B&A AIR CONDITIONING TECHNOLOGY COMPANY LIMITED

SINGLE PACKAGE ROOFTOP GAS HEATPUMP / COOLING UNIT USER MANUAL RANGE FROM 5 TO 10 NOMINAL TONS

Contents

I. SAFETY CONSIDERATIONS

- Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment. Untrained personnel can perform the basic maintenance functions of replacing filters. Trained service personnel should perform all other operations.

- When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguishers available for all brazing operations.

- This unit is for **OUTDOOR USE** and not **NOT ACCESSIBLE TO THE GENERAL PUBLIC**

- Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

- Recognize safety information. This is the safety ALERT symbol 

- When you see this symbol on the unit and in instructions or manuals, be aware of the potential for physical injury hazards.

- Understand the signal words **DANGER**, **WARNING**, and **CAUTION**. These words are used with the safety ALERT symbol. DANGER indicates a hazardous situation which, if not avoided, will result in death or severe personal injury. **WARNING** indicates a hazardous situation which, if not avoided, could result in death or personal injury. **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor to moderate injury or product and property damage. ***IMPORTANT*** is used to address practices not related to physical injury. **NOTE** is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in serious personal injury, death, and/or property damage.

Disconnect gas piping from unit when leak testing at pressure greater than 0.5 psig (3450 Pa). Pressures greater than 0.5 psig (3450 Pa) will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig (3450Pa), it must be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig (3450Pa) or less, a unit connected to such piping must be isolated by closing the manual gas valve(s).

- This unit contains **R454B refrigerent**. Maintenainces or services must be following **Safety Group A2L**

CAUTION

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use non-certified refrigerants in this product. Non-certified refrigerants could contain contaminates that could lead to unsafe operating conditions. Use ONLY refrigerants that conform to AHRI Standard 700.

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in reduced unit performance or unit shutdown.

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop.

