



SERVICE MANUAL

Home Comfort

Document Revisions

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Technical Support

PORTABLE AIR CONDITIONER

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Section 1 Basic Information

This Manual has been prepared to provide Electrolux Service Personnel with Operation and Service Information for Frigidaire Room Air Conditioners.

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Section 1 Basic Information

Safe Servicing Practices

Avoid personal injury and/or property damage by observing important Safe Servicing Practices. Following are some limited examples of safe practices:

1. DO NOT attempt a product repair if you have any doubts as to your ability to complete the repair in a safe and satisfactory manner.
2. Always Use The Correct Replacement Parts as indicated in the parts documentation. Substitutions may defeat compliance with Safety Standards Set For Home Appliances. Do not exceed maximum recommended wattage on light bulb replacements. Doing so could blow fuses and/or damage transformers.
3. Before servicing or moving an appliance:
 - Remove power cord from the electrical outlet, trip circuit breaker to the OFF position, or remove fuse.
4. Never interfere with the proper operation of any safety device.
5. Use ONLY REPLACEMENT PARTS CATALOGED FOR THIS APPLIANCE. Substitutions may defeat compliance with Safety Standards Set For Home Appliances.
6. GROUNDING: The standard color coding for safety ground wires is GREEN, or GREEN with YELLOW STRIPES. Ground leads are not to be used as current carrying conductors. It is EXTREMELY important that the service technician reestablish all safety grounds prior to completion of service. Failure to do so will create a hazard.
7. Prior to returning the product to service, ensure that:
 - All electrical connections are correct and secure.
 - All electrical leads are properly dressed and secured away from sharp edges, high-temperature components, and moving parts.
 - All non-insulated electrical terminals, connectors, heaters, etc. are adequately spaced away from all metal parts and panels.
 - All safety grounds (both internal and external) are correctly and securely connected.
 - All panels are properly and securely reassembled.

Section 1 Basic Information

Read all instructions before using this air conditioner.



WARNING

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Read product labels for flammability and other warnings.



WARNING

To reduce the risk of fire, electrical shock, or injury to persons when using your air conditioner, follow basic precautions, including the following:

1. Be sure the electrical service is adequate for the model you have chosen. This information can be found on the serial plate, which is located either on the side of the cabinet or behind the grille.
2. If the air conditioner is to be installed in a window, you will probably want to clean both sides of the glass first. If the window is a triple-track type with a screen panel included, remove the screen completely before installation.
3. Be sure the air conditioner has been securely and correctly installed according to the separate installation instructions provided with the unit.
4. Save this manual and the installation instructions for possible future use in removing or reinstalling this unit.



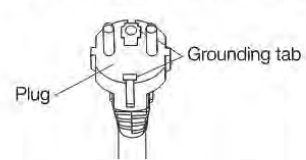
WARNING

Electrical Information

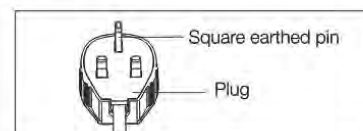
The electrical rating of the room air conditioner is stated on the serial plate. Refer to the rating when checking the electrical requirements.

1. Be sure the air conditioner is properly grounded. To minimize shock and fire hazards, proper grounding is important. The power cord is equipped with a three-prong grounding plug for protection against shock hazards.
2. The air conditioner is to be used in a properly grounded wall receptacle. If the wall receptacle is to be used is not adequately grounded or protected by a time delay fuse or circuit breaker, have a qualified electrician install the proper receptacle.
3. Do not use an extension cord or an adapter plug.

- This appliance must be earthed. This appliance is equipped with a cord having an earth wire. The plug must be plugged into an outlet that is properly installed and earthed.



- This appliance is equipped with a cord that has a earthed wire connected to an earthed pin. The plug must be plugged into a socket that is properly installed and earthed. Do not under any circumstances cut or remove the square earthed pin from this plug.



(only for UK)

Section 1 Basic Information

MODELS

PA Portable

- 9,000 to 12,000BTU cooling and heating capacity
- Rotary fan 3-speed control on base models
- Units with full-function electronic controls available
- Multi-Step fan speeds on electronic models
- Swing air direction control
- Rear Top & Removable Panel filter access
- Exhaust adaptor and window extension kits included for easy installation.

Accessories

Unit & Window Exhaust Adaptor

Unit exhaust adaptor connects the unit with the exhaust hose. Window Exhaust adaptor connects the window sliding kits with the exhaust hose.

Exhaust Hose

The hose connects between the unit and window exhaust adaptor to help exhaust the hot air from indoor to outdoor. with extending capability from its original length of 15" up to 59".

Foam Seal

Foam compresses to seal between window and window sliding kits, reducing vibration, outside noises, dust, insects, cold drafts in winter and warm air during summer.

Section 1 Basic Information

How to Choose a Room Air Conditioner

Compared to large capacity central units, room air conditioners have several advantages. The initial cost of a room air conditioning unit is significantly lower than the cost of central air. Because room air conditioners are designed for cooling small spaces, operating costs are reduced.

Calculating Cooling Capacity

Cooling capacity is the critical factor in properly selecting a room air conditioner. Cooling capacity is measured in British Thermal Units (BTUs) and typical models will range in capacity from 5,000 BTUs to 28,500 BTUs. Choosing an undersized unit will overwork the unit and it will not cool properly. Choosing an oversized unit will cost more to buy and operate and it will not dehumidify properly. Your dealer can help you to calculate capacity. Be prepared to provide specific information on:

- Room dimensions
- A simple floor plan to show the location of doors and north-facing windows
- The number of people it will serve
- Sources of heat such as lamps, TV and appliances
- An explanation of what's above the intended room
- Your insulation provisions

Cooling Capacity by Room Size

Measure the length and width of the area to be cooled. Multiply the length by the width to determine square footage or square meters. Locate the room size in the chart below to select the appropriate BTUs. Then use the product information to select the unit for your room.

Room Size		BTU
Sq. Feet.	Sq. Meters	
150	14	Up to 5,000
165	15	5,200
216	20	6,000
350	33	8,000
425	39	9,000
500	46	10,000
640	60	14,000
900	84	15,100
1,110	103	18,000
1,170	109	18,500
1,435	133	22,000
1,672	154	25,000
1,960	182	28,500



NOTE

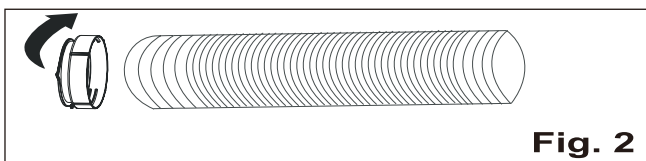
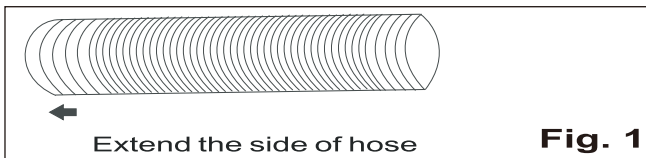
When cooling rooms with uninsulated ceilings, great rooms, or southern or western sun exposures – step up to the next BTU size or consult your sales professional.

INSTALLATION INSTRUCTIONS

Exhausting hot air

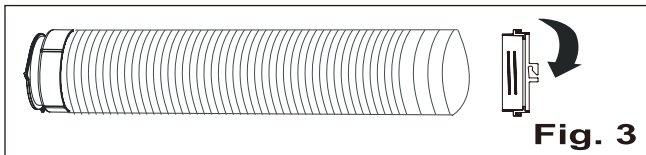
In the Cool Mode the appliance must be placed close to a window or opening so that the warm exhaust air can be ducted outside. First position unit on a flat floor and make sure there's a minimum of 50cm clearance around the unit, and is within the vicinity of a single circuit outlet power source.

1. Extend either side of the hose (Fig. 1) and screw the hose to adaptor A (Fig. 2).

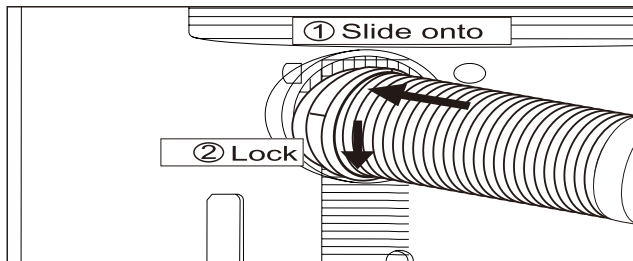


i The adaptor A already be screwed to the hose for this unit.

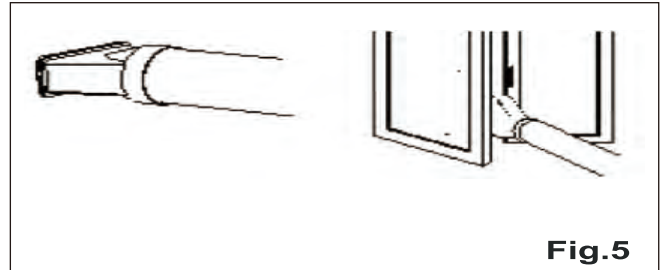
2. Extend the other side of the hose and screw it to adaptor B (Fig. 3).



