PETRA
Petra Engineering Industries Co.

PETRA
Petra Engineering Industries Co.

COMPUTER ROOM USER'S MANUAL
PASC/PASCc

Split Air Conditioner R22-R407c
50/60 Hz

www.petra-eng.com

PASC USER'S MANUAL March 2011 R.0

INDEX

Dear Customer

Thank you for choosing PETRA's Air Conditioning Split Unit Computer Rooms (PASC) unit.
Please read this manual thoroughly since it contains valuable information on installation, operation and maintenance of the unit. This will ensure a longer life time for the unit

The following symbols will be used in this operational manual to alert you to areas of potential hazard:

NOTE

A NOTE is used to highlight additional data that may be helpful to you.

CAUTION

A CAUTION is used to identify a hazard which could lead to personal or machine injury.

WARNING

A WARNING is used to identify a hazard which could lead to personal death or machine destruction or break down.

IMPORTANT

An IMPORTANT is used to focus on information that must be noted.

This manual covers the installation, operation and maintenance of PETRA's Air Conditioning Split Unit Computer Rooms (PASC) unit.

This will ensure proper operation and a long-life service for the unit.

NOTE

For more information please contact your local service center or refer to PETRA Factory.

NOTE

If you need any further information about PETRA's Air Conditioning Split Unit Computer Rooms (PASC) units or other Units, please do not hesitate to contact us at your nearest sales office.

IMPORTANT

All procedures presented in this manual, such as installation, operation and maintenance must be performed by trained and qualified personnel.

Receiving

On arrival, inspect the unit before signing the delivery note. Specify any damage on the delivery note and send a letter of protest to the last carrier of the goods.

Inspection

Check the shipment received according to the shipping list to make sure that shipment is complete. After inspecting the unit, protect properly during storage or while moving it to the actual installation site. This step is important to maintain warranty to protect unit against adverse weather, theft or vandalism on job-site.

Damage to Units

Be sure to inspect the unit upon receipt for damage. If the unit has been damaged in transit, file a claim with the transportation company immediately and check your insurance company immediately.

SAFETY CONSIDERATIONS

Installation, start up and service of air conditioning equipment can be hazardous due to system pressures, electrical components and equipment location [roofs, elevated structure...,etc.]. Therefore only trained and qualified installation and service technicians should install, start up or service this equipment.

NOTE
This manual covers the installation, operation and maintenance of PETRA's Air Conditioning Split Unit Computer Rooms (PASC) unit.

NOTE
PETRA Air Conditioning Split Unit Computer Rooms (PASC) units are equipped with unsurpassed features microprocessor controller to manage the unit performance for optimum efficiency at both full load and part load values.

NOTE
When working with the equipment, observe precautions in the literature as well as the tags, stickers and labels placed on the units.

NOTE
Keep all doors and screws installed on unit while moving unit and installing ductwork.
This will help ensure that the unit stays square allowing for easier removal of doors after the ductwork is attached.

NOTE
Follow all safety codes.

WARNING
Be sure to disconnect power before servicing this equipment.

WARNING
Before operating, be sure the unit is properly grounded to prevent injury or death from electrical shock.

WARNING
DO NOT VENT refrigerant relief valves within a building.
Relief valves outlet must be vented outdoors.

WARNING
Utmost care has been taken in the design and the manufacture of the units to ensure that they meet safety requirements. However, the individual operating or working on any machinery is primarily responsible for:
personal safety, safety of other personnel, and the machinery.

WARNING
Wear safety glasses and work gloves.

CAUTION
Be careful when handling, rigging and setting bulky equipment.

CAUTION
Keep quenching cloth and extinguishers nearby when brazing.

CAUTION
Do not tip units on their side during transportation or installation, otherwise severe internal damage may occur.

CAUTION
Before driving screws into the cabinet, check the inside of the unit to be sure the screw will not hit electrical or water lines.

CAUTION
The unit must not be operated outside the design limits specified in this manual.

CAUTION
The manufacturer will not be liable for any injury or damage caused by incorrect installation, operation or maintenance resulting from a failure to follow the procedures and instructions detailed in the manuals.

Petra parts only warranty

PETRA Product(s) is warranted to be free from defects in material and workmanship for twelve months after the date of installation or eighteen months after the date of delivery, whichever occurs first, if such defect arises from normal usage of the product in accordance with the instructions of the manufacturer.
In the event that any part becomes or is shown to be defective under normal usage within the warranty period, expect parts that customarily require replacement such as air filters, the manufacturer shall repair or replace such part ,at the sole discretion of the manufacturer.
The manufacturer's obligation under this warranty is limited to:

- Repairing the defective part

Or

- Furnishing a replacement part provided that the defective part is returned to the manufacturer

The warranty will be void if the product has been altered, applied to a different application that those it is designed for ,damaged ,misused ,subjected to abnormal use or service; or if the serial number has been altered, defaced or removed from the product.
The warranty will not cover any failure or improper function of any product due to misapplication or improper installation, inadequate or incorrect wiring, incorrect voltage conditions ;excessive oversize or undersize of product selection ,unauthorized service, or operation at abnormal conditions such as excessive temperatures or inadequate water flow rates.
In addition, the warranty does not include defects resulting from natural disasters, wars, riots, thefts, fires, earthquakes, floods, lightning bolts and sudden electrical surges.

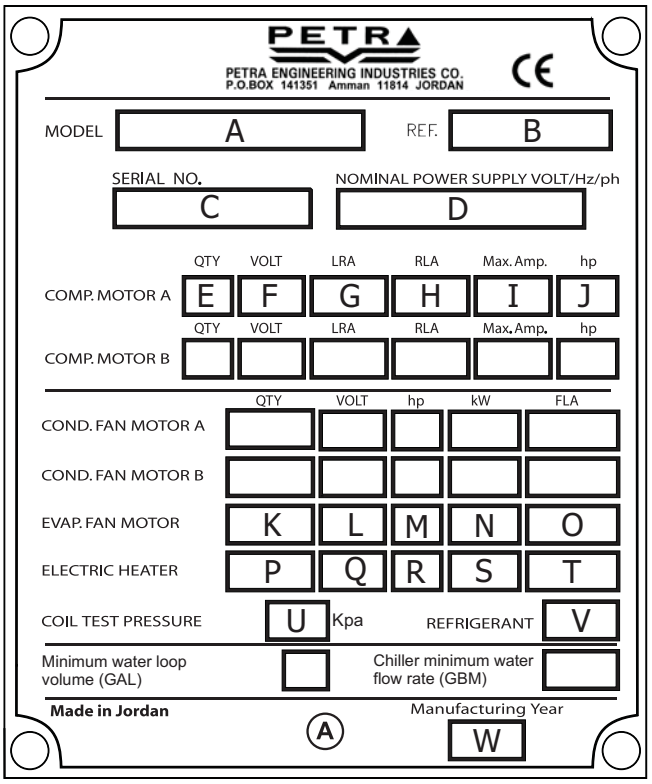
For warranty purposes, the following conditions must be satisfied:

- The initial start of the unit must be carried out by trained personnel from an Authorized Petra Service Center.
- All the scheduled maintenance operations detailed in this manual must be performed at the specified time by suitably trained and qualified personnel.
- Failure to satisfy any of these conditions will automatically void the warranty.

