

R-32 SAFETY MANUAL



IMPORTANT NOTE:

Please read this manual carefully before installing or operating your air conditioning unit. Make sure to save this manual for future reference.



CAUTION:





The system is charged with flammable refrigerant, safety checks are necessary to ensure that the risk of ignition is minimised.

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01. Symbols

Explanation of symbols displayed on the air conditioner. Information About This Guide

	This symbol shows that this appliance uses a flammable refrigerant. If the refrigerant leaks and exposed to an external ignition source, there is a risk of fire.
	This symbol shows that the Operation Manual should be read carefully.
	This symbol shows that a service person should be handling this equipment with reference to the Installation Manual.
	This symbol shows that there is information included in the Operation Manual and Installation Manual.

02. Warnings

- Do not use means to accelerate the defrosting process or to clean a unit, other than those recommended by manufacturer.
- The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).
- Do not pierce or burn any component of the pipework or system.
- Be aware that the R-32 refrigerant may not contain an odour.
- The appliance shall be stored so as to prevent mechanical damage from occurring.

03. Installation

- The installation of pipe work shall be kept to minimum.
- The airconditioning system and its pipe work shall be protected from physical damage and shall not be installed in unventilated space.
- The pipe work shall be constructed so that any leaked refrigerant will not flow or stagnate so as to cause a fire or explosion hazard in areas within the appliance and connected ducts where electrical components, which could be a source of ignition and which could function under normal conditions or in the event of a leak, are fitted.
- Total Installed Refrigerant Charge (factory refrigerant charge + adjustment on refrigerant) must not exceed the allowable charge (with respect to the minimum room size of the smallest conditioned area and release height)
- Compliance with national gas regulations shall be observed.
- Mechanical connections shall be accessible for maintenance purposes.
- The appliance shall not be installed in unventilated space, if the space is smaller than the minimum area with respect to the Release Height and Total Installed Refrigerant Charge of the system as specified in Table 1.1 and 1.2.
- Ventilations (if any) shall be kept clear of obstruction.
- An unventilated area where the appliance is installed shall be constructed that should any of the refrigerant leak, it will not stagnate so as to create a fire or explosion hazard.
The system shall be stored in a well-ventilated area where the room size corresponds to the room area as specified for operation.
- low temperature solder alloys, such as lead/tin alloys, are not acceptable for pipe connections or any other refrigerant pressure containing purposes.
- For ducted units:
 - Ducts connected to an appliance shall not contain a potential ignition source. Examples of such potential ignition sources are hot surfaces with a temperature exceeding 700°C and electric switching devices.
 - Only auxiliary devices approved by the appliance manufacturer or declared suitable with the refrigerant shall be installed in connecting ductwork.
 - Duct for supply and return air shall be directly ducted to the space. Open areas such as false ceilings shall not be used as return air duct.

Service Personnel

- Only licensed HVAC technicians* should install and service this air conditioning equipment. Improper service or alteration by an unqualified technician could result in significant and major damage to the product or property which may render your warranty null and void. Such unqualified service could also lead to severe physical injury or death. Follow all safety instructions in this literature and all warning labels that are attached to the equipment.
- R-32 refrigerant (Class A2L) is mildly flammable. Installation, service, maintenance and decommissioning of this unit must be performed by a licensed HVAC technician; qualified to handle R-32 refrigerant.
- Any person who is involved with working on the refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerant safely in accordance with an industry recognised assessment specification.
- Servicing shall be performed only as recommended by the manufacturer.
- Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of a person competent in the use of flammable refrigerant.
- Every working procedure that affects safety means shall only be carried out by competent persons according to Annex HH of AS/NZS 60335.2.40. Examples for such working procedures are:
 - breaking into the refrigerating circuit;
 - opening of sealed components;
 - opening of ventilated enclosures.

*Qualifications required will be appropriate Electrical, Refrigeration and Refrigerant Handling License and Training dependent on local State/Territory regulations.

04. Minimum Room Area and Maximum Charge Guide

The Minimum Room Area (A_{min}) should be less than the smallest area to be conditioned.

For installation with release height less than or equal to 0.6m, minimum area will be computed based on release height of 0.6m.

Where A_{min} is not satisfied, the installer must provide additional control measure/s in place as per AS/NZS 60335.2.40 standard for the installation to be acceptable.

The examples of controls measures are (but are not limited to):

- Ventilation
- Shut Off Valves
- Safety Alarm

These control measures are not provided by ActronAir and must be determined by the installer based on individual installation requirements.