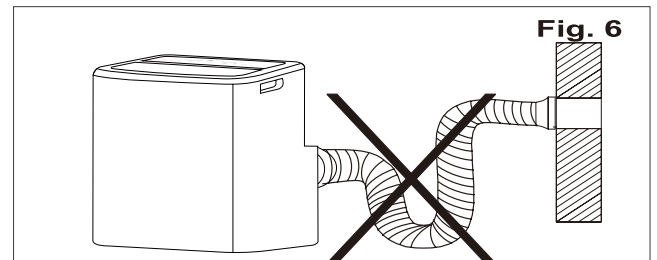
3. Install the adaptor A into the unit (Fig. 4).



4. Affix the adaptor B into the window. (Fig. 5)



i The hose can be extended from its original length of 38cm up to 150cm, but it is the best to keep the length to minimum required. Also make sure that the hose does not have any sharp bends or sags. (Fig. 6)



Section 1 Basic Information

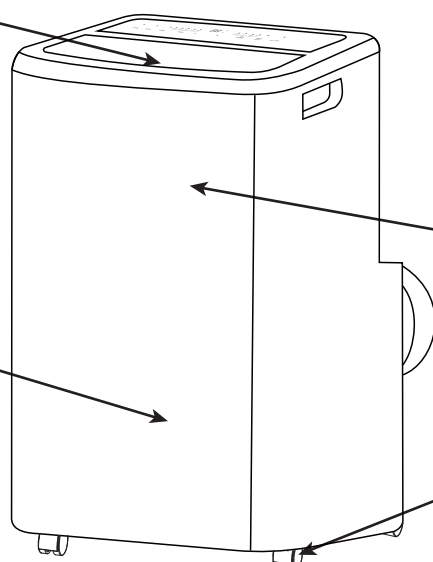
Normal Sounds

Sound of Rushing Air

At the top of the unit, you may hear the sound of rushing air being moved by the fan.

High pitched Chatter

Today's high efficiency compressors may have a high pitched chatter during the cooling cycle.



Gurgle/Hiss

"Gurgling or hissing" noise may be heard due to refrigerant passing through evaporator during normal operation.

Vibration

Unit may vibrate and make noise because of uneven floor.

Cleaning

Clean your air conditioner occasionally to keep it looking new. Be sure to unplug the unit before cleaning to prevent shock or fire hazards.

CLEANING THE UNIT

The cabinet and front may be dusted with an oil-free cloth or washed with a cloth dampened in a solution of warm water and mild liquid dishwashing detergent. Never use harsh cleaners, wax or polish on the cabinet front. Be sure to wring excess water from the cloth before wiping around the controls. Excess water in or around the controls may cause damage to the air conditioner.

CLEANING THE FILTERS

To keep your air conditioner working efficiently, you should clean the filters every week of operation. Grasp the upper panel tab and take off the filter which is behind the grill of the back panels as shown in the right fig. Wash the filter using liquid dishwashing detergent and warm water. Rinse filter thoroughly. Gently shake excess water from the filter. Be sure filter is thoroughly dry before replacing. Or, instead of washing you may vacuum the filter clean. Replace the filter after the filter is dry.

Winter Storage

If the air conditioner will not be used for an extended period of time:

1. Drain the water collection tank completely and leave the bottom drain cap and rubber plug long time enough to allow any residual water to drain out. Once the tank is completely drained and no more water flows out, reinstall the rubber plug and cap.
2. Remove and clean the filter, allow it to dry completely, then reinstall it.
3. Remove the batteries from the remote control.
4. Store the air conditioner in a cool, dry location, away from direct sunlight, extreme temperature and excessive dust.

Before using the air conditioner again:

1. Make sure the filter and drain cap are in place.
2. Check the cord to make sure it is in good condition, without cracks or damage.
3. Place new batteries in the remote control.
4. Install the air conditioner as described in the Installation Instructions.

Section 2 Operation Instructions

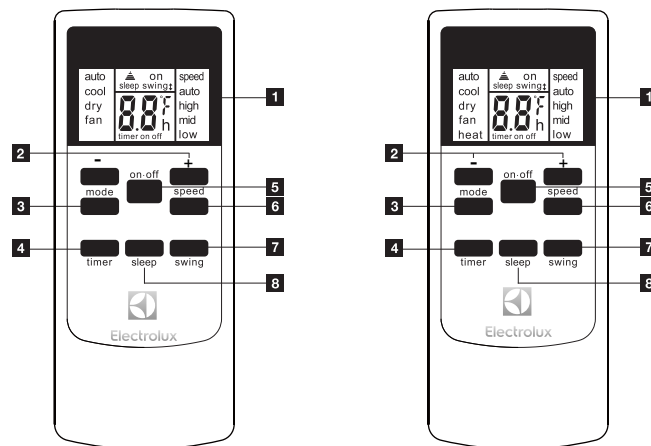
Electronic Control Operating Instructions

Before you begin, thoroughly familiarize yourself with the control panel and remote as shown below and all its functions. Then follow the symbol for the functions you desire. The unit can be controlled by the touch pad alone or with the remote.

Remote Controls

The illustration below shows the remote control configuration that used with Frigidaire Room Air Conditioner.

Remote Control



Cool Only models

- 1 Remote Control screen
- 2 Temp/Timer setting button
- 3 Mode button
- 4 Timer button

Heat and Cool models

- 5 on-off button
- 6 Fan Speed button
- 7 Swing button
- 8 Sleep button

Battery Installation and Important Instructions

Remove the cover at the back of the remote control. Insert the provided batteries correctly (see the instructions inside the battery compartment). Close up the cover.

To replace the old batteries (which have been used up) with two new R03 "AAA" 1.5V batteries, repeat the steps above.



If the remote control unit is replaced or discarded, the batteries must be removed and disposed of in accordance with local legislation as they do harm to the environment.

Do not mix old and new batteries.

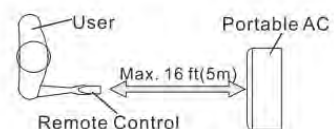
Do not mix alkaline, standard(carbon-zinc) or rechargeable(nickel-cadmium)batteries.

Do not dispose of batteries in fire. Batteries may explode or leak. If the remote control is not used for a long time, remove the batteries from the remote control.

The remote control must be handled with extreme care. Do not drop it or expose it to direct sunlight or sources of heat.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

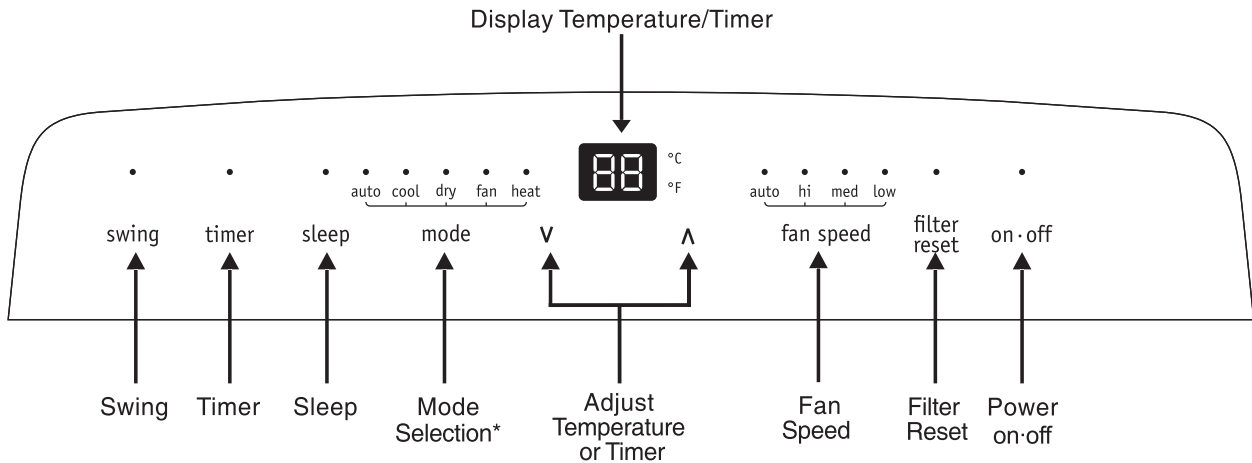
Point the remote control at the location of the signal receiver. The remote control must be no more than 16ft(5 meters) away from the unit(without obstacles between the remote control and the unit).



 **Electrolux**

Air Conditioner Features & Operating Instructions

Control Panel

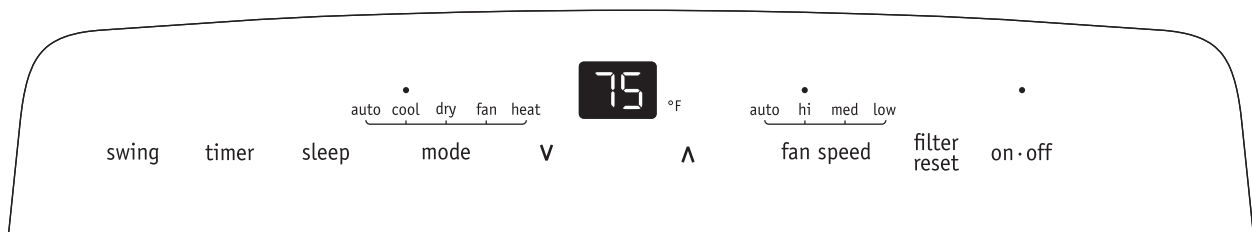


*Note: "heat" mode is for heat & cool models only.