WARNING

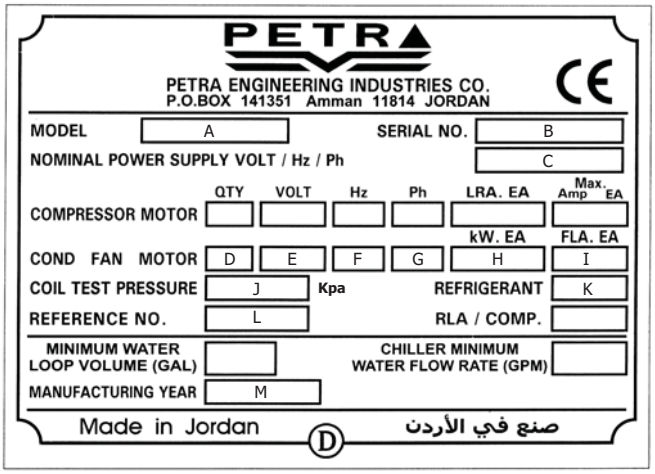
The warranty is void if the equipment is repaired or modified due to misuse, lack of maintenance or failure to comply with PETRA's instructions or recommendations. If the user does not conform to the above mentioned general notes, it may result in the cancellation of the warranty.

Indoor unit



A : The code identification of the machine model.
B : Reference number of the project.
C : The serial number of the machine.
D : The nominal operating power supply voltage over frequency over the number of phases required.
E : The quantity of compressors installed.
F : The voltage required for the compressors with ±10% tolerance.
G : Locked rotor ampere (starting current) for compressor.
H : Rated load ampere for each compressor.
I : The maximum running current.
J : Horse power of motor.
K : The quantity of evaporator motors installed.
L : The voltage required for the evaporator motor with ±10%tolerance.
M : The number of the phases of the evaporator motor.
N : Motor Kilowatt.
O : Full load ampere for each evaporator motor.
P : The quantity / stages of electric heater installed.
Q : The voltage required for the electric heater with ±10%tolerance.
R : The number of the phases of the electric heater.
S : Kilowatt capacity of the heater.
T : Full load ampere for electric heater.
U : Test pressure at 3100 Kpa.
V : The type of refrigerant.
W : Manufacturing date of the machine.

Outdoor unit



A: The code identification of the machine model.
B: The serial number of the machine.
C: The nominal operating power supply voltage over frequency over the number of phases required.
D: Number of condenser fan motor.
E: The voltage required for the condenser motor with ±10% tolerance.
F: The frequency of the condenser motor.
G: The number of phases of the condenser motor.
H: Nominal power consumption of the condenser motor.
I : Full load ampere for condenser motor.
J : Coil test presser at 3100 Kpa.
K: The type of refrigerant.
L : The reference number of the machine.
M: Manufacturing date of the machine.

Indoor Unit

Compressor

The compressor used is the highly efficient, heavy-duty hermetic compressor located in a separate compartment, refrigerant cooled motor with internal thermal overload protection in each phase. The compressor has the following features:

- High performance & efficiency
- Low noise
- Internal Relief Valve
- Crankcase Heater
- Rubber vibration absorber

Evaporator Coil

The evaporator coil is designed to deliver its respective duty with optimum performance at all design conditions. Coils are manufactured from seamless copper tubes mechanically expanded into aluminum fins. All coils are tested at 3110Kpa air pressure under water to avoid leakage. They also undergo dry chemical cleaning after manufacturing for optimum system cleanliness.

Evaporator Fan

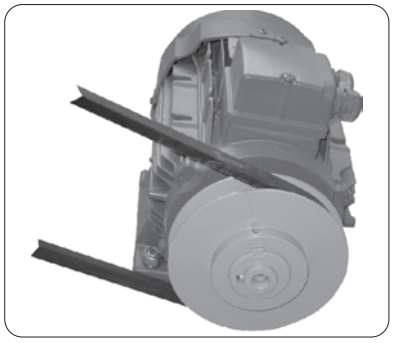
Each module has Double Width Double Inlet (DWDI) forward curved centrifugal belt driven type fan. Fans are statically and dynamically balanced to ensure quiet operation and optimal performance. The fan section features are the following:

- Permanently lubricated ball bearings
- Fan deck for improved airflow
- Draw through airflow for even air distribution
- Grooved type V-Belts
- Adjustable blower speed by means of variable pitch motor pulley

Evaporator Fan Motors

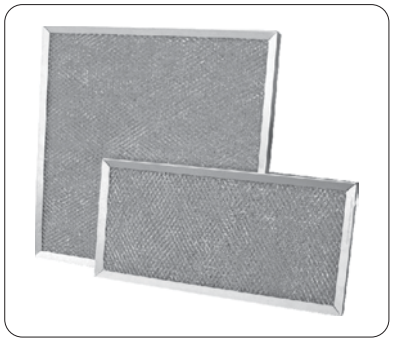
Motors are of the totally enclosed induction type, with fan/motor assembly placed on a floating base with flexible connection at the fan/casing interface. The base itself is mounted on rubber in sheer vibration isolators to eliminate noise and vibration transition to building.
All motors have the following features:

- Induction type, single speed, four poles
- Highly efficient
- Squirrel-cage
- Internal thermal current protection
- Ip55 protection with class "F" insulation



Filters

Each Module has a 50mm thick washable aluminum flat filter.



Drain Pan

Coils are equipped with a corrosion free stainless steel drain pan that is insulated on the sides and underside to prevent condensation.

Outdoor unit

Condenser Coil

The condenser coil is designed to deliver its respective duties with optimum performance at all design conditions. Coils are manufactured from seamless copper tubes mechanically expanded into aluminum fins. All coils are tested at 3110Kpa air pressure under water to avoid leakage. They also undergo dry chemical cleaning after manufacturing for optimum system cleanliness.

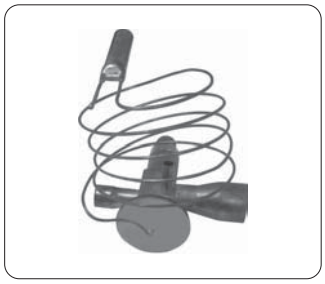
Direct Drive Fan

Fans are of the propeller (Axial) type, which are directly mounted on the motor shaft. Fan blades are made of coated steel for maximum corrosion resistance, and are statically and dynamically balanced before installation. PETRA also provides its "Patented Design" for the condenser fan mounting; this new design offers low noise operation with high efficiency performance. All condenser fans are equipped with wire guards.

Refrigeration components

Thermostatic Expansion Valve

This device controls the superheat of refrigerant vapor at the outlet of the evaporator, it acts as a throttle device between the high pressure and low pressure sides of a refrigeration system and ensures that the rate of refrigerant flow into the evaporator exactly matches the rate of evaporation of liquid refrigerant in the evaporator. Thus, the evaporator is fully utilized and no liquid refrigerant will reach the compressor.



Suction Accumulator

Its purpose is to protected the compressor from damage due to the sudden return of liquid through suction lines. Compressors on many air-conditioning units are often subjected to this sudden return, resulting in broken valves, pistons, connecting rods, crank-shafts, blown gaskets or bearing failure.

The suction accumulator will protect the compressor, even if several pounds of refrigerant may suddenly return through the suction line it will not flood into the compressor.
The liquid refrigerant is temporarily held in the suction accumulator and metered back to the compressor at a controlled rate, through the metering orifice.

Moisture sight glass indicator

The sight glass allows the operator or service personnel to observe the flow of liquid refrigerant. It provides a warning signal in the event that moisture has entered the system, indicating that the filter should be changed or that some action needs to be taken to effectively dry the system. Clear flow of liquid refrigerant indicates sufficient charge in the system.

NOTE

Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading.
With the unit running, the indicating element must be in contact with the liquid refrigerant to give a true reading.

Service Charging Nipple

It is a schroader valve used to enable service personnel to take the pressure for different purposes such as unit checking or charging....etc.

Solenoid valve

This is normally closed with a de-energized coil solenoid valve and is fitted on the liquid line. The solenoid valve is opened when the compressor is ON and closed when the compressor is OFF.

Filter Drier

Moisture will enter a system any time it is operated for Field services. A filter drier is a very effective method for removing small amounts of moisture and contamination. It is installed in the refrigerant liquid line, so that all the refrigerant in the circulation passes through the drier, each time it circulates through the system.