NOTE

- Calculations of A_{min} for split products shall be based on Installed Refrigerant not to exceed the manufacturer's specified maximum refrigerant charge.
- Total Installed Refrigerant Charge = Refrigerant Pre-Charge of the appliance + Additional Charge during installation.
- Release height refers to the lowest point refrigerant can enter the conditioned space:
 - For Wall hung Splits this refers to the lowest point of the indoor unit in the conditioned space.
 - For ducted systems this refers to the lowest supply or return outlet installed in the space.

Table 1.1 Required Minimum Room Area (A_{min})

		Release Height (m)		
		0.6	2.2	2.3
R-32 Charge (g)	1850	29.128	2.167	1.982
	2400	49.022	3.646	3.336
	2950	74.065	5.509	5.040
	3080	80.737	6.005	5.494
	3590	109.688	8.159	7.465
	3720	117.776	8.760	8.015
	3750	119.683	8.902	8.145
	3850	126.152	9.383	8.585
	4000	136.173	10.129	9.267
	4200	150.131	11.167	10.217
	4500	172.344	12.819	11.729
	5000	212.771	15.826	14.480
	5500	257.452	19.149	17.520
	6000	306.390	22.789	20.851

During installation ensure that the Minimum Floor Area of the smallest room is satisfied based on the Release height; or the maximum R-32 Charge amount is not exceeded. Note that safety measures as per AS/NZS 60335.2.40 may be required.

Table 1.2 Maximum Charge Amount (m_{max}) Requirement

		Release Height (m)		
		0.6	2.2	2.3
Floor Area (m ²)	2	*	*	1858
	5	*	2810	2938
	10	*	3975	4155
	15	*	4868	5089
	20	*	5621	5876
	30	1877	6884	7197
	40	2168	7949	8310
	60	2655	9736	10178
	80	3066	11242	11753
	100	3428	12569	13140
	125	3832	14052	14691
	150	4198	15393	**
	200	4848	**	**
	250	5420	**	**

Based on the minimum release height.

Vertical (Upright) indoor's release height shall not be less than 0.6 m high, wherefore no indoor pipe routing should go below 0.6 m above the floor. In installation that does not meet the minimum required area with respect to the system's refrigerant charge and release height, additional safety measures are required, see Annex GG of the AS/NZS 60335.2.40.

Unit must be installed in accordance to Installation and Commissioning Guide. Maximum refrigerant charge is to be calculated based on the maximum pipe length of the unit. Installation must be in accordance with the Installation specification and clearance of the unit.

* If charge amount is less than 1842g inclusive, there is no restriction on the floor area.

** Total refrigerant charge from 15.96 to 79.82 kg will require additional safety provisions in accordance with AS/NZS 60335.2.40.

05. Information Servicing

05.01. Checks to the area

Prior to beginning work on systems containing **flammable refrigerants**, safety checks are necessary to ensure that the risk of ignition is minimised. For repair to the refrigerating system, 05.02 to 05.06 shall be conducted prior to conducting work on the system.

05.02. Work procedure

Work should be carried out using the procedures outlined in this document whilst maintaining a high level of risk mitigation and maintaining safe work practices.

05.03. General work area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided where possible, and the area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material Installation Instructions.

05.04. Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.

05.05. Presence of fire extinguisher

If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. A dry powder or CO₂ fire extinguisher must be kept adjacent to the charging area.

05.06. No ignition sources

- No person carrying out work in relation to a refrigeration system which involves exposing any pipe work that contains or has contained flammable refrigerant shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.
- All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which flammable refrigerant can possibly be released to the surrounding space.
- Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. **No Smoking** signs shall be displayed where applicable.

05.07. Ventilated area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

05.08. Checks to the refrigeration equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt, consult the manufacturer's technical department for assistance.

The following checks shall be applied to installations using **flammable refrigerants**:

- The charge size is in accordance with the room size within which the refrigerant containing parts are installed;
- The ventilation machinery and outlets are operating adequately and are not obstructed;
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;
- Refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any

substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

05.09. Checks to electrical devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- That no live electrical components and wiring are exposed while charging, recovering or purging the system;
- That there is continuity of earth bonding.

06. Repairs to Sealed Components

- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.

Ensure that the apparatus is mounted securely.

Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

NOTE

The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.

07. Repair to Intrinsically Safe Components

Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.

Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.

Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

08. Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

09. Detection of Flammable Refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

10. Leak Detection Methods

The following leak detection methods are deemed acceptable for all refrigerant systems.

Electronic leak detectors may be used to detect refrigerant leaks but, in the case of **flammable refrigerants**, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant free area.)

Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed.

Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. For appliances containing flammable refrigerants, oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

11. Removal and Evacuation

When opening the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:

- Remove refrigerant;
- Purge the circuit with inert gas;
- Evacuate;
- Purge again with inert gas;
- Open the circuit by cutting or brazing.

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing **flammable refrigerants**, the system shall be purged with OFN to render the unit safe. This process may need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing **flammable refrigerants**, flushing shall be achieved by breaking the vacuum in the system with OFN and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final OFN charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe-work are to take place.

Ensure that the outlet for the vacuum pump is not close to any ignition sources and that ventilation is available.

12. Charging Procedures

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimise the amount of refrigerant contained in them.
- Cylinders shall be kept upright.
- Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigeration system.

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

13. Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment in detail. It is recommended good practice that all refrigerants are recovered safely. ActronAir does not recommend reusing R-32. However, an oil and refrigerant sample shall be taken in case analysis prior to reuse of reclaimed refrigerant. It is essential that electrical power is available before the task is commenced.

- a. Become familiar with the equipment and its operation.
- b. Isolate system electrically.
- c. Before attempting the procedure, ensure that:
 - Mechanical handling equipment is available, if required, for handling refrigerant cylinders;
 - All personal protective equipment is available and being used correctly;
 - The recovery process is supervised at all times by a competent person;
 - Recovery equipment and cylinders conform to the appropriate standards.
- d. Pump down refrigerant system, if possible.
- e. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- f. Make sure that cylinder is situated on the scales before recovery takes place.
- g. Start the recovery machine and operate in accordance with manufacturer's instructions.
- h. Do not overfill cylinders. (No more than 80% volume liquid charge).
- i. Do not exceed the maximum working pressure of the cylinder, even temporarily.
- j. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- k. Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

14. Labelling

Equipment shall be labelled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing **flammable refrigerants**, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

15. Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge are available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, **flammable refrigerants**. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

16. Start Up and Commissioning Report

NOTE

This form has to be filled by the installer and handed over to the customer for future reference

CUSTOMER	Name:	Tel. Number:
	Address:	
INSTALLER	Name:	Tel. Number:
	Address:	
Site Address:		Date Installed:
Model:		Serial Number:

Cooling

Circuit Temperature Settings	
Supply Air Temperature	°C
Return Air Temperature	°C
Suction Temperature	°C
Discharge Temperature	°C
Condenser Coil Temperature	°C
Ambient Temperature	°C

Indoor Fan Settings	
Indoor Fan Current	Amps
Indoor Fan Airflow	l / s
Indoor Fan PWM	%
Set Static	Pa
Outdoor Fan Settings	
Outdoor Fan Current	Amps

Heating

Circuit Temperature Settings	
Supply Air Temperature	°C
Return Air Temperature	°C
Suction Temperature	°C
Discharge Temperature	°C
Condenser Coil Temperature	°C
Ambient Temperature	°C

Indoor Fan Settings	
Indoor Fan Current	Amps
Indoor Fan Airflow	l / s
Indoor Fan PWM	%
Set Static	Pa
Outdoor Fan Settings	
Outdoor Fan Current	Amps

Unit Installation

Total Installed Refrigerant Charge*	kg
Pipe Sizes (Liquid/Gas line)	Field Pipe Length
System A	m
System B**	m
System C**	m
System D**	m
System E**	m

Release Height (min)	m
Actual Smallest Room Area	m ²
Computed A _{min}	m ²
Is additional safety measures require? If yes, tick which applies:	
Leak Detection device installed	<input type="checkbox"/> Yes <input type="checkbox"/> No
Ventilation	<input type="checkbox"/> Yes <input type="checkbox"/> No
Others	<input type="checkbox"/> Yes <input type="checkbox"/> No

Was the Refrigerant Information Label on the outdoor electrical box properly filled out	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are piping protected or enclosed to avoid mechanical damage.	<input type="checkbox"/> Yes <input type="checkbox"/> No

* Total Installed Refrigerant Charge = Refrigerant Pre-Charge of the appliance + Additional Charge during installation.

** Applicable only to multisplit installation.



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ActronAir is constantly seeking ways to improve the design of its products, therefore specifications are subject to change without notice.