Operating Instruction

Cool mode

Press the "mode" button until the Cool mode indicator lights.
Press the "fan speed" button to choose the fan speed according to the illumination of the fan speed indicator.
You can choose the "hi", "med", "low", or "auto" fan speed setting.
Press the "Λ" or "V" button to choose the temperature you want.

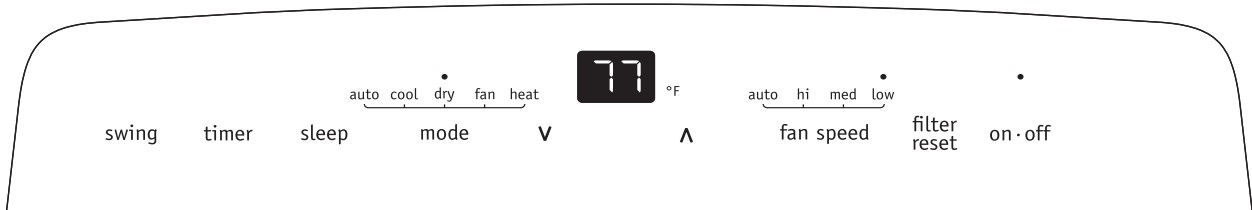


Operating Instructions

Dry mode

Press the “mode” button until the Dry mode indicator lights. In this mode, the “**Λ**” or “**V**” button is disabled and the screen displays the room temperature. The unit will continuously drain moisture from the room.

Note: In this mode, the fan speed will be set as “low” automatically, which cannot be changed.



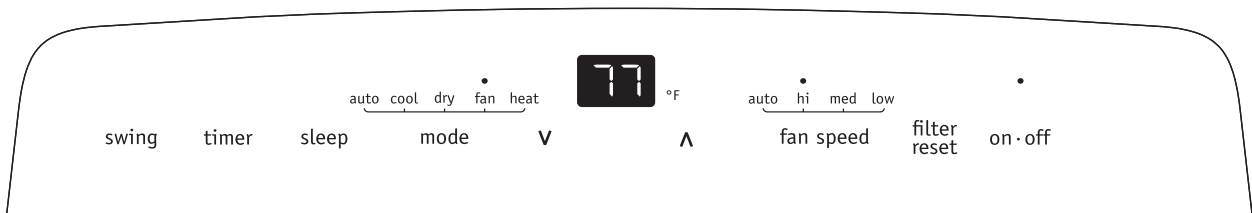
Fan mode

Press the “mode” button until the Fan mode indicator lights.

In this mode, you can select fan speed “hi”, “med” or “low”.

The screen displays room temperature.

Note: In this mode, the air exhaust hose does not need to be connected.

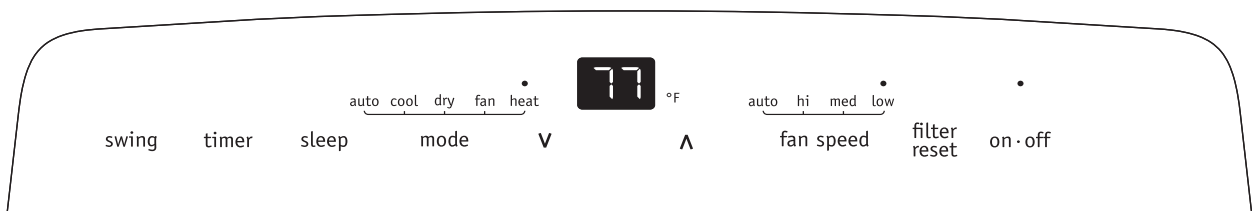


Heat mode(For Heat & Cool models only)

Press the “mode” button until the Heat mode indicator lights.

Press the “**Λ**” or “**V**” button to choose the temperature you want.

At the same time, the “low” fan indicator lights.



Note:

- In this mode, fan speed cannot be selected.

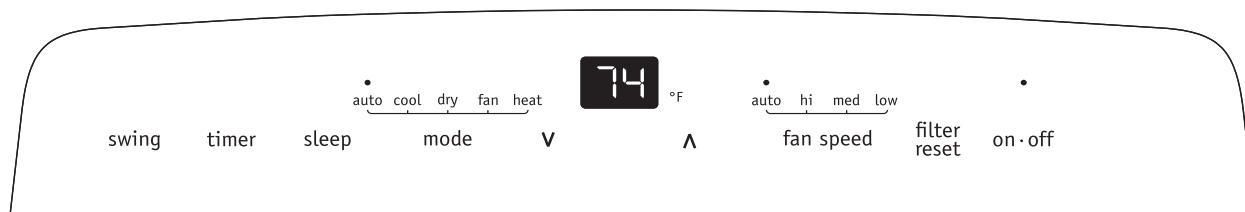
Operating Instructions

AUTO mode

Press the “mode” button until the AUTO mode indicator lights.

Press the “**▲**” or “**▼**” button to choose the temperature you want. The screen will display the setting temperature. In this mode, the unit will automatically select cooling, heating(not applicable for cooling only models), or fan only operation depending on what temperature you have selected and the room temperature. The air conditioner will control room temperature automatically round the temperature point set by you.

Note: In this mode, fan speed cannot be selected.



Timer mode

The timer facilitates the user to delay the unit startup or shutdown.

How to delay startup

Plug in the unit, so the unit turns to standby.

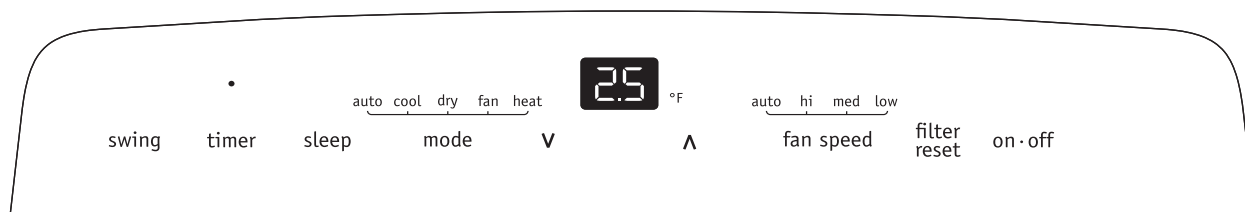
Press the “timer” button, then the Timer indicator and number of hours on the screen will light.

Tap or hold the UP arrow (**▲**) or the DOWN arrow (**▼**) to change delay start timer at 0.5 hour increments up to 10 hours, then at 1 hour increments up to 24 hours.

After 5 seconds, the setting will be confirmed automatically and the control will count down the time remaining until startup.

The unit will start up in the mode as previously set. Press the “timer” button again within 5 seconds, you will quit the timer setting directly.

To cancel the setting, press the “timer” button again will show the remain time and press the button again to quit the function.



How to delay shutdown

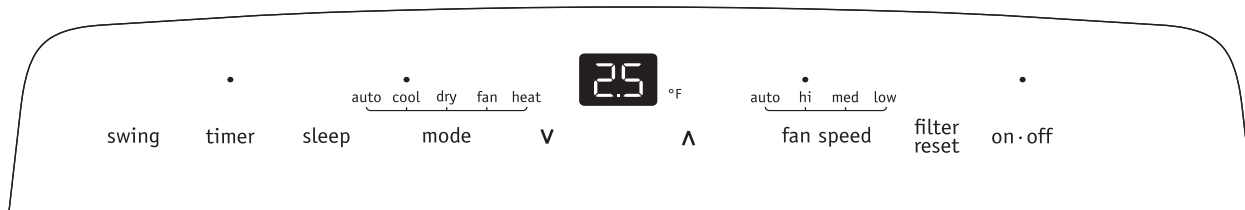
You can delay shutdown when the unit is on.

Press the “timer” button, then the Timer indicator and number of hours on the screen will light.

Tap or hold the UP arrow (**▲**) or the DOWN arrow (**▼**) to change delay shutdown timer at 0.5 hour increments up to 10 hours, then at 1 hour increments up to 24 hours.

After 5 seconds, the setting will be confirmed automatically and the control will count down the time remaining until shutdown. Press the “timer” button again within 5 seconds, you will quit the timer setting directly.

To cancel the setting, press the “timer” button again will show the remain time and press the button again to quit the function.