Pressure Switches

High Pressure Switch / (Manual Reset) The switch has fixed, non-adjustable settings, and is mounted in the discharge side of the compressor. The switch is provided to protect the compressor and the refrigeration system from unsafe high pressure conditions. If an unsafe high pressure condition should exist, the switch opens and shuts OFF the compressor

High Pressure Switch

Low Pressure Switch

The unit's control module prevents the unit from restarting. Do not operate the unit on high pressure of more than 2826 Kpa.

- Low Pressure Switch / (Automatic Reset)

This switch, which is mounted on the compressor has fixed, non-adjustable settings.

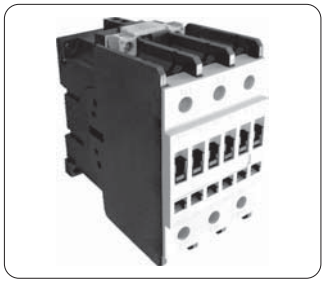
It is of the automatic reset type.

Pressure Switches Limit Table	Cut Out	Cut In
High Pressure Kpa	2826	1896
Low Pressure Kpa	69	138

Electrical components

Contactor

The contactors are mainly used for controlling 3-phase motors.

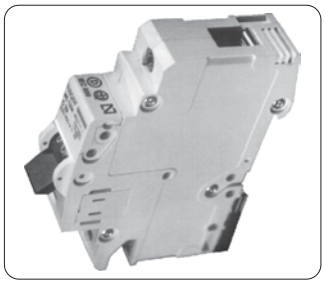


NOTE

The unit should contain all the required contactors to start all motors such as (compressors and condenser fan motor).

Control Circuit Breaker (CCB)

This device is incorporated in the unit as part of the control circuit to protect the control circuit from short circuiting.



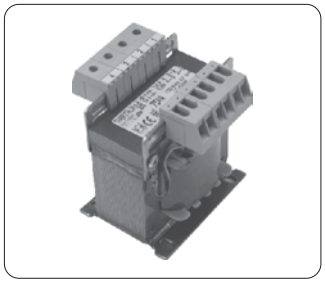
CAUTION

The crankcase heater of each compressor can be energized when this control circuit breaker is switched ON.

It is highly recommended to energize the crankcase heaters of the compressors 24 hours before operating the unit for the first time or if the unit was out of use for a long period of time.

Control Transformer

Transforms the voltage from primary voltage (220 , 240 volt) into secondary voltage (24 volt) for microprocessor supply.



Voltage Monitor /Phase Failure Relay (PFR)

The function of this device is to protect the unit in the following conditions:

- Phase reversal
- Phase loss
- Under voltage
- Phases imbalance
- Over voltage

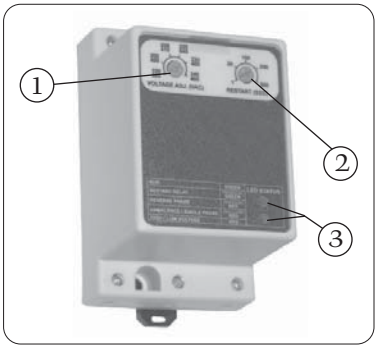
The controller will give an alarm signal if any of the above conditions occur, to indicate the fault condition. The PFR has a small indication LED to indicate its status as follows.
Green light: to indicate the correct power supply and nominal operation
Red light: to indicate fault condition

WARNING

If the unit was tripped on the PFR it should restart automatically after the cause of the trip has been eliminated.

See the picture for the following legend

1. Line voltage adjustment: rotate the "VOLTAGE ADJ. (VAC)" to the nominal three - phase line voltage feeding the motor to be protected
2. Restart delay adjustment: rotate the "RESTART (SEC)" adjustment to the description position
3. LED STATUS: to indicate the operation of the device:
   When turning on the power to the unit ,the LED will alternate between red and green until a start delay period has elapsed. Then the LED will turn solid green to indicate that the device energizes its output contacts and operates normally without any faults.
   In case of fault, the LED will turn solid red to indicate that the device has been tripped and its output contacts do not energize. When the cause/s of the trip has/have been eliminated, the LED will alternate between red and green until an automatic restart delay period has elapsed, and then turn solid green to indicate the normal operating of the device.



NOTE

The under/over voltage tripping occurs at ±10% of the set value a deviation of 10% of the nominal voltage.

Internal Thermal Motor Protector (TMP)

A. All condenser fan motors are protected by internal over current protection. The function of this internal protection is to monitor the temperature rises at "hot spots" inside the motor windings.

If the motor temperature is increased to a dangerous level, the bimetallic strip inside the motor will open and stop the compressor related to this circuit.

B. Compressor internal motor protector (MP)
   The device can be found inside the electric terminal box of each compressor. The function of this device is to monitor the temperature of the motor windings in combination with PTC resistors built into each phase windings. After cool down, a built in lockout prevents the compressor from restarting and eliminates pendulum switching.

Cranckcase Heater

The heater minimizes the absorption of the liquid refrigerant by the oil in the crankcase during brief or extended shutdown periods.

NOTE

The heater is located in the bottom cover of the compressor. The heater must be tight to prevent it from backing out of the heater well. The heater eventually burns out if exposed to air for an extended period.

CAUTION

Never open any switch that de-energizes the crankcase heater unless unit is being serviced or is to be shut down for a prolonged period.
After a prolonged shutdown on a service job, energize the crankcase.

Electric Heater

-Finned tube electrical heating elements with automatic thermal safety cutout and contractors.
Maintain the room dry bulb temperature during the system's dehumidification process.

Air flow switch

This device is used to provide protection in case of airflow failure (when the supply fan has failed or when the supply air meets any resistance in a way that reduces heat exchange with the electric heaters). The controller will prevent the electric heaters from continued operation and will turn the whole unit off.

- Differential pressure switch: This device is incorporated in the unit to provide protection in case of a dirty filter
- Time & date display
- Low ambient control: To permit the unit to operate in low ambient temperatures, head pressure control can be installed by varying the speed of the condenser fan motor using a speed regulator or a variable frequency drive.

Steam Humidifier

The steam humidifier is of the immersed electrode type and is based on the most advanced microprocessor technology. It is complete with cleanable cylinder, fill and drain valves, stainless steel distributor and electronic control.

Refrigeration Options

- Pressure gauges for refrigeration circuit (high/low pressure gauges)
- Ozone friendly refrigerant R-134a for models (PASC 85 - PASC 175)
- Hot gas bypass
- Extra refrigerant accessories such as liquid receiver
- High pressure gauge used to read the high pressure (liquid or discharge), its normal range is (3068 - 4137)Kpa

Electrical Options

- Power circuit breaker for each motor
- Main power circuit breaker for the whole unit
- External overload for each motor
- Disconnect service switch: a unit mounted non-fused disconnect service switch with external handle to isolate the unit from power voltage for servicing
- Earth leakage relay for each compressor
- Earth leakage relay for the whole unit
- Automatic or manual provision for pump down operation
- Building automation system interface. Interfacing with another building management system can be achieved by some additions which can communicate with other devices using the serial communication port
- Graphical display for Temperature and Humidity with Time
- Stand-by function and auto sequencing between units to equalize operating hours
- Smoke detector, to provide protection for the system from the hazards of fire that may occur for any reason. The device has the ability to sense the presence of smoke, and if present, it will a give signal to the controller which will shut down the unit

NOTE

PETRA can provide a full supervisory system for full monitoring of the unit operation. This includes the hardware devices and the software.

Main Function Of Supervisory System

- Modification of the control parameters for each single connected instrument
- Local or remote supervisory system
- Readings for temperature and humidity sensors are incorporated in the unit
- Status of the unit (ON/OFF, alarm, stand by)
- Alarm management of the unit includes:
  a. Display message with detailed alarm description
  b. Print out in real time of detected alarm.
- Daily reports of events.

Construction Options

Specially treated condenser coil: Available where the air cooled condenser is subject to contaminating or corrosive air stream. Special coatings can be applied to reduce corrosion.