II. UNIT ARRANGEMENT AND ACCESS GENERAL

Fig. 1a — Typical Access Panel Locations For 5 ton unit

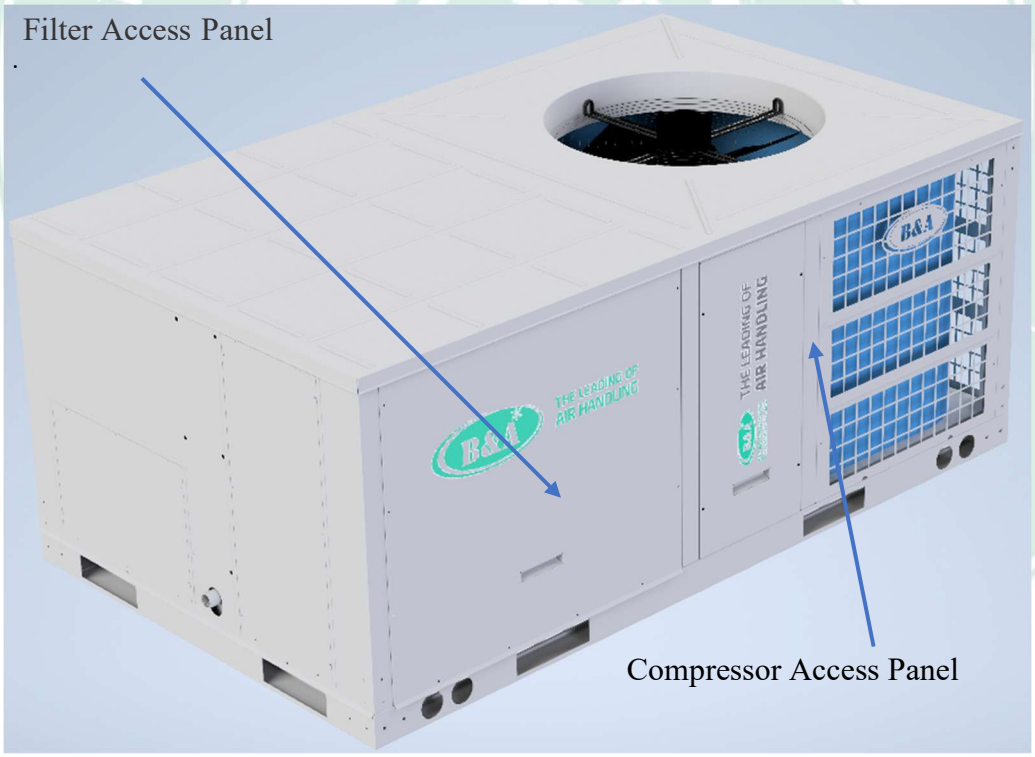


Fig. 1b — Typical Access Panel Locations For 7.5 ton and 10 ton units

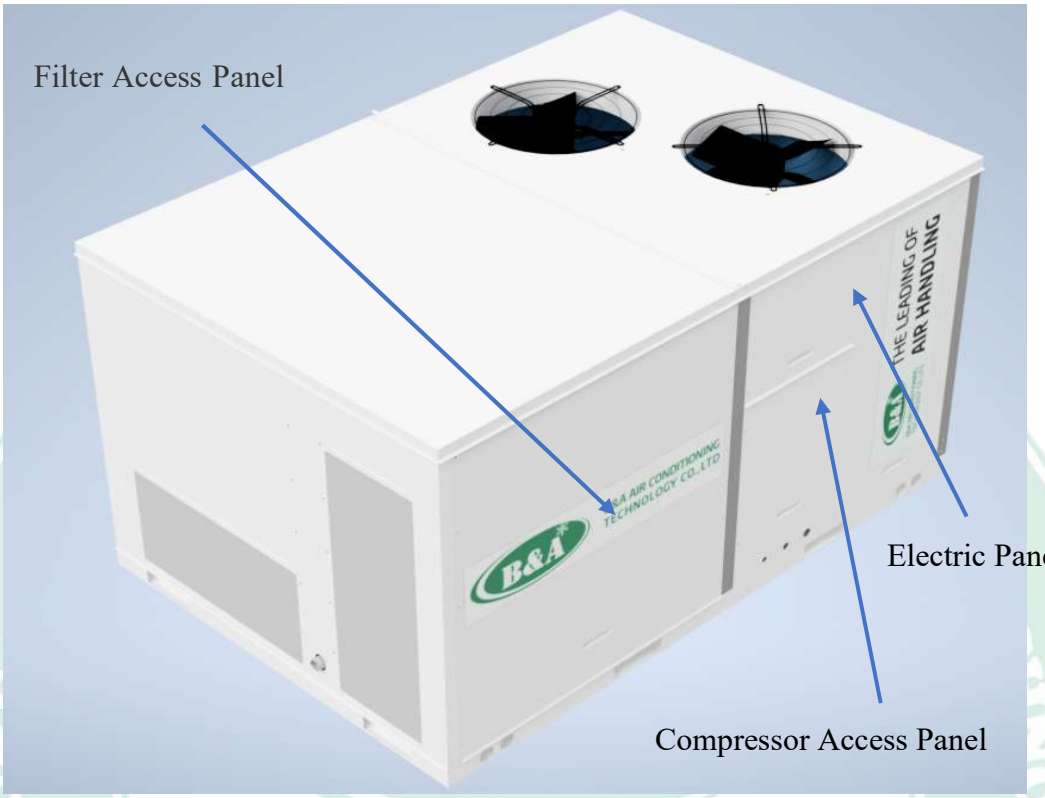
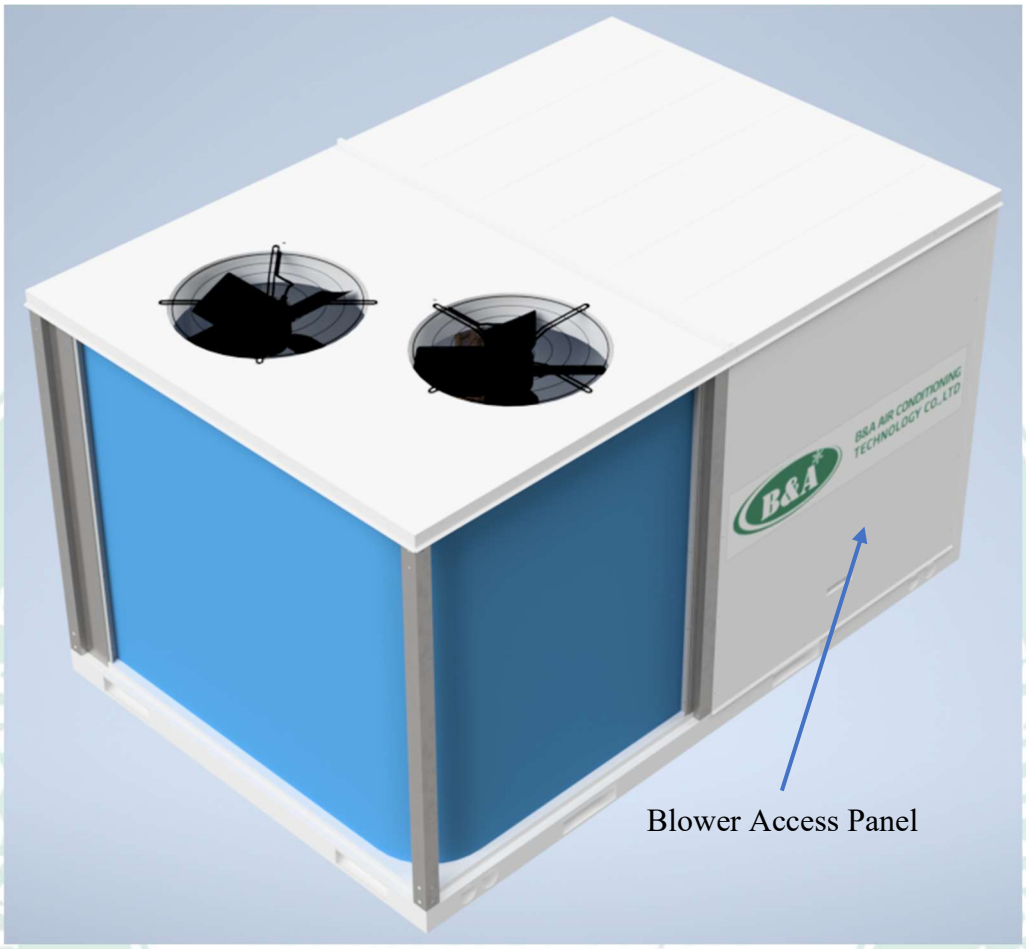