Operating Instructions

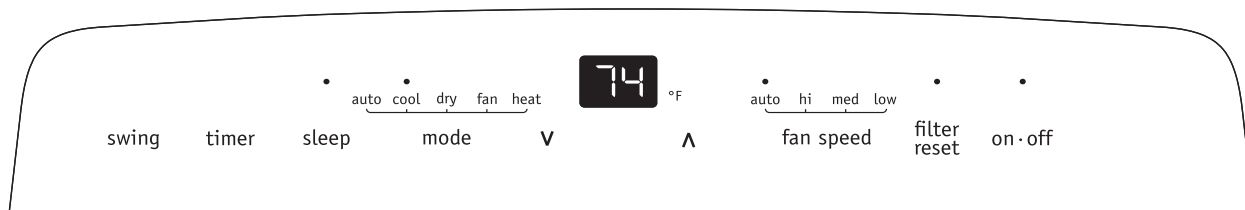
Sleep mode

When the unit is in Cool, Heat or Auto mode, you can press the “sleep” button to make the unit run in Sleep mode. In this mode, the fan speed will be set as “auto” automatically, which cannot be changed.

In Cool/Heat mode the selected temperature will increase/decrease by 2 °F 30 minutes after the mode is selected. The temperature will then increase/decrease by another 2 °F after an additional 30 minutes. This new temperature will be maintained for 7 hours before it returns to the originally selected temperature. This ends the “Sleep” mode and the unit will continue to operate as originally programmed.

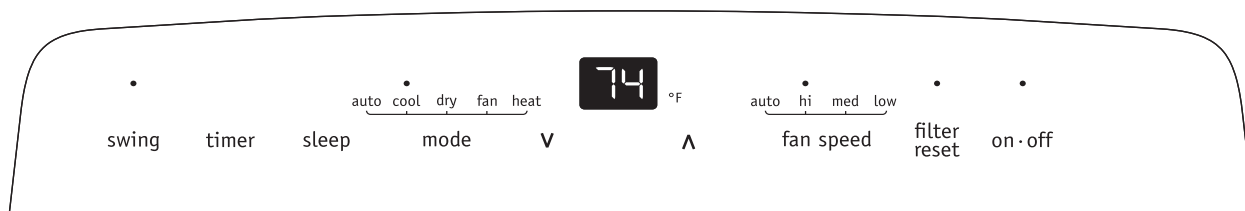
The “Sleep” mode program can be cancelled at any time during operation by pressing the “Sleep”, “mode”, “fan speed” or “on-off” button.

Note: In Fan or Dry mode, Sleep mode cannot be set.



Louver Swing Function

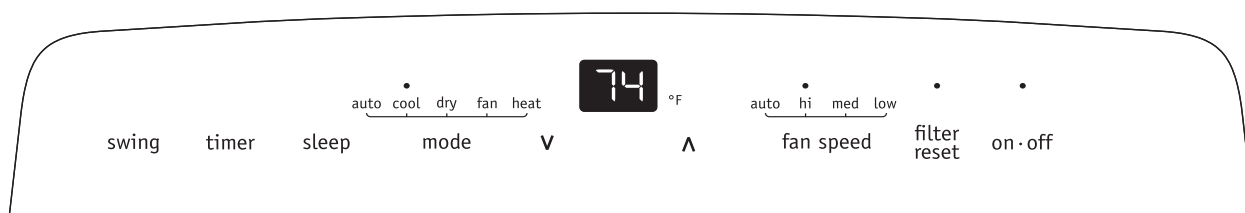
Press the “swing” button to enable louver swing function, the swing indicator will illuminate and the louver on the top panel will swing up and down. Press this button again to disable the louver swing function.



Filter reset

This feature is a reminder to clean the Air Filter (See Care and Cleaning) for more efficient operation.

The filter indicator will illuminate after 250 hours of fan operation. Press the “filter reset” button, to reset after cleaning the filter.



°F /°C function

Press the “Λ” and “V” button the same time for more than 3 seconds to switch between degree Fahrenheit and degrees Celsius.

Note: Under Dry/Fan mode, you can not select °F/°C.

Section 3 Troubleshooting and Testing

AIR CONDITIONER VOLTAGE LIMITS

Low voltage is a common cause of trouble in the operation of any room air conditioner. Improper voltage may cause one or more of the following problems:

1. Unit will not start.
2. Compressor motor cycling on motor protector.
3. Premature failure of motor protector.
4. Blown fuses.
5. Premature failure of compressor or fan motor.
6. Noticeable dimming of lights when air conditioner is running.
7. Evaporator icing. Low voltage may reduce fan speed resulting in inadequate air flow over evaporator, thereby allowing it to ice up.

Low voltage can also be the direct result of inadequately wired circuits, extension cords, or loose fuses and connections to the power supply. Voltage may also be a general condition in the area (a responsibility of the power company).

All units will start and run on the minimum voltage stated in the chart to the left (Figure 4-1), and will perform satisfactorily if the voltage remains constant. Low voltage caused by defective wiring will not remain constant under load.

To test for low voltage, use a reliable meter with sufficient capacity to measure the required voltage. Take measurements at the electric power entry point and at the electric outlet serving the air conditioner. Take readings with the unit off, while the unit is starting, and again while the unit is running. The lowest reading should not drop below the lowest value listed in the chart.

HIGH VOLTAGE

High voltage can be equally troublesome, causing motors to overheat, cycle on their protectors, or break down electrically. This problem can only be solved by the power company.

ELECTRONIC CONTROL

This control is not repairable. If any component in the control is defective, the entire control must be replaced.

NAMEPLATE		
RATING	MINIMUM	MAXIMUM
220-240VAC	198 VAC	254 VAC

Figure 4-1.



CAUTION

Repair or replace any malfunctioning line voltage component before testing or replacing the electronic control. DO NOT assume a service problem is directly caused by the electronic control system. A line voltage component (including power cord and wiring) that has opened, shorted, grounded or otherwise malfunctioned, may have created a service problem.

Section 3 Troubleshooting and Testing

Section 3 Troubleshooting and Testing

Troubleshooting Procedures

Before calling for service, review this list. It may save you time and expense. This list includes common occurrences that are not the result of defective workmanship or materials in this appliance.

Air conditioner will not operate.

- Wall plug disconnected. Push plug firmly into wall outlet.
- House fuse blown or circuit breaker tripped. Replace fuse with time delay type or reset circuit breaker.
- Control is OFF. Turn Control ON and set to desired setting.
- P1 appears in the display window. Drain water as described in 7.3 Drainage Section .
- Room Temperature lower than the set temperature (Cool Mode). Reset the temperature.

Air from unit does not feel cold enough.

- Room temperature below 16 °C. Cooling may not occur until room temperature rises above 16 °C.
- Reset to a lower temperature.
- Compressor shut-off by changing modes. Wait approximately 3 minutes and listen for compressor to restart when set in the COOL mode.

Air conditioner cooling, but room is too warm - NO ice forming on cooling coil behind decorative front.

- Outdoor temperature below 16 °C. To defrost the coil, set Fan mode.
- Air filter may be dirty. Clean filter. Refer to 8. Care and Cleaning section. To defrost, set to Fan mode.
- Temperature is set too low for nighttime cooling. To defrost the coil, set to Fan mode. Then, set temperature to a higher setting.

Section 3 Troubleshooting and Testing

- Exhaust duct not connected or blocked. See 5.1 Exhausting hot air Section.

Air conditioner cooling, but room is too warm - ice forming on cooling coil behind decorative front

- Dirty air filter - air restricted. Clean air filter. Refer to 8. Care and Cleaning section.
- Temperature is set too high. Set temperature to a lower setting.
- Air directional louvers positioned improperly. Position louvers for better air distribution.
- Front of unit is blocked by drapes, blinds, furniture, etc. - restricts air distribution. Clear blockage in front of unit.
- Doors, windows, registers, etc. open - cool air escapes. Close doors, windows, registers, etc.
- Unit recently turned on in hot room. Allow additional time to remove "stored heat" from walls, ceiling, floor and furniture.

Air conditioner turns on and off rapidly.

- Dirty air filter - air restricted. Clean air filter.
- Outside temperature extremely hot. Set FAN speed to a faster setting to bring air through cooling coils more frequently.

Room too cold.

- Set temperature too low. Increase set temperature.

PLEASE NOTE: CHECK THE PLATE FOR THE TYPE OF REFRIGERANT GAS USED IN YOUR APPLIANCE.



WARNING!

Specific information regarding appliances with R290 refrigerant gas.

- Thoroughly read all of the warnings.
- When defrosting and cleaning the appliance, do not use any tools other than those recommended by the manufacturing company.
- The appliance must be placed in an

area without any continuous sources of ignition (for example: open flames, gas or electrical appliances in operation).

- Do not puncture and do not burn.
- Refrigerant gases can be odourless.
- The appliance must be installed, used and stored in an area that is greater than 13 m².
- This appliance contains 235g or 245g (see rating label back of unit) of R290 refrigerant gas.
- R290 is a refrigerant gas that complies with the European directives on the environment. Do not puncture any part of the refrigerant circuit.
- If the appliance is installed, operated or stored in a nonventilated area, the room must be designed to prevent the accumulation of refrigerant leaks resulting in a risk of fire or explosion due to ignition of the refrigerant caused by electric heaters, stoves, or other sources of ignition.
- The appliance must be stored in such a way as to prevent mechanical failure.
- Individuals who operate or work on the refrigerant circuit must have the appropriate certification issued by an accredited organisation that ensures competence in handling refrigerants according to a specific evaluation recognized by associations in the industry.
- Repairs must be performed based on the recommendations from the manufacturing company. Maintenance and repairs that require the assistance of other qualified personnel must be performed under the supervision of an individual specified in the use of flammable refrigerants.