- Copper fin /copper tube coils.
- Condensate pump: Provided for field installations.
- Top discharge construction with supply and return grills
- Centrifugal type condenser fans: Recommended for indoor installations; allows for ducted intake and discharge
- Semi hermetic compressors
- Two compressors for a single module
- Water or Glycol cooled condenser
- Synthetic media flat filter
- Chilled water cooling coil

MICROPROCESSOR CONTROLLER

PETRA's microprocessor controller is engineered to meet the most demanding requirements for all control and data monitoring applications.
It could be activated to perform different functions for cooling and heating applications. However, in order to render the microprocessor control and peripherals easy to use by all skill levels of service teams, only necessary functions for safety sequence of operation and alarm function are activated as standard conventional control such as, high pressure, flow switches, etc., thus allowing the service technicians to inspect and maintain such devices in the conventional manner.

PETRA air conditioning controller provides the following:

- Ease of use with a 4row/20column LCD display and an attractive user-friendly interface.
- Remote start-up system command, automatic (cooling/heating) system changes over.
- General alarm dry-contact that can be interfaced with remote alarm device.
- Extended wall mounted display for remote control from up to 150 meters. (Optional)
- Safety and control time delays:
    a. Time delay for the unit in start-up and shut down
    b. Time delay between two subsequent starts of the same compressor
    c. Time delay between activation of 1st and 2nd compressor (multi compressors unit option only)
    d. Time delay between stops of 1st and 2nd compressor (multi compressors unit option only)
    e. Time delay between activation of main fan and the compressor
- Ability to be connected to printer without PC. (Optional)
- Control of activation of electrical heaters. (Reheat Function)
- Low ambient control.
- Compressor selection (activation) depending on operating hours (lead-lag management) to maintain the same operating hours for each compressor.
- Connectivity to the p-LAN network for up to 16 units to provide the unit with much more stages or options. (optional)
- Controlling the unit in de-humidification and humidification modes.
- Managing the stand-by and sequencing functions to equal operating hours. (Optional in case of multi units)
- Permanent parameters saving in the EPROM, to prevent data loss in case of power failure.
- Connectivity to Modbus, Lontalk or BACnet, B.M.S. (Optional)
- Supervisory and maintenance function with hardware and software provided by Petra. (Optional)
- Auto restart after power failure.
- Giving the following alarm messages:
    - Loss of airflow
    - Dirty filters
    - High discharge pressure
    - Low suction pressure
    - High and low room temperatures
    - High and low room humidity
    - Compressor thermal overload
    - Condenser fan motor thermal overload
    - Evaporator fan motor thermal overload
    - Heaters' thermal overload
    - Phase failure (under voltage, over voltage, phase imbalance, phase loss and phase reversal)
    - Fire alarm (Fire system supplied by others)
    - Water under floor
    - Humidifier alarm
    - Smoke detector alarm (Optional)
- The following standard data can be obtained on the screen:
    - Current room temperature
    - Current supply Temperature
    - Current room humidity
    - Temperature set point
    - Humidity set point
    - Cooling status
    - Heating status
    - Humidification status
    - De-humidification status
    - Compressor (ON/OFF)
    - Evaporator fan (ON/OFF)
    - Electric heater (ON/OFF)
    - Steam humidifier (ON/OFF)
    - Date and time display
    - Compressor operating Hours
    - Alarm history: The advanced microprocessor displays the last 1600 alarms with time and date stamp for each alarm

Room preparation

While designing the room, consideration should be given to the following factors:

1.Ease of entry for the system ,floor- loading factors and accessibility of piping and wiring.
2.The room must be sealed with a vapor barrier to minimize moisture, the room should be throughly insulated to minimize thermal loads.

Unit location

- To achieve optimum performance and easy maintenance it is essential to prepare an installation site that meets with the location and space requirements for the model being installed.
- The location of the unit is important for efficient and balanced environmental control in your room.
- The air conditioner should be located as close as possible to the largest heat load.

A computer room using a raised floor plenum for air distribution should have at least 30cm of clear space between the false floor and sub-floor for air conditioners below 15 ton capacities.
Pay special attention to the location of pipe chases, electrical conduits and other under floor obstructions.
Minimum clear space for larger rooms should be 45cm when air conditioners with a capacity of 15 tons or larger are utilized.

IMPORTANT

PETRA is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

NOTE

The unit should be installed directly on flammable materials such as wooden structures or roofs.

Receiving the unit

To ensure that you have received the unit in excellent condition:

1.Perform careful inspection of the unit immediately upon receipt.
2.Verify that all parts ordered were received as specified and that the unit is the correct size with the necessary voltage to fulfill your environmental control needs.

UNIT INSTALLATION

Down flow discharge

The space between the raised floor and subfloor, used as an air distribution plenum or a chase where ducting to discharge grilles.

Up flow discharge

The same unit location considerations for a down flow discharge system also apply to up flow discharge systems. Air distribution is either through a supply duct or through a discharge plenum into the conditioned space.

Connection

Electrical connection

- The PASC unit uses three phase power for operation.
- Power wiring must be provided through modeled case circuit breaker(MCCB) or fused disconnect switch with the recommended rating.
- Each unit is provided with an electric cable inlet to supply the unit with the specified power rating.
- By referring to the name plate ,you can check the maximum operating current, voltage supply and operating frequency.
- The unit should be grounded in accordance with local codes

Condensate drain connection

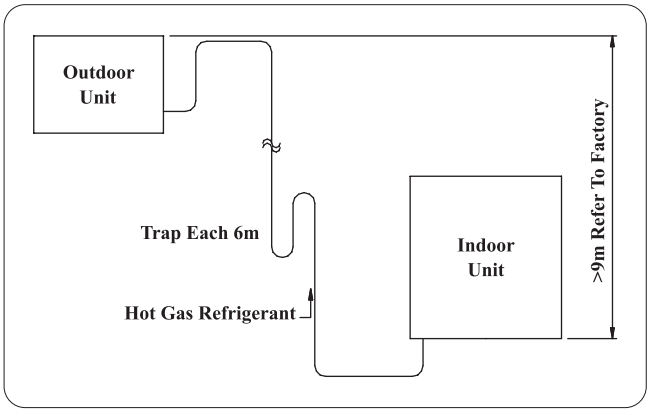
Condensate from the evaporator pan and the discharge from the humidifier system drains through a drain in the side of the unit.

Humidifier connection

The humidifier inlet connection is in the bottom mechanical section.

Piping connection

The hot gas refrigerant piping out from the bottom of the indoor unit. The size of the piping connection (liquid and hot gas) depend on the unit model as in the figure below.



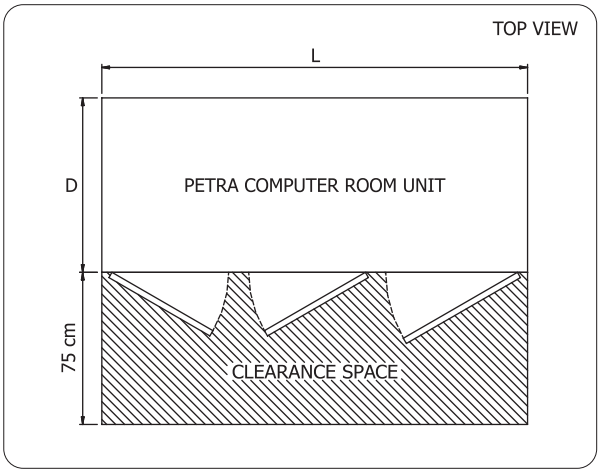
PASC Model	Pipe Size 50Hz		Pipe Size 60Hz	
	Hot Gas	Liquid	Hot Gas	Liquid
PASC 175	11/8"	7/8"	11/8"	7/8"
PASC 145	7/8"	5/8"	7/8"	5/8"
PASC 115	7/8"	5/8"	7/8"	5/8"
PASC 85	7/8"	1/2"	7/8"	1/2"
PASC 55	5/8"	1/2"	7/8"	1/2"
PASC 45	5/8"	1/2"	5/8"	1/2"
PASC 35	1/2"	3/8"	5/8"	1/2"

INSTALLATION

Operating Space

When installing the unit consider the following:

- Foundation should be made of flat-leveled concrete or steel stand
- Free space 75cm in front of the unit's door should be available
- Once the unit is in place, check again that the unit is leveled



OPERATION

Unit check before starting

- Ensure that all piping has been completed.
- Check for refrigerant piping leak.
- Open suction, discharge and liquid line valve for each compressor.
- Ensure that the thermal expansion valve bulb is strapped and well insulated from other than suction temperature effect onto the suction line.
- Make sure that the blower belts are adjusted correctly.
- Before replacing the units panels, make sure that the inside of the unit, especially the blower wheels, is free from debris.
- Make sure that the filters are in place and clean.