Fig. 2a — Blower Access Panel Location for 5 ton unit

Fig. 2b — Blower Access Panel Location for 7.5 ton and 10 ton units



Routine Maintenance

These items should be part of a routine maintenance program, to be checked every month or two, until a specific schedule for each can be identified for this installation:

QUARTERLY INSPECTION (AND 30 DAYS AFTER INITIAL START)

- Return air filter replacement
- Outdoor hood inlet filters cleaned
- Condenser coil cleanliness checked
- Condensate drain checked

SEASONAL MAINTENANCE

These items should be checked at the beginning of each season (or more often if local conditions and usage patterns dictate):

Air Conditioning

- Ensure outdoor fan motor mounting bolts are tight
- Ensure compressor mounting bolts are tight
- Inspect outdoor fan blade positioning
- Ensure control box is clean
- Check control box wiring condition
- Ensure wire terminals are tight
- Check refrigerant charge level

Heating

- Heat exchanger flue passageways cleanliness
- Gas burner condition
- Gas manifold pressure
- Heating temperature rise

Economizer or Outside Air Damper

- Check inlet filters condition
- Check damper travel (economizer)
- Check gear and dampers for debris and dirt

Air Filters and Screens

Each unit is equipped with return air filters. Each of these filters and screens will need to be periodically replaced or cleaned.

Filters

RETURN AIR FILTERS

CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this CAUTION can result in premature wear and damage to equipment.

DO NOT OPERATE THE UNIT WITHOUT THE RETURN AIR FILTERS IN PLACE.

Dirt and debris can collect on heat exchangers and coils possibly resulting in a small fire. Dirt buildup on components can cause excessive current used resulting in motor failure.

IMPORTANT

REPLACEMENT FILTERS SHOULD BE U.L.C CERTIFIED OR EQUIVALENT AND THE SAME DIMENSIONAL SIZES AS SUPPLIED WITH THE EQUIPMENT.

This unit should be replaced with filters compliance to UL 900 Certified for Air Filter Unit or equivalent standard & the same dimensional sizes as equipment specs on the Appendix B.

Return air filters are disposable fiberglass media type. Access to the filters is through the small lift-out panel located on the rear side of the unit, above the evaporator/return air access panel. (See Fig. 3.)

To remove the filters:

1. Grasp the bottom flange of the upper panel.
2. Lift up and swing the bottom out until the panel disengages and pulls out.
3. Reach inside and extract the filters from the filter rack.
4. Replace these filters as required with similar replacement filters of same size.

To re-install the access panel:

1. Slide the top of the panel up under the unit top panel.
2. Slide the bottom into the side channels.
3. Push the bottom flange down until it contacts the top of the lower panel

OUTSIDE AIR HOOD

Outside air hood inlet screens are permanent aluminum-mesh type filters. Check these for cleanliness. Remove the screens when cleaning is required. Clean by washing with hot low-pressure water and soft detergent and replace all screens before re-starting the unit. Observe the flow direction arrows on the side of each filter frame.