Section 4 Model Specifications

Model	12K A HP	
Chassis type	PA Portable	
Customer Model	EP12A591CHI / FP12A591CHI	
PNC	950014403/ 950014407	
Capacity features		
BTU - Cooling	12000	
BTU - Heating	9200	
Moisture Removal(L/h)	1.6	
EER	2.6	
Electrical Information		
Voltage	220V	
Amps - Cooling	5.8	
Amps - Heating	4.24	
Watts - Cooling	1300	
Watts - Heating	1000	
Receptacle Type	European	
Power Cord Number	/	
Wiring Diagram	/	
Page #	Page 6-1	
Air Flow System		
Capacitor- μ far ads	1.5UF/450V	3.5UF/450V
Fan Motor Mfg	Welling	Welling
Fan Motor Mode	YDK-15-6 YDK-18-6A	YDK45-4
Fan Motor Mfg.	/	/
Fan Motor Model	/	/
Fan Motor Number	/	/
Speed	630/570/490 680/600/520	1130
Refrigeration System		
Compressor Mfg.	GMCC	
Compressor Model	DSM215V2UDZ	
Compressor Number	/	
Compressor Type	ROTARY	
Overload Protector	/	
Capacitor- μ far ads	35uF	
R290(g)	210	
Restrictor Tube	/	
Thermostat Type	Electronic	
Installation Instructions		
Kit Type	Air Discharge Hose	
Part Number & Location	Page 7-1	

Section 5 Sealed System

IMPORTANT

The purpose of this service manual is to give the service technician an understanding of the changes in refrigerants and sealed system service. Persons attempting to use this service manual to make repairs to sealed system refrigeration systems should have electrical training as well as training in sealed system repairs. The person making the repairs must know and understand all laws (Local and International) governing handling of all refrigerants. The technician must be trained in the use of recovery and recycling equipment. Electrolux Home Products, Inc. cannot be responsible, nor assume any liability, for injury or damage of any kind arising from the use of this manual.

NOTE

Electrolux does not permit the use of recovered refrigerant in the servicing of our products for in-warranty and out-of-warranty repairs or for products covered by service contracts. Therefore, only new refrigerant or refrigerant that has been reclaimed back to new specifications by a refrigerant manufacturer is to be used.

Safety Data

R290 PROPANE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PROPANE
OTHER NAME: Liquefied Petroleum Gas (LPG)
USE: Refrigerant Gas

2. HAZARDS IDENTIFICATION

CLASSIFICATION: Flammable Gas, Gas under pressure, Compressed Gas
SIGNAL WORD: DANGER
HAZARD STATEMENT(S): Extremely flammable gas, Contains gas under pressure, may explode if heated
SYMBOL(S): Flames, Gas Cylinder



PRECAUTIONARY STATEMENT(S):

Prevention: Keep away from heat, sparks, open flame, and hot surfaces. No Smoking

Response: Leaking gas fire: Do not extinguish unless leak can be stopped immediately. Eliminate all ignition sources if safe to do so.

Storage: Protect from sunlight, store in a well ventilated place.

EMERGENCY OVERVIEW:

Flammable gas. Liquid under high pressure.

POTENTIAL HEALTH EFFECTS:

Effects of Overexposure:

Eye Contact

No known significant effects or critical hazards.

Skin Contact

No known significant effects or critical hazards.

Inhalation

Acts as simple asphyxiant.

Ingestion

Ingestion is not a normal route of exposure for gases

3. COMPOSITION / INFORMATION ON INGREDIENTS

<u>INGREDIENT NAME</u>	<u>CAS NUMBER</u>	<u>WEIGHT %</u>
Propane	74-98-6	100

COMMON NAMES and SYNONYMS

Liquefied Petroleum Gas (LPG) R-290

There are no impurities or stabilizers that contribute to the classification of the material identified in Section 2

4. FIRST AID MEASURES

SKIN:

In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

EYES:

Immediately flush eyes with plenty of warm water for at least 15 minutes. Get medical attention.

INHALATION:

Immediately remove to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Get medical attention immediately.

INGESTION:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention if symptoms appear.

ADVICE TO PHYSICIAN:

No specific treatment. Contact poison treatment specialist immediately if large amounts have been inhaled or ingested.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES**FLASH POINT:**

AUTO IGNITION TEMPERATURE: 841.70F (449.850C)

UPPER EXPLOSIVE LIMIT (volume % in air): 9.5%

LOWER EXPLOSIVE LIMIT (volume % in air): 2.1%

EXTINGUISHING MEDIA: These products are carbon oxides (CO,CO₂).

UNUSUAL FIRE HAZARDS:

Extremely flammable in presence of open flames, sparks and static discharge of oxidizing materials.

FIRE FIGHTING INSTRUCTIONS:

CO₂, dry chemicals, water spray, or fog. If involved in fire, shut off flow immediately if it can be done without risk. Apply water from a safe distance to cool container and protect surrounding area. Extremely flammable. (SCBA) with a full face piece operated in positive pressure mode. Gas may accumulate in confined areas, travel considerable distance to source of ignition and flash back causing fire or explosion. Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK PROCEDURES:

Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (Section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

7. HANDLING AND STORAGE

NORMAL HANDLING:

Keep container closed. Use only with adequate ventilation. Keep away from heat, sparks and flame. To avoid fire, minimize ignition sources. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Do not and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

puncture or incinerate container. High pressure gas. Use equipment rated for cylinder pressure. Close valve after each use

STORAGE RECOMMENDATIONS:

protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52°C (125°F).

Keep container tightly closed. Keep container in a cool, well-ventilated area. Cylinders should be stored upright, with valve

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

airborne levels below recommended exposure limits. The engineering controls also need to keep gas, vapor or dust concentrations below any explosive limits. Use explosion-proof ventilation equipment Use only with adequate ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to keep

PERSONAL PROTECTION:**SKIN PROTECTION:**

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

EYE PROTECTION:

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

RESPIRATORY PROTECTION:

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

EXPOSURE GUIDELINES

(Exposure Limits) <u>INGREDIENT NAME</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>OTHER LIMIT</u>
Propane	1000 ppm	1000 ppm	

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Colorless, liquefied compressed gas
PHYSICAL STATE:	Gas at ambient temperature
ODOR:	Odorless
SOLUBILITY IN WATER:	0.0244 g/liter
BOILING POINT:	-43.20F (-41.790C)
VAPOR PRESSURE :	109 psig
FLASHPOINT:	-104?C (-155?F)
EVAPORATION RATE:	Not available
FLAMMABILITY:	Extremely flammable in the presence of ignition sources or oxidizing materials
LEL/UEL:	1.8% / 8.4%
PARTITION COEFFICIENT n-OCTANOL/WATER:	Log Pow: 1.09
AUTO IGNITION TEMPERATURE:	287?C / 549?F
DECOMPOSITION TEMPERATURE:	Data not available
VISCOSITY:	Not applicable
VAPOR DENSITY:	1.6 (Air=1)
% VOLATILES BY VOLUME:	100%
DENSITY:	0.116 lb / cu ft
pH:	Not applicable
MELTING/FREEZING POINT:	-302.60F (-185.890C)
SPECIFIC VOLUME (ft³/lb):	8.62069
MOLECULAR FORMULA:	C ₃ H ₈
MOLECULAR WEIGHT:	44.11 g/mole
BOILING/CONDENSATION POINT :	-161?C / 259?F

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY

The product is stable.

REACTIVITY:

Not reactive under normal storage conditions.

INCOMPATIBILITY WITH OTHER MATERIALS:

Extremely reactive or incompatible with oxidizing agents.

CONDITIONS TO AVOID:

Avoid all possible sources of ignition (spark or flame). Do not cut, weld, braze, solder, drill, or grind container

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

IDLH: 2100 ppm

Chronic effects on humans: Causes damage to the following organs: the nervous system.

Acute toxic effects on humans: No specific information is available in our database regarding the other toxic effects of this material for humans.

SPECIFIC EFFECTS:

Carcinogenic effects: No known significant effects or critical hazards.

Mutagenic effects: No known significant effects or critical hazards.

Reproductive toxicity: No known significant effects or critical hazards.

12. ECOLOGICAL INFORMATION

DEGRADABILITY (BOD):

Products of degradation: These products are carbon oxides (CO,CO₂) and water.

Toxicity of the products of biodegradation: The product itself and its products of degradation are not toxic.

Environmental fate: Not available

Environmental hazards: No known significant effects or critical hazards.

Toxicity to the environment: Not available.

13. DISPOSAL CONSIDERATIONS

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, and local regulations.