Check before operating for the electric side

- Ensure the main cable for the power supply of the unit according to the manufacturer's recommendation (refer to the Electrical Data Tables).
- Make sure that the unit is properly grounded.
- Proper disconnect switch is installed beside the unit for emergency or for maintenance purposes.
- Check all internal electric components and terminal blocks for loose connections, which may have been caused by shipping.
- Check the blower motor overload for correct settings (FLA of motor nameplate) and make sure that the overload has not been tripped.
- All field connection wiring is connected properly to the control terminal such as:
  - General alarm signal
  - Remote switch signal
- Refer to Electrical Field Wiring for more information.

NOTE

Also it is important to refer to the wiring diagram for the exact field wiring connection.

- Make sure that there are no obstacles available that may stop the condenser fan(s).
- Please test by moving the fan(s) by hand. Also check the direction of rotation.
- Inspect visually for any loose wires.

PASC Starting

1. Turn the power disconnect switch to the "ON" position and make sure the voltage is as specified on the unit nameplate.
2. Verify that the rotation of the blower motor is correct otherwise interchange any two of the three main line power.
3. Make sure that all alarms and controls function properly. The alarms that usually appear on the display of the controller are as follows:
   - -Power loss
   - -High or low temperature
   - -High or low humidity
4. Verify from the operation of the unit and the humidifier to do that, put the set point on the controller on the extreme conditions to check the unit and change the humidity set point to check the humidification and dehumidification.
5. The controller operates:
   - -Heating and cooling
   - -Humidification and dehumidification

Before Starting the Unit

- Check the electrical connection for tightness.
- Switch on the main power supply.

Use the following formula to determine the present voltage imbalance.

Example: Present Voltage Imbalance

$$100 \times \frac{\text{Max. Voltage Deviation}}{\text{Average Voltage}}$$

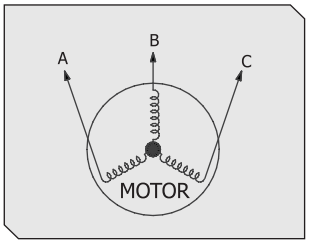
Supply voltage = 380 volt/3ph/50Hz
AB = 383 volt
BC = 376 volt
AC = 378 volt

$$\text{Average Voltage} = \frac{383 + 376 + 378}{3}$$

=379 volt

Determine maximum deviation from average voltage:

AB = 383 - 379 = 4v
BC = 379 - 376 = 3v
AC = 379 - 378 = 1v



Maximum deviation is [4v]. Determine present voltage imbalance:

$$\text{Voltage imbalance} = 100 \times \frac{4}{379} = 1.0\%$$

The amount of phase imbalance is satisfactory, as it is below the maximum allowable phase imbalance value [2%]

NOTE

Contact your local electric utility company immediately, if supply voltage phase unbalance is more than 2%.

NOTE

Check that the voltage monitor [Phase Failure Relay Lamp] is ON, and check that the setting is according to that specified on the nameplate. Switch the control circuit breaker ON to energize compressor crankcase heater. Crankcase heaters are wired in the control circuit, so they are always operable when the control power supply disconnect is ON, even if any safety device is open or the unit switch is in the OFF position.

IMPORTANT

Start unit under supervision of qualified service technician

Start up Check list

Start up Check List (before operating the unit)

Project Name:	Date:
Customer Name:	Project No.:
Model:	Address:
Signature:	

Location of Machine	YES	NO	COMMENTS
Check if there is minimum 2 meters distance between the machine and any restricting surface			
Check if all components of machine easily accessible and serviceable			
Check the Leveling of machine			
Check for any objects restricting incoming/ outgoing air flow at evaporator or condencer			
Check for any leftover cardboard pieces or packing material on evaporator or condencer coil			

Condition of Machine	YES	NO	COMMENTS
Check if any refrigerant line broken			
Check if there are any gas or oil leaks in system			
Check if protection devices in electric panel operate properly			
Check if all mechanical protection devices operate properly			
Check all thermostats and anti-freeze thermostats if they fixed at locations properly			
Check if evaporator and condencer fans are rotate freely			
Check if pulleys are properly fixed in place			
Check if pulley belts loose			

Electrical Connections:	YES	NO	COMMENTS
Check the cable size and compare it with the design			
Check wiring system if there is any loose			

Unit Operation Check list

Running Check List

Model:	Address:
Project No:	

OPERATION CONDITIONS	READING
Unit Operation Mode	
Running Time After Stabilization	
Pressure Drop At Cooler	(Pa)
Evaporator Flow Rate	(CFM)
Condenser Flow Rate	(CFM)
Ambient Temperature	(°C)
Compressor Running Operation	
Frequency	(Hz)
Entering Wet Bulb Temp.	(°C)
Leaving Wet Bulb Temp.	(°C)
Humidity %	

REFRIGERATION TEST	READING
Refrigerant Charge Type	
Refrigerant Charge Weight	(Kg)
Condenser Inlet Temperature	(°C) (Air/Water)
Condenser Outlet Temperature	(°C) (Air/Water)
Evaporator Inlet Temperature	(°C) (Air/Water)
Evaporator Outlet Temperature	(°C) (Air/Water)
Discharge Pressure	(Kpa)
Liquid Line Pressure (At Shut Off Valve)	(Kpa)
Suction Pressure	(Kpa)
Discharge Temperature	(°C)
Liquid Line Temperature (Before Exp. Valve)	(°C)
Suction Temperature	(°C)
Sub Cooling	(°C)
Evaporator Superheat	(°C)

ELECTRICAL TEST	READING
System Voltage At Test ± 10%	R-S: R-T: S-T:
Compressor Running	(A)
Condenser. Fan Motor Running	(A)
Evaporator Blower Motor Running (Supply)	(A)
Evaporator Blower Motor Running (Return)	(A)
Earth Continuity	Ok: Not Ok:
Insulation Test	Ok: Not Ok:

Each PASC unit is designed and constructed for dependable operation with minimal maintenance. To ensure maximum operating efficiency, some suggested procedures with the recommended intervals are listed below

WARNING

Be sure to disconnect power before attempting to check or service the unit to prevent accidental start-up of the unit.

IMPORTANT

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the equipment and minimize the possibility of costly failures.

Regular maintenance

Weekly Maintenance

After the unit has been operating for approximately 30 minutes and the system has stabilized, check the operating conditions & complete the procedures below:

- Check the evaporator refrigerant pressure & the condenser refrigerant pressure.
- Check the liquid line sight glasses. The refrigerant flow past the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line.
- If operating pressure and sight glass conditions seem to indicate refrigerant shortage, measure the system superheat and system sub-cooling.
- If operating conditions indicate a refrigerant overcharge, remove refrigerant at the liquid line service valve. Allow refrigerant to escape slowly, to minimize oil loss. Do not discharge refrigerant into the atmosphere.
- Measure the power supply voltage, compressors and fans running amperes.
- Inspect the entire system for unusual conditions and inspect the condenser coils for dirt & debris.