INLET AIR SCREEN

This air screen is retained by filter clips under the top edge of the hood. (See Fig. 3.)

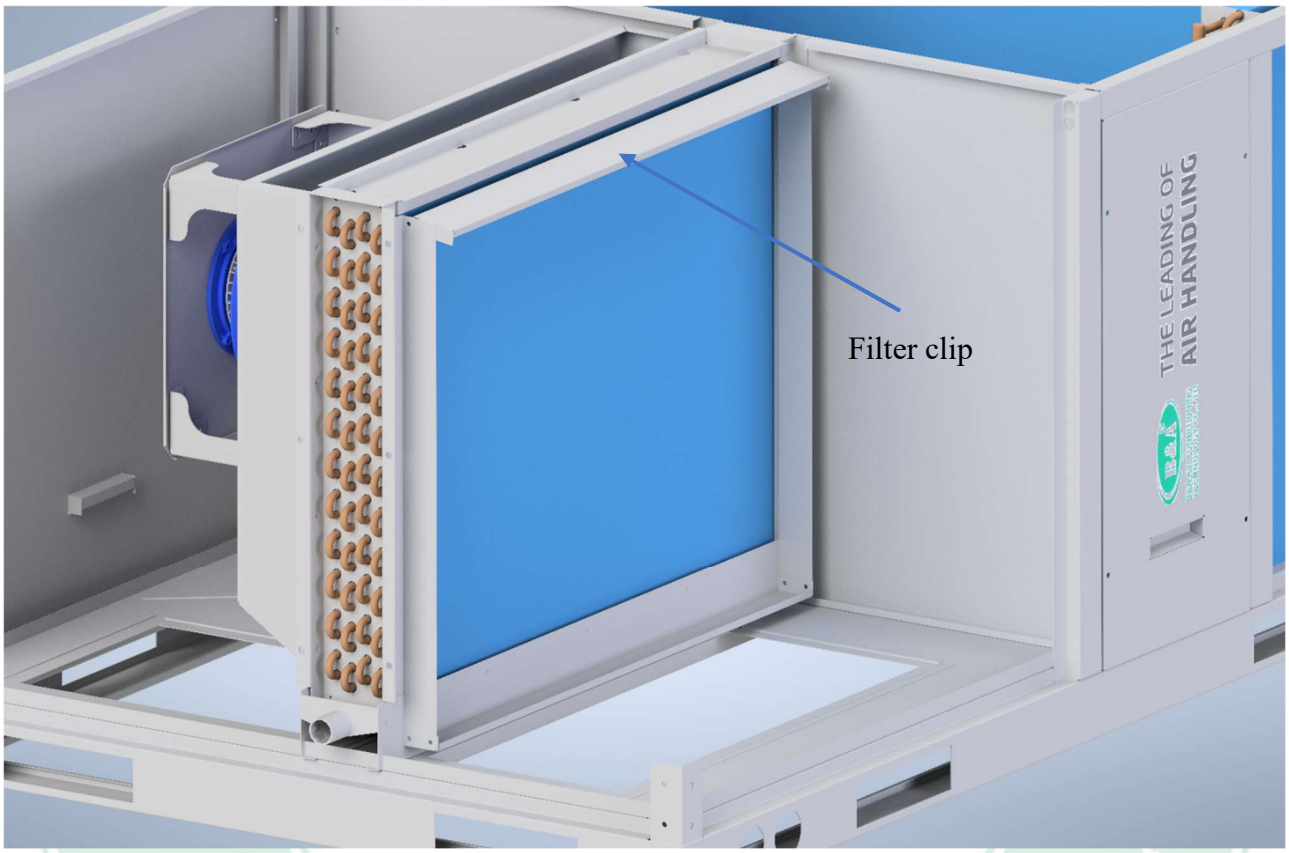


Fig. 3 — Filter Installation

To remove the filter, open the filter clip. Re-install the filter by placing the frame in its track, then closing the filter clip.

III. SUPPLY FAN (BLOWER) SECTION

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before performing service or maintenance operations on unit, LOCKOUT/TAGOUT the main power switch to unit. Electrical shock and rotating equipment could cause severe injury.

All low voltage wiring should be routed through the provided raceway built into the corner post of the unit or secured to the unit control box with the electrical conduit in order to provide UL-required clearance between high and low-voltage wiring.