16. OTHER INFORMATION

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH	=1
FLAMMABILITY	=4
INSTABILITY	=0
SPECIAL	=None

HMIS RATINGS:

HEALTH	=1
FIRE HAZARD	=4
REACTIVITY	=0
PERSONAL PROTECTION	=C

DISCLAIMER

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HC-290 (PROPANE)

PRESSURE - TEMPERATURE CHART

<u>Pressure</u>	<u>Temperature</u>	<u>Pressure</u>	<u>Temperature</u>	<u>Pressure</u>	<u>Temperature</u>
<u>psig ('Hg)</u>	<u>Degrees F</u>	<u>psig</u>	<u>Degrees F</u>	<u>psig</u>	<u>Degrees F</u>
(22)	-92.57	37	15.76	145	87.51
(20)	-85.05	38	16.82	150	89.78
(18)	-78.72	39	17.86	155	92.01
(16)	-73.23	40	18.88	160	94.19
(14)	-68.36	41	19.89	165	96.32
(12)	-63.96	42	20.88	170	98.41
(10)	-59.95	43	21.87	175	100.5
(8)	-56.26	44	22.84	180	102.5
(6)	-52.82	45	23.80	185	104.4
(4)	-49.61	46	24.74	190	106.4
(2)	-46.59	47	25.68	195	108.3
0	-43.74	48	26.60	200	110.2
1	-41.04	49	27.51	205	112.0
2	-38.46	50	28.42	210	113.8
3	-36.01	51	29.31	215	115.6
4	-33.66	52	30.19	220	117.3
5	-31.40	53	31.06	225	119.1
6	-29.23	54	31.92	230	120.8
7	-27.14	55	32.77	235	122.4
8	-25.13	56	33.62	240	124.1
9	-23.18	57	34.45	245	125.7
10	-21.29	58	35.28	250	127.3
11	-19.46	59	36.10	255	128.9
12	-17.69	60	36.91	260	130.4
13	-15.96	61	37.71	265	132.0
14	-14.28	62	38.50	270	133.5
15	-12.65	63	39.29	275	135.0
16	-11.06	64	40.07	280	136.5
17	-9.50	65	40.84	285	137.9
18	-7.99	66	41.60	290	139.4
19	-6.50	67	42.36	295	140.8
20	-5.06	68	43.11	300	142.2
21	-3.64	69	43.86	305	143.6
22	-2.25	70	44.59	310	145.0
23	-0.89	75	48.19	315	146.3
24	0.44	80	51.63	320	147.7
25	1.75	85	54.95	325	149.0
26	3.03	90	58.13	330	150.3
27	4.29	95	61.23	335	151.6
28	5.52	100	64.21	340	152.9
29	6.74	105	67.10	345	154.2
30	7.93	110	69.90	350	155.4
31	9.10	115	72.62	355	156.7
32	10.26	120	75.27	360	157.9
33	11.39	125	77.84	365	159.1
34	12.51	130	80.35	370	160.3
35	13.61	135	82.79	375	161.5
36	14.70	140	85.18	380	162.7

INSTRUCTIONS FOR REPAIRING APPLIANCES CONTAINING R290

1 GENERAL INSTRUCTIONS

1.1 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, the following precautions shall be complied with prior to conducting work on the system.

1.2 Work procedure

Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed.

1.3 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. 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.

1.4 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 flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with flammable refrigerants, i.e. nonsparking, adequately sealed or intrinsically safe.

1.5 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. Have a dry powder or CO₂ fire extinguisher adjacent to the charging area.

1.6 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.

1.7 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.

1.8 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.

1.9 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 there no live electrical components and wiring are exposed while charging, recovering or purging the system;
- that there is continuity of earth bonding.

2 REPAIRS TO SEALED COMPONENTS

2.1 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.

2.2 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 apparatus is mounted securely.

Ensure that seals or sealing materials have not degraded such 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 may inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.

3 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.

4 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.

5 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.

6 LEAK DETECTION METHODS

The following leak detection methods are deemed acceptable for systems containing flammable refrigerants.

Electronic leak detectors shall be used to detect flammable refrigerants, but the sensitivity may not be adequate, or may need recalibration. (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. Oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

7 REMOVAL AND EVACUATION

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, 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. The system shall be "flushed" 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 this task. 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 pipework are to take place. Ensure that the outlet for the vacuum pump is not close to any ignition sources and there is ventilation available.

8 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 OFN. 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.

9 DECOMMISSIONING

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use 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.

10 LABELLING

Equipment shall be labelled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

11 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 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.

Low/High Side Leak or Undercharge

A loss of refrigerant can result in any of the following:

1. Excessive or continuous compressor operation.
2. Air from AC unit is not cold.
3. A partially frosted evaporator (depending on amount of refrigerant loss).
4. Low suction pressure (vacuum).
5. Low wattage.

The condenser will be "warm to cool", depending on the amount of refrigerant lost.

In the case of a low side refrigerant leak resulting in complete loss of refrigerant, the compressor will run but will not refrigerate. Suction pressure will drop below atmospheric pressure and air and moisture will be drawn into the system, saturating the filter drier.

Therefore, you must obtain a sample of the oil and check with an oil test kit to determine the amount of contamination. You will find that the oil in an R-290 system will have to be replaced after most low side leaks.

If there is reason to believe the system has operated for a considerable length of time with no refrigerant and the leak occurred in the low side of the system, excessive amounts of moisture may have entered the system. The system will probably require a system flush and a compressor replacement.

If a slight undercharge of refrigerant is indicated and no leak can be found after a thorough leak test, the charge can be corrected without changing the compressor. If you are "topping off" the charge, it is necessary to charge R-290 refrigerant into the low side of an operating system.

If a high side leak is located and some refrigerant remains in the system it may not be necessary to change the compressor.

Electrolux Home Products Inc. does not approve the use of the Sweep Charge for sealed system repair. This method of servicing sealed systems is often used to repair products in the field. The Sweep Charge does not adequately remove moisture from the oil in the compressor. In a R-290 system you will need to replace the compressor if the product has had a low side leak.

Testing for Refrigerant Leaks

NOTE

The line piercing valve (clamp-on type) should be used for test purposes only. It must be removed from system after it has served its purpose.

If the system is diagnosed as short of refrigerant and the system has not been recently opened, there is probably a leak in the system. Adding refrigerant without first locating and repairing the leak or replacing the component will not permanently correct the difficulty.

The leak must be found!

Sufficient refrigerant may have escaped to make it impossible to leak test effectively. In such cases, add a 1/4" line piercing valve to the compressor process tube. Add sufficient refrigerant vapor to increase the pressure to 75 lbs. per sq. in. Through this procedure, leaks are more easily detected before discharging the system into reprocess/recapture equipment. Check the low side for leaks. Run the compressor 2 or 3 minutes and check the high side for leaks. Recover refrigerant using an EPA approved recovery system.

Checking For Internal Leaks

Before checking for internal leaks, check all accessible system components and joints for leaks.

If an internal leak is suspected, it must be confirmed. Use the following procedure:

1. Discharge the system by using refrigerant recovery equipment. (See Evacuation & Recharging on page 6-16)
2. Pinch off and solder closed one end of the part of the system to be tested.
3. Solder a 1/4" charging hose fitting to the open end of the part of the system to be tested.
4. Connect a pressure gauge and access valve to the open end of the part of the system to be tested. Pressurize to 250 lbs. using dry nitrogen or carbon dioxide.
5. Leave the pressure on for 24 hours. Any drop in pressure is an indication of a leak.

Section 5 Sealed System

WARNING

NEVER PRESSURIZE WITH OXYGEN. NEVER OPEN A HIGH PRESSURE TANK UNLESS IT IS EQUIPPED WITH A PRESSURE REGULATOR. NEVER PUT HIGH PRESSURE ON THE DOME OF THE COMPRESSOR - IT MIGHT EXPLODE. MAKE SURE GAUGE FITTINGS ARE IN GOOD CONDITION AND DO NOT LEAK.

If dry nitrogen or carbon dioxide is not available. Follow instructions 1 through 3, then use 4 and 5 listed below as an alternative method.

4. Connect gauges to charging hose fittings. Pull a vacuum on each side of the system.
5. Leave the vacuum on each side of the system for 24 hours. Any loss of vacuum is an indication of a leak.

Compressor Oil Contamination

Before installing new compressor, check for possible system contamination by obtaining an oil sample from the old compressor. On R-290 systems use an oil test kit to check for contamination. If oil has a burned odor or shows contamination (dark color), the system should be flushed to remove as much of the contamination as possible before installing a new compressor. If this contamination is allowed to remain in the system it will mix with the new oil causing it to become contaminated and damage the new compressor or cause a restriction in the cap tube.

Flushing The System With Nitrogen

It is recommended that system be flushed with dry Nitrogen. However, if refrigerant is used to flush the system you must look at the serial plate to see what type of refrigerant is used in the system. This is the only refrigerant that can be used to flush the system and it must be recovered.

CAUTION

Use extreme care when using Dry Nitrogen to flush systems. Pressure in nitrogen cylinder could be as high as 2500 psi. Nitrogen cylinder must be equipped with approved pressure regulator and pressure relief valve. Ensure that your hoses have adequate ratings for pressure involved and that all of your equipment is in good condition.

When flushing with nitrogen there MUST Be a pressure regulator on the tank with the maximum pressure on the low side of the sealed system (evaporator) at 150 PSI and at the High side, 300 PSI.

