A.2 Transportation Safety Requirements for Unitary Air Conditioners Using A2L

✓ A.2.1 不同制冷剂充注量机组运输的规定 A.2.1 Regulations on Transportation of Units with Different Refrigerant Charge

- 1) 按照GB 12268—2012附录B的规定, 单台A2L制冷剂充注量小于12kg时, 不作为危险货物运输。 1) According to the provisions of Appendix B of GB 12268-2012, when the A2L refrigerant charge of a single unit is less than 12kg, it shall not be transported as dangerous goods.
- 2) 按照GB 12268—2012附录B的规定, 单台A2L制冷剂充注量大于等于12kg时, 按照危险货物运输。)According to the provisions of Appendix B of GB 12268-2012, when the A2L refrigerant charge of a single unit is greater than or equal to 12kg, it shall be transported as dangerous goods.

✓ A.2.2 运输车辆与设备要求 Requirements for Transport Vehicles and Equipment

✓ A.2.3 运输作业前要求 Requirements before Transportation

✓ A.2.4 运输过程要求 Requirements for Transportation Process

❖ A.3 采用A2L制冷剂单元式空调机维修保养安全操作要求A.3 Safe Operation Requirements for Repair and Maintenance of Unitary Air Conditioners Using A2L Refrigerant

✓ A.3.1 维修场所的安全要求Safety Requirements for Maintenance Sites

- 维修场地应明亮、宽敞、空旷、通风良好，配置消防装置。The maintenance site should be bright, spacious, open, well ventilated and equipped with fire-fighting devices.
- 除了焊接操作外，维修场所不应有明火等热源存在，不应有易燃物存放。Except for welding operations, there should be no heat sources such as open flames in the maintenance site, and no flammable materials should be stored there.
- 维修场地通风设备和电器设备应使用防爆型的，正规穿管走线。The ventilation equipment and electrical equipment of the maintenance site shall be explosion-proof and shall be cabled through regular pipes.
- 维修人员进入维修场地前检查场地：无火源、打开通风系统Maintenance personnel should make sure there is no fire source and turn on the ventilation system of the maintenance site before entering.
- 干燥季节维修产品时，当相对湿度低于40%，应采取防静电措施。When repairing the product in the dry season, the relative humidity should be lower than 40%, and anti-static measures should be taken.
- 严格遵守维修设备管理制度。Personnel at the site should strictly abide by the maintenance equipment management system.

✓ A.3.2 维修保养工具的要求 A.3.2 Requirements for Repair and Maintenance Tools

- 维修工具中与制冷剂接触的维修工具应单独存放和使用，不同制冷剂的维修工具不得混用或混放。The maintenance tools in contact with the refrigerant shall be stored and used separately with other tools, and the maintenance tools of different refrigerants shall not be stored or used together.
- 检查制冷剂检漏设备是否已经校准。制冷剂检漏设备设定的报警浓度最高不能超过LFL（最低爆炸极限）的25%。维修过程中该设备必须全程处于工作状态。It is necessary to check that refrigerant leakage detection equipment has been calibrated. The maximum alarming concentration set by the refrigerant leakage detection equipment should not exceed 25% of the LFL (Lower Flammable Limit). The equipment must be in working condition throughout the maintenance process.
- 与制冷剂直接接触的用电操作工具和设备应采用防爆型工具。Electric operating tools and equipment that are in direct contact with refrigerants should be repaired with explosion-proof tools.

小结Summary



- ❖ 在制冷空调设备的安装、维修、维护、运行过程中推行良好的操作规范，保持制冷空调设备的高效、安全、稳定运行，降低再维修率，促进制冷剂回收、循环再利用及合理的处置，可以有效减少制冷剂的泄漏和温室气体排放，可以取得明显的经济效益和社会效益。
Good operating practices in the installation, repair, maintenance and operation of refrigeration and air-conditioning equipment, could maintain efficient, safe and stable operation, reduce the re-maintenance rate, and promote the recovery, recycling and reasonable disposal of refrigerants, which assists effectively reduce refrigerant leakage and greenhouse gas emissions, achieving obvious economic and social benefits.
- ❖ 随着制冷剂替代进程的发展，（弱）可燃制冷剂在中小型空调设备中的应用已经成为主流趋势，对于安装维修环节提出了更高的技术要求，这需要从业人员加强培训，了解相关的法规标准要求并严格遵守。
With the development of refrigerant substitution process, the application of (weakly) combustible refrigerants in small and medium-sized air-conditioning equipment has become the mainstream trend. Thus, higher technical requirements are put forward for installation and maintenance, which requires professionals to strengthen training and strictly followed the related regulations and standards.



谢谢!
Thanks!