Supply Fan (Direct-Drive)

All FC units have the EcoBlue™ direct drive vane axial fan system. The fan is driven by an EC motor with speed that is user set through the Control Board (CB). Speeds are fully configurable from 40% to 100% of motor's maximum speed. See Fig. 5

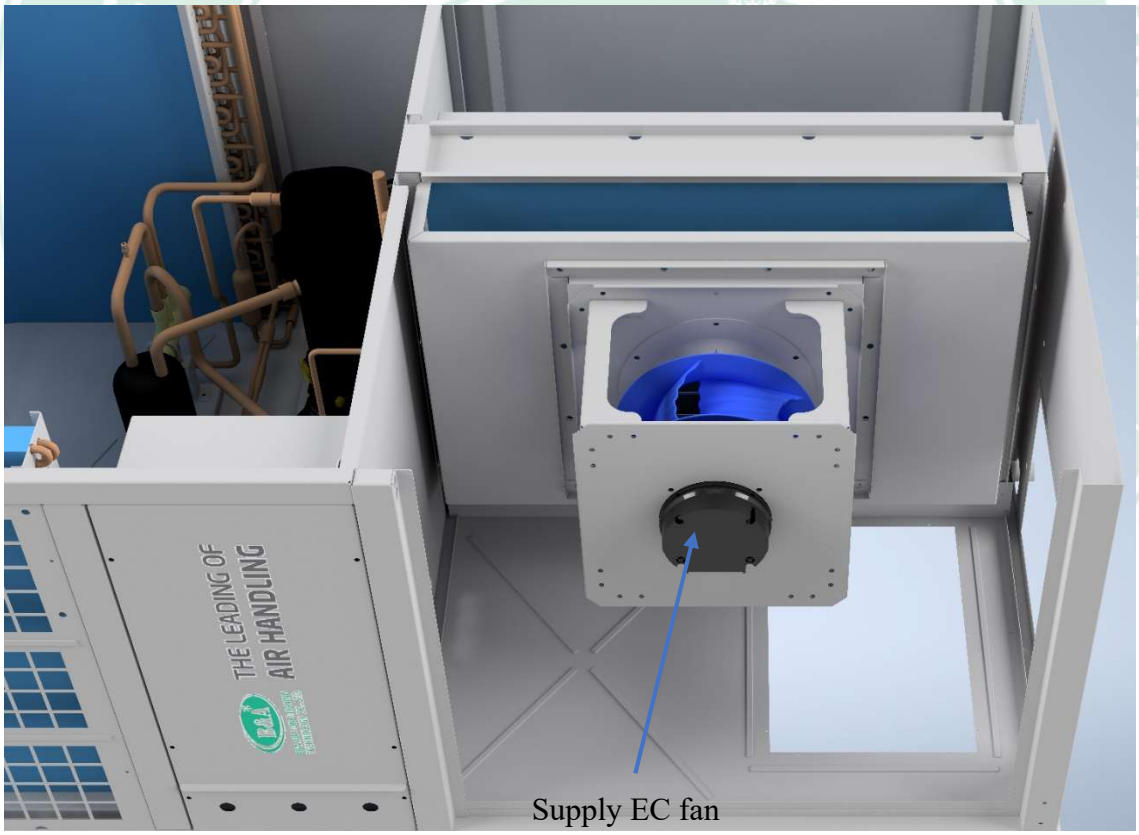
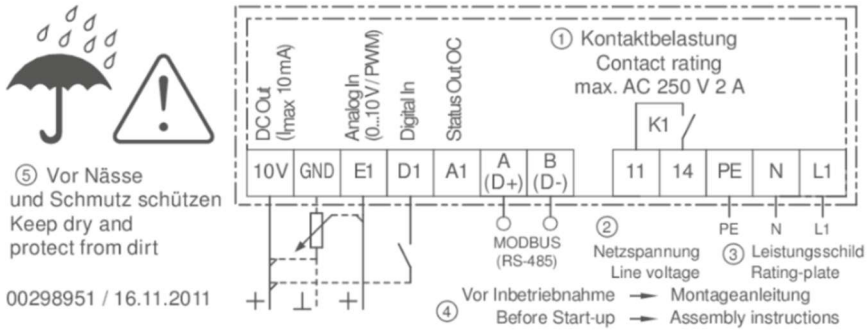


Fig. 5 — Direct-Drive Supply Fan Assembly

Fig. 6 — EC Motor Connection
L1-N: 1 phase, 200~277V, 50/60Hz, 780W, 2.9~4A, 3750 /min, 131'F



EVALUATING MOTOR SPEED

The direct drive EC blower motor uses a constant speed design. Motor speed is controlled by a 0-10 vdc signal, where 10 vdc is equal to motor's maximum rpm.