The end of the flushing hose on this tank regulator must be equipped with a hand shut-off valve (Robinair No. 40380). Close hand shut-off valve and adjust nitrogen regulator to correct pressure before proceeding with flushing procedure.

1. Remove compressor. Connect process coupling to outlet tube of condenser.
2. Fasten cloth over other end of coil to prevent old oil from spraying over room.
3. Connect hand shut-off valve on flushing hose to process coupling.
4. Slowly open hand shut-off valve and allow nitrogen to flow through condenser until discharge is clear.

CAUTION

DO NOT EXCEED 300 PSIG.

5. Disconnect cap tube from evaporator. Flush evaporator in same manner as condenser.

CAUTION

DO NOT EXCEED 150 PSIG.

6. Flush cap tube. This is only possible if you have a proper service valve adapter.

CAUTION

DO NOT EXCEED 300 PSIG.

7. Reassemble system.

Section 5 Sealed System

High-pressure cutout

A high-pressure cut-out switch with a rating higher than 150 psi will keep the recovery unit from prematurely relieving high pressure when recovering R-290. Some manufacturers offer equipment with an override switch so a higher-pressure switch is used when recovering R-290. The problem with having a dual switch (300 psi or higher) is that an R-290 recovery refrigerant tank (DOT 400) and a standard recovery tank (DOT 350) are virtually indistinguishable unless marked. Using recovery equipment with a high-pressure switch rated at 300 psi with a standard DOT 350 recovery tank can cause the relief valve to blow, creating an extremely dangerous situation.

Maintaining Equipment

Proper maintenance of equipment is critical for safety. Calibrate the gauges on the manifold set before every use and annually check the manifold set for leakage. Inspect the hoses for nicks or cracks and that the gaskets are in good shape. Make sure the valve assemblies are not leaking. Inspect the recovery unit periodically to ensure that it is safe to use. If degradation in the rate of recovery is noticed, check the built-in or external filter.

Definitions

Recovery:

To remove refrigerant in any condition from a system and store it in an external container without necessarily testing or processing it in any way.

Recycling:

To clean refrigerant for reuse by oil separation and single or multiple passes through devices, such as replaceable core filter-driers, which reduce moisture, acidity and particulate matter. This term usually applies to procedures implemented at the field job site or at a local service shop.

Reclaim:

To reprocess refrigerant to new product specifications by means which may include distillation, will require chemical analysis of the refrigerant to determine that appropriate product specifications are met. This term usually implies the use of processes or procedures available only at a reprocessing or manufacturing facility.

Basic Components

The basic components of an air conditioner are a compressor, condenser, evaporator and heat exchanger (capillary tube and suction line). Filter driers are installed when the sealed system is entered and/or the sealed system components are serviced.

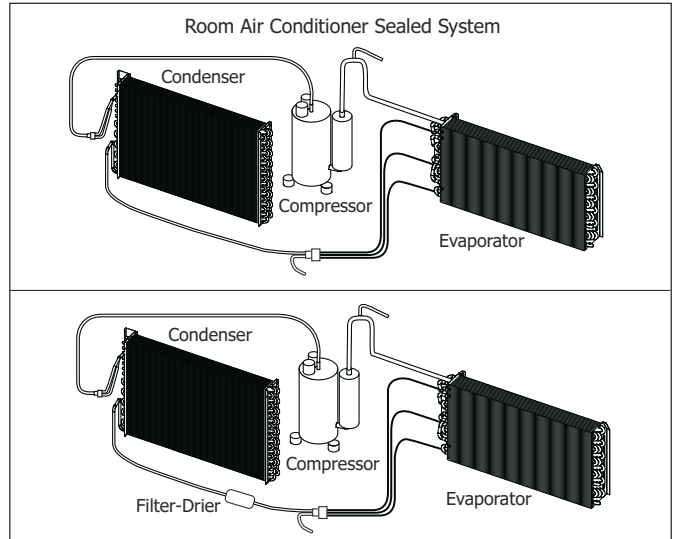


Figure 6-3. Air-Conditioner Sealed System
Lower illustration shows location of added filter-drier after servicing the sealed system.

Refrigerant Cycle

The refrigerant cycle is a continuous cycle that occurs whenever the compressor is in operation. Liquid refrigerant is evaporated in the evaporator by the heat of the room being cooled. The refrigerant vapor is then drawn from the evaporator, through the suction line, to the compressor.

Compression raises the pressure and temperature of the vapor in the compressor and the vapor is then forced through the discharge valve into the discharge line and into the condenser. Air passing over the condenser surface removes heat from the high pressure vapor which then condenses to a liquid. The liquid refrigerant then flows from the condenser to the evaporator through the small diameter liquid line (capillary tube).

Before it enters the evaporator, the liquid refrigerant is sub-cooled in the heat exchanger by the low temperature suction vapor in the suction line. When refrigerant is added, the frost pattern will improve, the suction and discharge pressures will rise, the condenser will become hot and the wattage will increase.

Recovery Methods

Even though refrigerant properties are different, the basic recovery process is the same for R-410A and R-290. R-410A is much more dense than R-290 and has a higher vapor pressure making it more difficult to recover. The hook-up and recovery instructions will vary from manufacturer to manufacturer so be sure to read and understand all of the operation instructions for the refrigerant recovery unit being used.

Push-Pull Recovery

Quickly removes the liquid refrigerant, but you must change the hose connections to recover vapor refrigerant after all of the liquid is removed. This method is not recommended unless trying to recover more than 10 pounds of refrigerant.

Liquid Recovery

Not all recovery equipment is capable of handling direct liquid recovery. Check with the manufacturer of the recovery equipment used to find out if the unit is capable and if there are any special instructions for direct liquid recovery.

Vapor Recovery

This method is slower than liquid recovery, yet is the most common method used to recover refrigerant.

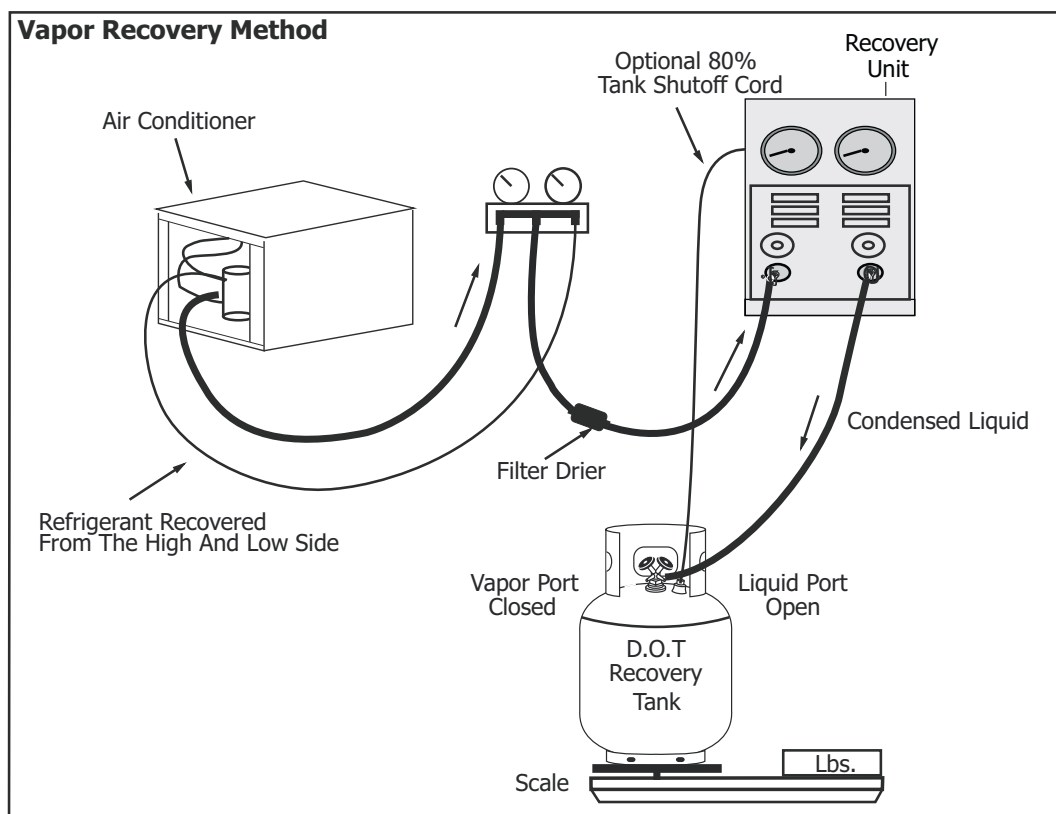


Figure 6-4.

Refrigerant Recovery Systems

Efficient recovery of refrigerant from equipment or containers requires evacuation at the end of the recovery cycle. Suction lines to a recovery compressor should be periodically checked for leaks to prevent compressing air into the recovery refrigerant tank during evacuation. In addition, the recovery refrigerant tank pressure should be monitored, and evacuation stopped in the event of a rapid pressure rise indicating the presence of noncondensable air. The recovery refrigerant tank contents should then be analyzed for NAG, and the recovery system leak checked if air is present. DO NOT continue to evacuate a refrigeration system that has a major leak.