Monthly maintenance

- Check the belt tension and that the drive belts are good.
- Check the configuration of the microprocessor.
- Check the alarms on the microprocessor.
- Make sure the condensate drain is open.
- Check supply air filter, clean or replace it.

Annual Maintenance

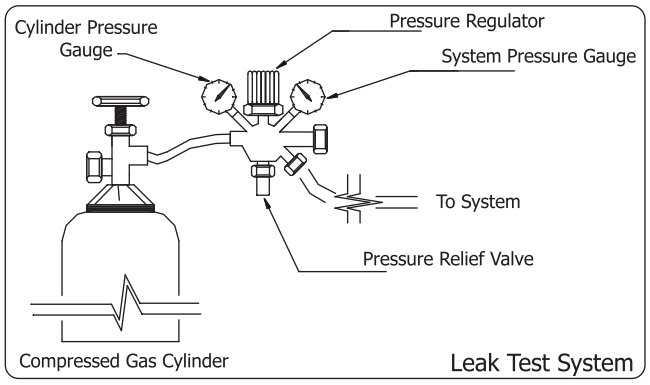
- Have a qualified service technician check the settings & functions of each controller. Inspect the condition of the compressor & control contactors and replace as required.
- Inspect all piping components for leakage and damage.
- Clean & repaint any areas that show signs of corrosion.
- Inspect electrical wiring conditions and tighten any loose connections.
- Clean the condenser coils.
- Clean the condenser fans, check the fan assemblies for proper clearance in the fan openings and for motor shaft misalignment.
- Check the oil level (if available).

Special maintenance

- After each severe windstorm, check the unit's exterior panels for secureness and damage.
- After each major electrical strom, check the unit for blown fuses or tripped overloads.
- Check the unit's insulation periodically to make sure that it is secure.

Leak Test System

All units should be under sufficient pressure to conduct a leak test after installation. If there is no system pressure, admit nitrogen into the system until some pressure is observed and then proceed to test for leaks. After leaks are repaired, the system must be dehydrated.
Use dry nitrogen and refrigerant to raise the system pressure up to 1035Kpa. This procedure requires a separate relief valve with a gauge set and a gas cylinder.
With the compressed gas cylinder in the upright position, admit the dry nitrogen slowly until the desired pressure is obtained. Carefully check the complete system for leaks by means of soap bubbles.
Where bubbles appear, a leak exists.
Check all points that are expected to leak, such as flare connections, flanges, quick coupling, brazing, joints etc.
Leave the system for a certain time and watch the gauge for any drop in reading. When the test is complete, system pressure should be reduced to 0Kpa the compressor is evacuated and charged with the proper kind of refrigerant.



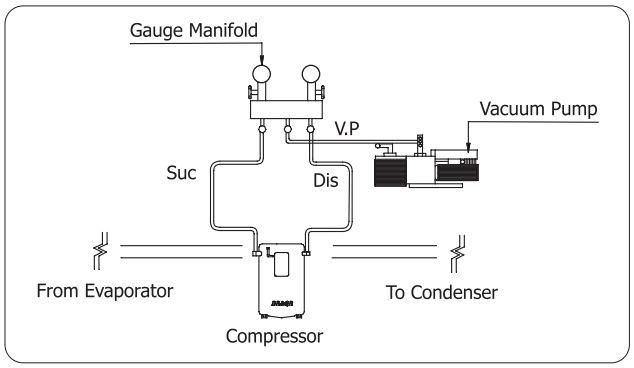
Leak Test System

System Evacuation

System evacuation is considered the most important process to prepare the unit for charging and to remove both air and moisture from the system.

1- Connect gauge manifold to the system.
2- Purge all pressure from the system by opening the system service valve[s] and the gauge manifold hand valves.
3- Connect the center hose on the gauge manifold to the vacuum pump.
4- Start the vacuum pump.
5- Close OFF the gauge manifold hand valve.
6- Stop the vacuum pump but not before closing the gauge manifold hand valves.

7- Disconnect the center hose of the gauge from the vacuum pump and connect it to a cylinder containing the proper type of refrigerant.



8- Open cylinder valves and loosen the center hose at gauge manifold. Purge the hose for a few seconds then tighten the connection.
9- Close the refrigerant cylinder valves and admit refrigerant into the system until a pressure of about 35 Kpas is indicated on the gauges.
10- Disconnect the hose from the cylinder.
11- Open the gauge manifold hand valves and purge the pressure from the system.
12- Repeat steps 3 through 11.
13- Repeat steps 3 through 9 only.
14- Open the gauge manifold hand valves and admit refrigerant into the system cylinder.
Pressure is indicated on the gauges.
15- Close the high side gauge manifold hand valves.
16- Start the unit and add the proper charge of refrigerant.

Refrigerant Charging

The unit is charged with the refrigerant for which it is designed. Efficient operation of an air-conditioning unit depends on the correct charge of refrigerant by weight. In case of an under charged unit, the evaporator is starved of refrigerant, which leads to low compressor suction pressure, loss in output and perhaps overheating of the compressor motor might occur in case of suction gas cooled compressors (high superheat).
Overcharging the unit can lead to condenser overflow and thus too high condenser pressure, to evaporator flooding and possibly to compressor damage due to liquid coming into the compressor.

Sudden pressure in the condenser indicates exceeding the pumping capacity of the unit and filling of the condenser with liquid, increased cooling of suction line as well as an increase in noise of the working valve in the compressor.

Liquid knocking also indicates unit overcharge or incorrect adjustment and/or incorrect function of the control system. Gaseous refrigerant is only charged if small quantities are intended.

Refrigerant cylinders with double or single valves stand upright and refrigerant is charged by means of the pressure gauge connection in the compressor suction service valve. When doing so, check condenser pressures when charging liquid refrigerant and determine charging weight.

NOTE

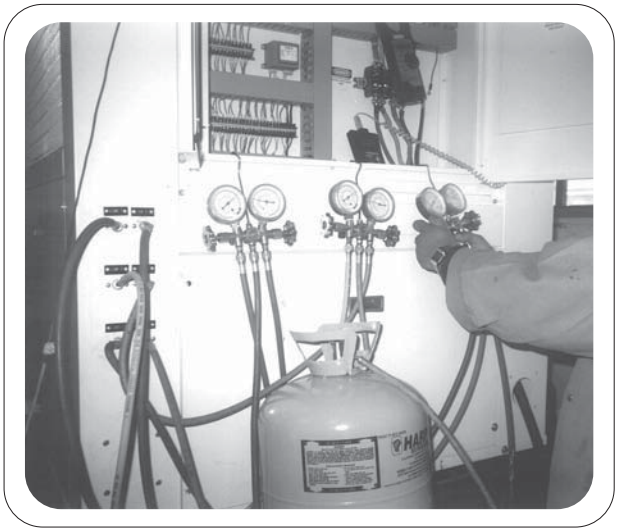
If cylinder pressure drops too low for further charging before the job is finished, place cylinder in a bucket of warm (26.6° - 46° C) water, or use a heat lamp to increase pressure.

WARNING

Do not apply heat with a torch. Never heat cylinder above 49°C.

CAUTION

Never heat cylinders with the flame of the lamp such as a Bunsen or Welding Burner.



Refrigerant charging

To determine the correct refrigerant quantity observe the refrigerant flow in the sight glass in the liquid line. Since an uninterrupted supply of liquid is necessary for the proper functioning of the expansion valves, it may be assumed that the unit has been correctly filled when a clear flow of liquid refrigerant is visible. Bubbles or foam usually indicate insufficient refrigerant.
However, care should be taken that no bubbles are seen in the sight glass, even though, the unit has been fully filled.

Additionally the temperature in the condenser could also lead to sudden evaporation, e.g. by switching the fan ON at the condenser. Thus, the sight glass is a valuable device in determining the correct filling quantity.