SELECTING FAN SPEED

All units come factory set for 10 VDC or approximately 100% of the motor's maximum speed. Fan speed should be set per job specification cfm (cubic feet per minute) and ESP (external static pressure) required and per Fan speed set up label included on the unit's high voltage cover. In some cases, the Fan Speed Set Up label may already include the field setting if unit was previously installed. Check the box on the lower half of the label to see if the field voltage setting was filled in and if so, set fan speed to that voltage. Otherwise see detailed instructions below.

START UP DELAY TIME

Turn this knob to change start up time when power on the machine from 0 to 200 seconds. After this delay time, the compressor will run following the thermostat signals

HEATER POWER KNOB

This knob is only valid with the option of resistor heater module. Turn this knob to change power of heaters from 0% to 100% by PWM (pulse width modulation)

NOTE: Fan Speed Set-Up is for full load airflow. If the unit has multiple stages of cooling, low cool and ventilation may operate at lower fan rpms. This offset is factory set and controlled by the control board (CB).

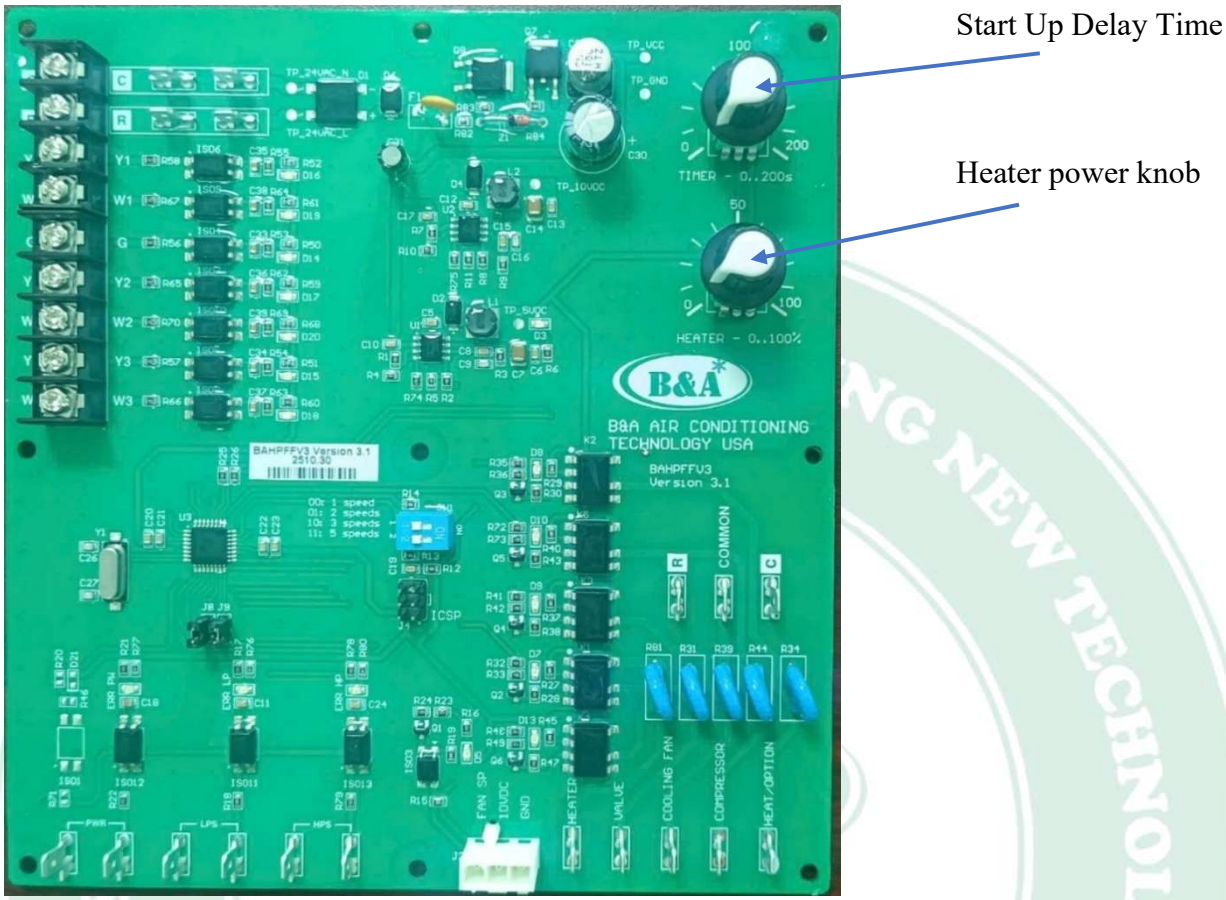
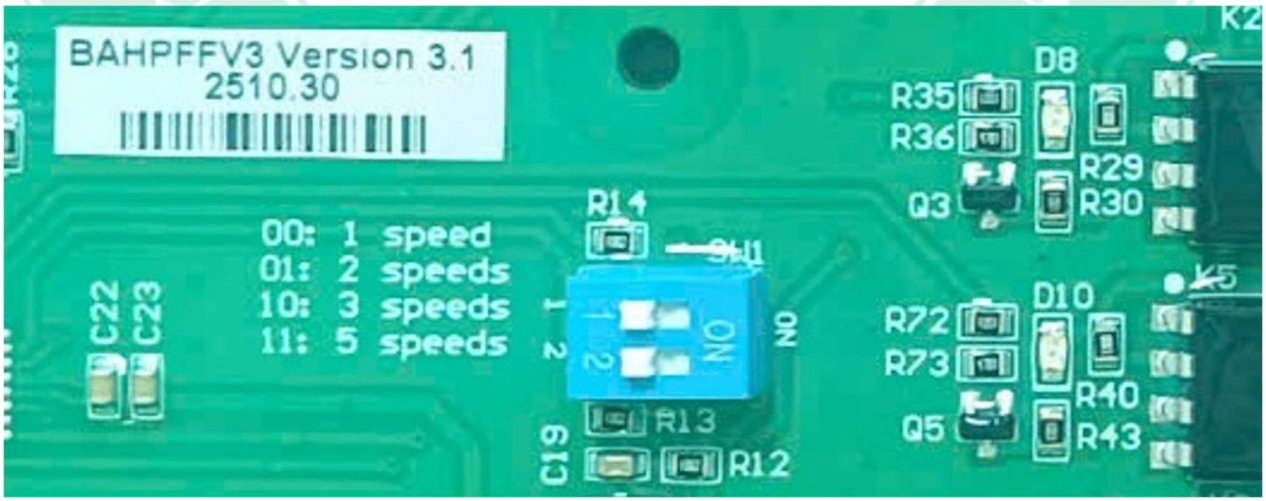