Section 5 Sealed System

Recovering Refrigerant

Recovering refrigerant is the first step in preventive maintenance or repair of equipment. Simply put, recovery means transferring the systems refrigerant into a refillable refrigerant tank.

The first step is to have on hand, clean, safe, refillable refrigerant tank evacuated to 25 microns, and labeled for each different type of refrigerant you will be working with. Example; for repairing Electrolux Home Products Inc. built products you will need one refrigerant tank for R-12, one for R-290, one for R-410A, one for R-134a, and one for R-500 if working on dehumidifiers.

Second step is you must have dedicated equipment for HFC (R-290) refrigerant. Because of the difference in the oil and the refrigerant, you can not use the same equipment on HFC based refrigerants as used on CFC based refrigerants.

Required Recovery Equipment

1. 2 - Line piercing valves.
2. 1 - Recovery unit.
3. 1 - Refrigerant tank labeled and color coded per refrigerant type.
4. 1 - Scale.

▶ IMPORTANT

Your Country may have regulations or restrictions governing the discharging of chlorofluorocarbons (CFC's) such as R-12 and R-22 to the atmosphere. Therefore, when discharging or purging the sealed system, use an approved refrigerant recovery system.

To recover the refrigerant:

1. Disconnect unit from source of power.
2. Attach an approved self tapping line tap valve to the process tube. Connect refrigerant recovery system to tap valve. Turn on recovery system, open the line tap valve, and allow refrigerant to flow into an approved tank. (See Figure 6-5)

⚠ CAUTION

Always make sure your equipment is in good condition and all manufacture instructions are followed to prevent the accidental rupture of a hose, connection fitting, or a tank, that could cause a serious injury. Always sit the tank on a scale when you are transferring refrigerant into the tank. Always check the weight to see when the tank is full, do not over fill the tank.

3. Allow the recovery pump to run until the system has reached 13 inches of vacuum.
4. Shut system down and allow to set for two minutes. If pressure is below (0) pounds per square inch, disconnect equipment and proceed with repair.
5. If pressure does not stay below (0) pounds per square inch, repeat steps 3 and 4 until all refrigerant is removed and system remains in a vacuum.

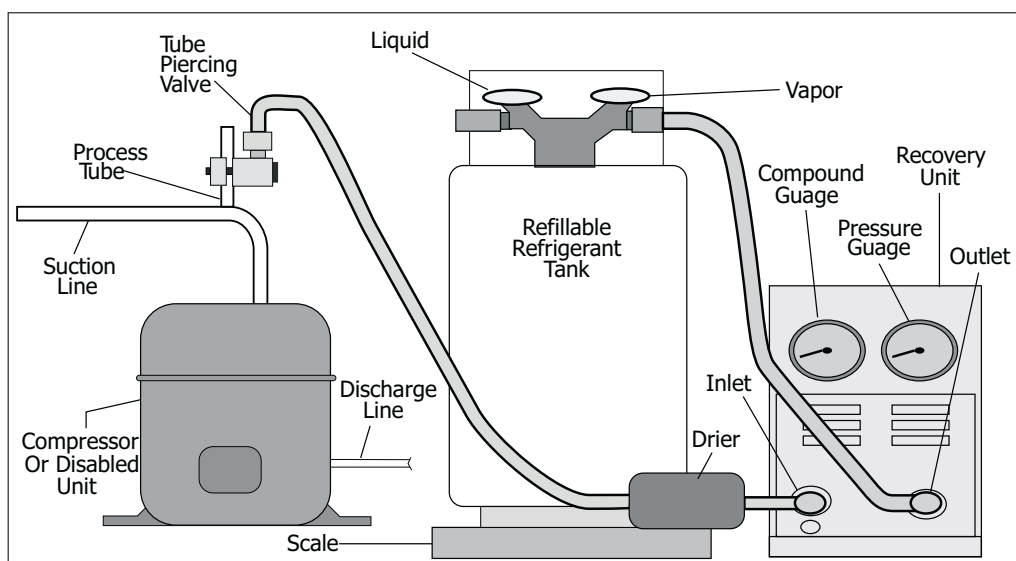


Figure 6-5. Diagram of Recovery Equipment

WARNING

Wear approved safety glasses when working with or on any pressurized system or equipment. Have an approved dry type fire extinguisher handy when using any type of gas operated torch.

NOTE

When calculating the amount of refrigerant to recharge the sealed system, always use the amount listed on the Data Plate plus an additional .78 ounces to allow for the addition of the filter-drier to the sealed system.

Soldering

1. All joints to be soldered must have a proper fit. Clearance between tubes to be soldered should be from .001" to .006". It is not practical to actually measure this; however, you do not want a dry fit or loose fit. Tubing joints should overlap about the distance of their diameter except for restrictor tubes, which should be inserted 1.25".
2. Clean all joint areas with fine steel wool or preferably an abrasive cloth, such as grit cloth No. 23 or Scotch-Brite.
3. Apply a thin film of liquid flux recommended for silver soldering to surfaces to be joined, and to surfaces immediately adjacent to joint.

CAUTION

During application of heat, use wet cloths to prevent heat from conducting to areas other than the soldered joint. Use a sheet of metal or torch guard pad as a heat deflector to keep flame away from inflammable materials and painted surfaces.

4. Align tubing so no stress is on joint. Do not move tubing while solder is solidifying or leaks will result.
5. Use a torch of adequate capacity so joint can be quickly heated with a minimum of heat travel to other points. Use a good grade of silver solder.
6. Solder connections. If tubing is properly cleaned and fluxed, solder will flow readily. Use only enough solder to make a good bond.
7. Allow joint to cool, then wash exterior with water to remove flux.

R-290 refrigerant molecules are smaller than R-22 molecules. This means that R-290 will pass more minor leaks and the rate of flow will be greater than for R-22. Therefore, it is now more important than ever to follow good brazing practices. Use a good grade of silver solder. A 45% silver solder is recommended.

Section 5 Sealed System

Vacuum Pump Maintenance

It is absolutely essential to maintain your vacuum pump according to the manufacturer's instructions, including required oil changes at the recommended intervals. Vacuum pump oil should always be changed after evacuating a contaminated system. Vacuum pump performance should be checked periodically with a micron gauge.

Vacuum pump suppliers may or may not recommend changing the vacuum pump oil to the same type that's in the system being evacuated. Some manufacturers may recommend a vacuum pump that's dedicated to R-290 systems.

Robinair has stated that their current and discontinued vacuum pump models, using mineral oil currently specified for use in their vacuum pumps, can be used to evacuate R-290/alkyl benzene oil systems. Robinair also states that it is acceptable to alternate between evacuating R-12/mineral oil and R-290 alkyl benzene oil systems without adversely affecting the vacuum pump's performance.

For other brands of vacuum pumps, check with the manufacturer for restrictions and guidelines when using with R-290.

⚠ CAUTION

If you use a vacuum pump with mineral oil to evacuate an R-290 system, it is ABSOLUTELY ESSENTIAL to have a shut-off valve between pump and your manifold gauge set. The hand valve must be closed during all times when vacuum pump is not operating. This will prevent migration of mineral oil vapor into R-290/ Polyol Ester oil systems. If the vacuum pump should stop during evacuation for any reason, the hand pump shut-off valve must be closed immediately.

VACUUM CHART		
Vacuum Inches Hg.	Microns	Boiling Point of Water °F
28.940	25000	77.9
29.530	10000	52.0
29.832	4600	32.0
29.882	1000	1.0
29.901	500	-11.2
29.915	150	-32.8
29.917	100	-38.2
29.919	50	-49.0

To achieve the required 29.9 inch (500 micron) vacuum, a properly maintained two-stage vacuum pump in good condition is required. A two stage pump can reach a deeper vacuum than a single stage because the exhaust from the first pumping stage is discharged into the second pumping stage. This means the second stage begins pumping at a lower pressure so a lower ultimate vacuum can be achieved.

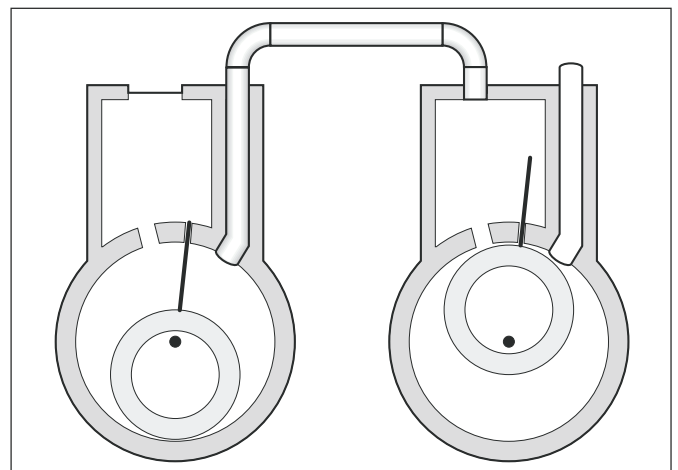


Figure 6-8. Two Stage Vacuum Pump

Portable Models (PA Portable)