After all field connections (electrical and mechanical) have been completed and the system has been evacuated, the system can be fully charged with refrigerant in two ways as shown below.

The main job of a service engineer is to keep the modern, mechanical cooling system running. It is essential to know the proper way to handle refrigerant for all types of systems. All systems do not use the same refrigerant. All systems do not use the same amount of charge even when capacities may be entirely comparable.

All manufacturers include a name-plate that clearly lists the refrigerants for which the system was designed. How much charge to use will vary widely from system to system. This makes it doubly important always to check the catalogs & service bulletins.

Do not charge blends in vapor phase. This means that the refrigerant should be removed from the cylinder as a liquid (either from the dip tube in a two valve cylinder or by inverting the cylinder). The liquid is allowed to evaporate (flush) in the charging lines. Small systems with a single component refrigerant such as 134a are usually charged through the gauge port of the compressor suction service valve.

Normal procedure is:

- Back-seat suction service valve as for normal operation.
- Loosely connect line from service manifold to suction service valve gauge port.
- Connect center line from manifold to the refrigerant cylinder.
- Back-seat discharge service valve.
- Loosely connect the remaining line from the service manifold to discharge service valve gauge port.
- Slightly open cylinder valve to purge vapor up to the compressor discharge service valve.
- Tighten the discharge service valve connection at gauge port.
- Purge vapor from cylinder up to compressor suction service valve.
- Tighten suction service valve connection gauge port. Open both compressor service valves.
- Place cylinder of refrigerant on weighing scale.
- Pressurize system to full cylinder pressure and make final leak check.
- Start compressor. Run unit head pressure and stabilize suction pressure. Open the cylinder valve completely and control the flow of refrigerant from the manifold. From time to time, note suction pressure with the cylinder valve closed.From time to time, note discharge pressure to see that it does not rise above the level normally expected under operating conditions. For an air-cooled system, the discharge pressure should be approximately the pressure corresponding to ambient temperature plus 11°C (refrigeration) to 17°C (air conditioning). When correct weight of refrigerant has been introduced, close cylinder valve and disconnect charging line.
- When satisfied that the system is operating as it should, back-seat both suction and discharge service valve. Bleed pressure from both gauge lines through the manifold charging port.
- Replace cylinder valve cap and fit flare plugs in open ends of charging and gauge lines. Replace plugs in gauge ports of compressor service valve.

NOTE

If possible, refrigerant should always be charged by weight, using a good scale.

Charging the refrigerant in the liquid phase has always been customary for larger systems. It is essential for charging blend refrigerants such as 407c. If a complete charge is to be added to an evacuated system the liquid is frequently charged through the compressor discharge service valve. The compressor is not operated while charging. The procedure for attaching the manifold and purging the lines is similar to that described for vapor charging. On most systems, a charging port is located on the liquid line downstream from the receiver.
In this case, refrigerant can be added while the system is not operating. General suggestions will not always apply to specific operations but the following outline may be helpful.
Connect the refrigerant cylinder to the charging port. Use as short a line as possible to minimize water contamination or use a drier if indicated by conditions. The cylinder should be upside down if it does not have a liquid/ vapor valve. Install a pressure gauge so that the compressor discharge pressure can be observed.
Connect the refrigerant cylinder to the charging port. Use as short a line as possible to minimize water contamination or use a drier if indicated by conditions. The cylinder should be upside down if it does not have a liquid/ vapor valve. Install a pressure gauge so that the compressor discharge pressure can be observed.
With the connection to the charging port loose, crack cylinder valve and purge charging line with refrigerant using the VAPOR hand wheel of a cylinder fitted with a liquid/ vapor valve. Tighten connection, open cylinder valve and check for leaks.
With the connection to the charging port loose, crack cylinder valve and purge charging line with refrigerant using the VAPOR hand wheel of a cylinder fitted with a liquid/ vapor valve. Tighten connection, open cylinder valve and check for leaks.
Close the valve at the receiver outlet or if there is no receiver close the valve in the liquid line upstream from the charging port. This is necessary to prevent the condensing pressure from forcing liquid into the cylinder.

With the compressor running , slowly open the charging port valve and charge liquid using the LIQUID hand wheel at a rate fast enough to keep the compressor from cutting out on low-pressure control if possible. The refrigerant flow can also be controlled by the cylinder valve to avoid ending up with a hose full of liquid refrigerant, The same result can be obtained by closing the cylinder valve first when charging is finished.
Watch the discharge pressure. A rapid rise in pressure indicates, that the condenser is filling with liquid. If this is the case, the system pump-down capacity still seems low on charge, an auxiliary receiver may be needed.

CAUTION
Never charge the liquid in the low pressure side of the system.

CAUTION
Don't overcharge. Overcharging results in higher pressure, possible compressor damage and higher power consumption.

CAUTION
During charging or removal of refrigerant, be sure water/fluid is continually circuiting through the cooler to prevent freezing. Damage caused by freezing is considered abuse and may void PETRA warranty.

System Pump Down

This procedure is used to isolate the refrigerant in the condenser coil. This process can be utilized for maintenance, repairs and long periods of shutdown.
Pump down procedure:
- Install pressure gauge in the unit, if not installed.
- Install a jumper across the terminals of the low pressure cutout.
- Operate the unit.
- Start closing the shut off valve while the unit is operating.
- When low pressure gauge reaches about 5 Psig, shut down the unit.
- Immediately close the compressor suction valve.
- Repeat the above once again.
- Remove the jumper from the low pressure cutout.

Compressor Oil

All units are factory charged with oil. The approved oils to be added as needed are: 3GS or equivalent.

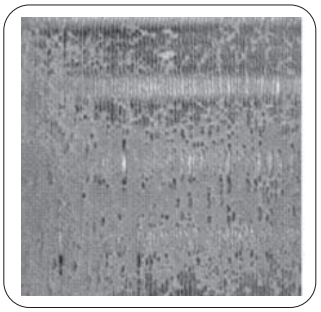
CAUTION
Do not re-use drain oil and do not use any oil that has been exposed to the atmosphere.

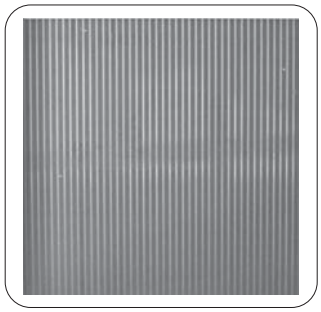
Changing Filter Drier

The main function of the filter dryer is to eliminate any humidity or deposits inside the system. When the filter is blocked, a certain pressure drop across the filter occurs and a temperature difference between the liquid in/out and the filter can be sensed. In this case the filter has to be changed.
The process is as follows:
- System pump down procedure has to be carried out.
- Loosen the flare connection or solder of filter drier.
- Take out the old filter.
- Install the new filter drier.
- Evacuate the low pressure side (do not forget to open solenoid valve).
- Open all valves, and the unit is ready to start.

Coil Cleaning

Periodic verification of coil cleanliness is required. Dirty coils increase drops in air side pressure and reduce heat transfer potential, Every six months examine finned surface for accumulation of dirt or lint. If necessary wash down the affected areas with a mild detergent solution and a soft brush. Care should be taken not to disturb the fin's surfaces.


Before Cleaning


After Cleaning

CAUTION
Do not probe the coils with a metal scrapper as damage may cause tube leaks.
For coil combing:
-Choose proper fin width comb.
-Be careful not to damage tubes and fins.

Final Check

Before leaving the unit, check all controls and protective devices function properly.