Fig. 7 — CB Fan Speed Controls

Units with Electro-Mechanical Controls

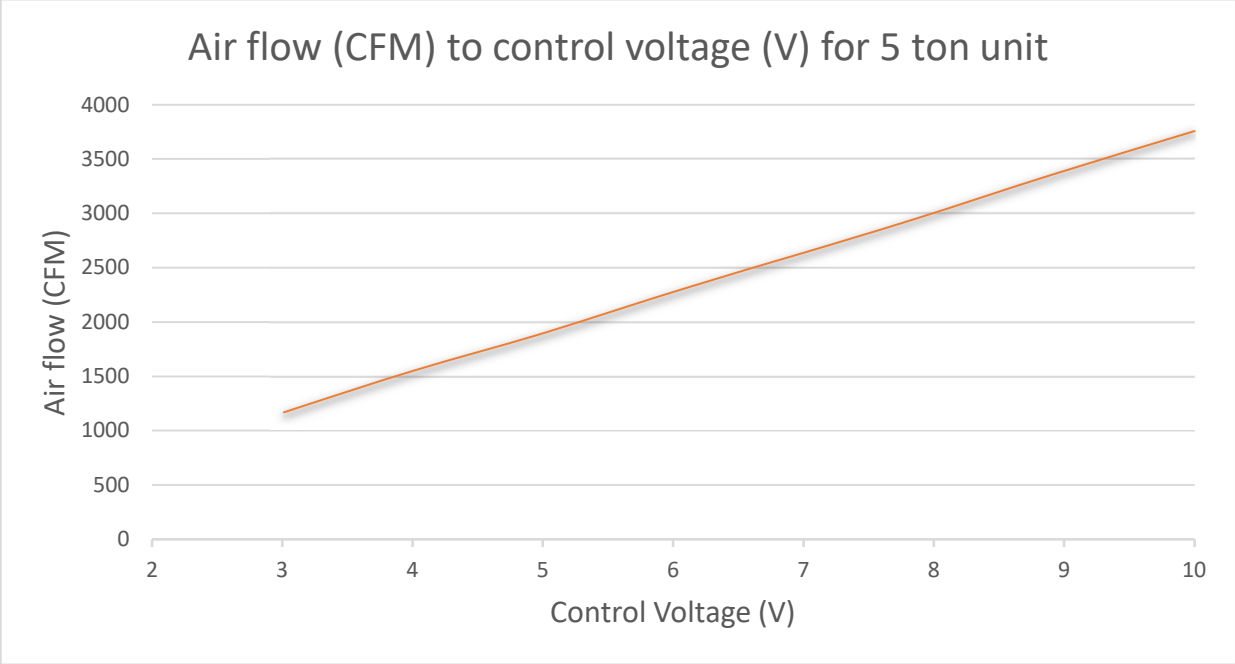
The Fan Speed set up controls are located on the lower section of the Control Board (CB).