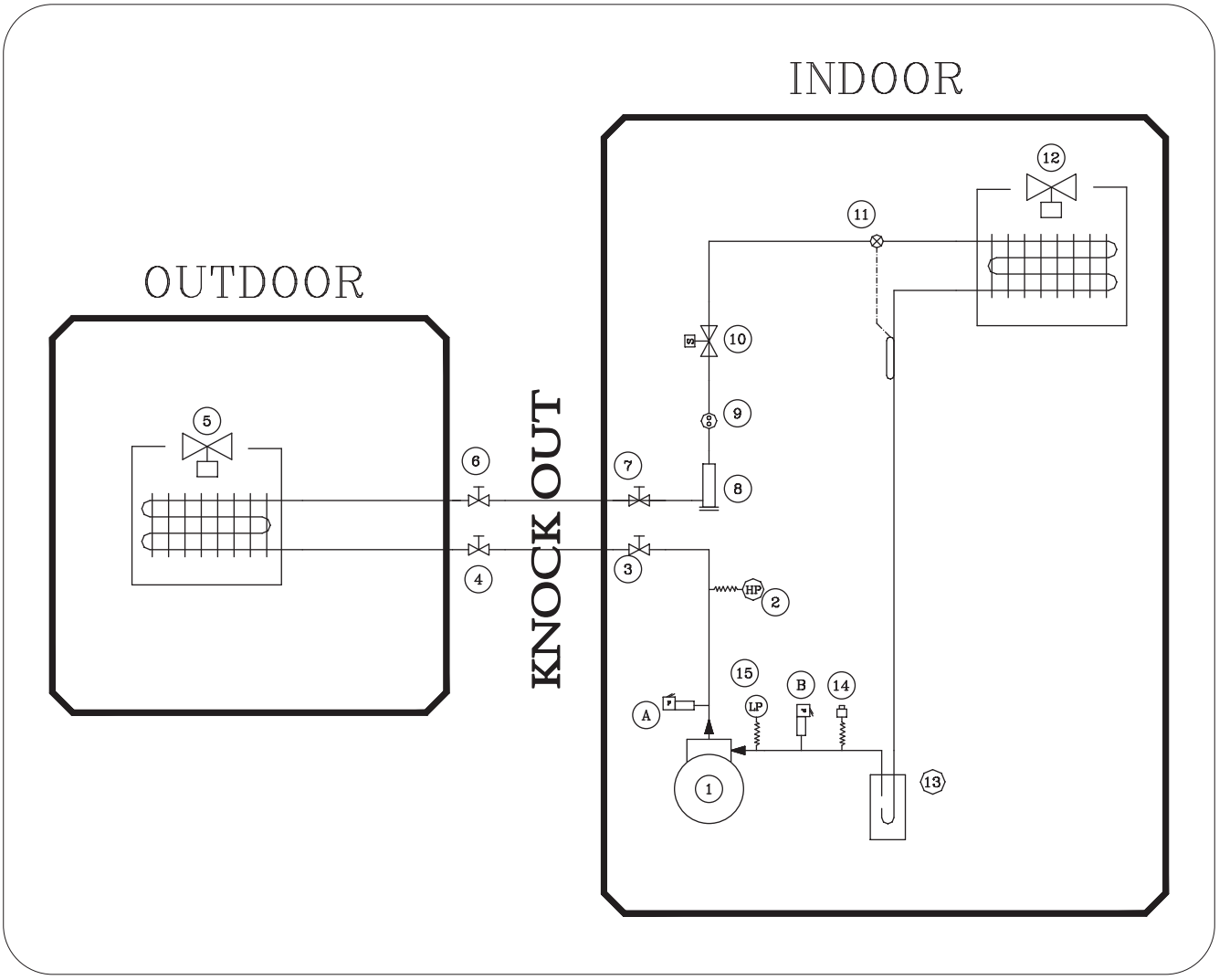
Use the tables in this section to assist and help you in identifying the cause or causes of any malfunctions in the unit's operation. The column headed RECOMMENDED ACTION will suggest repair procedures.

CAUTION

Disconnect electrical power inspection before servicing the unit and allow all rotating equipment to stop completely. Failure to do so may result in personal injury or death from electrical shock or any moving parts.

Source of Trouble	Possible Causes	Corrective Steps
1. Compressors fail to start	a. Main switch is off b. Defective contactor c. System shut down by safety devices d. Thermostat set too high e. Liquid line solenoid will not open f. Motor electrical trouble g. Loose wiring	a. Switch on b. Repair or replace c. Determine type and cause of shutdown and correct it before resetting safety switch d. Check evaporator temperature. Lower thermostat setting, if possible without freeze-up e. Repair or replace f. Check motor for opens, short circuits or burn-out g. Check all wire junctions. Tighten all terminal screws
2. Compressor is noisy or vibrating	a. Improper isolation b. Improper piping support c. Improper clearances d. Flooding of refrigerant into crankcase e. Motor rotor is loose (SRC)	a. Check isolator operation b. Relocate, add, or remove hangers. c. Running gear is worn. Overhaul compressor and replace defective parts d. Check rating and setting of expansion valve e. Check key fit and tightness of rotor locking bolt
3. High discharge pressure	a. System overcharged with refrigerant b. Excessive loading c. Non condensibles in system	a. Remove excess b. Reduce load c. Purge the non-condensibles
4. Low discharge pressure	a. Insufficient refrigerant in system b. Low suction pressure c. Worn piston rings. Worn discharge service	a. Check for leaks. Repair and add charge b. See point 6. c. Overhaul compressor
5. High suction pressure	a. Excessive load b. Expansion valve over feeding	a. Reduce load or add equipment b. Check remote bulb. Regulate superheat. Check valve rating against the application

Source of Trouble	Possible Causes	Corrective Steps
6.low suction pressure	a. lake of refrigerant b. Evaporator dirty or iced up c.expansion valve malfunctioning	a. check for leaks. Repair and add charge b. clean or defrost c. Check and reset for proper superheat. Repair or replace if necessary.
7.compressor losses oil	a. shortage of refrigerant b. Low suction pressure c. expansion valve stuck open d. Restriction in refrigeration system	a.Repair leak and recharge system With refrigerant and oil. b. see entry "low suction pressure" c. repair or replace expansion valve d. Locate restriction and remove
8.Blower does not run	a. Power failure b. Defective contractor c. Controller alarm d. Overload tripped	a. Check power source and input cable b. Repair or replace c. Clear alarm(s) d. Reset and check cause
9. Evaporator coil ices	a. Low refrigerant b. Clogged air filter c. Evaporator blower motor d. Thermostat	a. Check the system for correct operation or leakage b. Clean the filter or replace it if found too dirty c. Check the rotation of the blower and the overheated motor. replace motor if necessary d. Check settings, calibration and wiring. Replace if necessary
10.Short capacity system	a. Gas in liquid refrigerant line (bubbly sight glass) b. Expansion valve is stuck (short cycle or continuous running) c. Clogged drier-strainer d. Ice or dirt on evaporator coil	a. Repair leak and recharge b. Replace valve c. Replace with new drier-strainer d. Defrost or clean the coil
11.Humidifier does not operate.	a. Electrical connections are loose. b. Water not hooked up c. The set point is less than the relative humidity.	a. Tighten electrical connections b. Turn on water c. No corrective action is needed
12.Controller fails to start	a. No power to controller	a. Check the input cable and the control fuse
13.Reheat element inoperative	a. Overheat switch actuated b. Thermostat set too low c. Thermal line in heater is opened.	a. Reset and check b. Adjust to required temperature c. Replace line



#	ITEM	STATUS
15	Low Pressure Gauge.	OPTION
14	Charging Nipple.	STD
13	Suction Accumalator.	STD
12	Evaporator Coil.	STD
11	Expansion Valve.	STD
10	Solenoid Valve.	STD
9	Sight Glass.	STD
8	Filter Drier.	STD
7	Shut Off Valve.	STD
6	Shut Off Valve.	OPTION
5	Condenser Coil.	STD
4	Shut Off Valve.	OPTION
3	Shut Off Valve.	OPTION
2	High Pressure Gauge.	OPTION
1	Hermetic Compressor.	STD

#	CONTROLLER	STATUS
B	Low Pressure Switch.	STD
A	High Pressure Switch.	STD