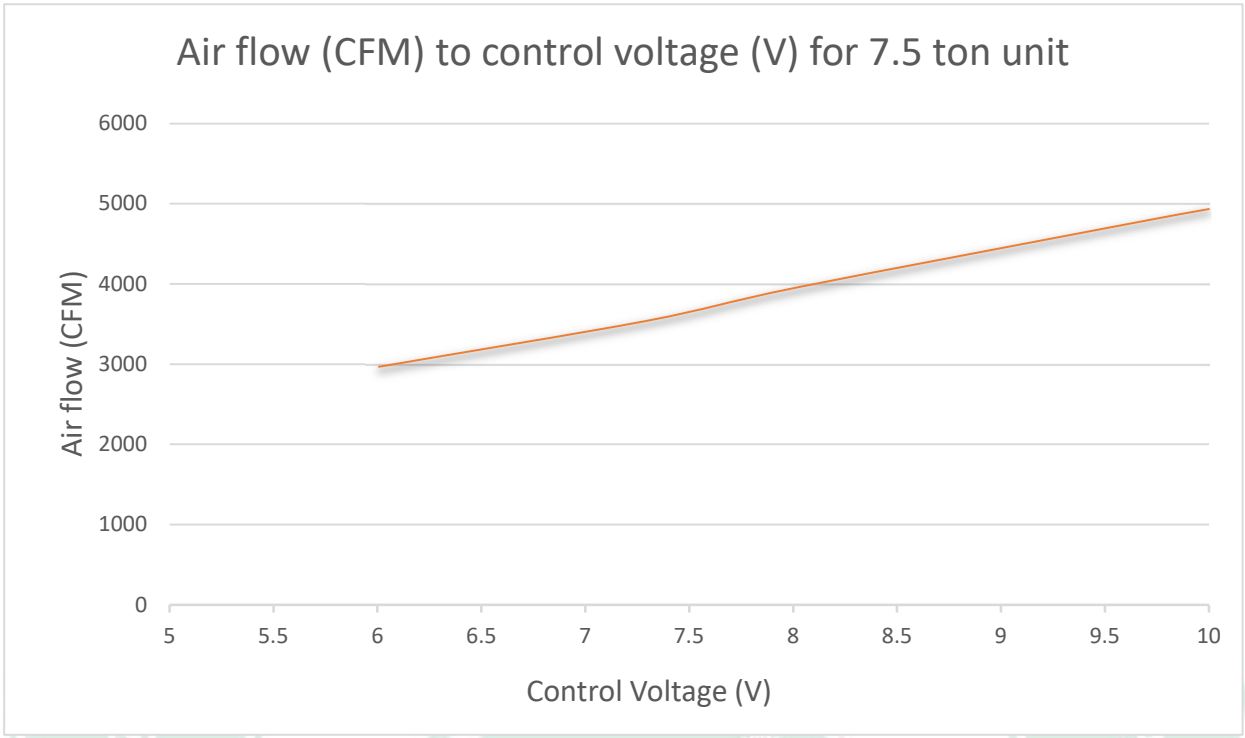
See **Fig. 8 — Location dip switch on the Control Board**



1. Check the fan speed setting on dip switch located on the middle of the Control Board (CB)
2. Using the value on the Fan Speed Set Up able 1 (see Fig. 8), select the vdc from the table and calculate CFM and ESP for the base. See Table 1, Fig 9 and 10 for Fan data

Dip Switch / Thermostats Fan Speed	00 Single speed thermostats (High)	01 Two speed thermostats (Low-High)	10 Three speed thermostats (Low-Mid-High)	11 Five speed thermostats (Low2-Low1-Mid-High1-High2)
Low 2 Output (G)	10 VDC	7 VDC	6 VDC	6 VDC
Low 1 Output (Y2)	N/A	10 VDC	8 VDC	7 VDC
Mid Output (W2)	N/A	N/A	10 VDC	8 VDC
High 1 Output (Y3)	N/A	N/A	N/A	9 VDC
High 2 Output (W3)	N/A	N/A	N/A	10 VDC





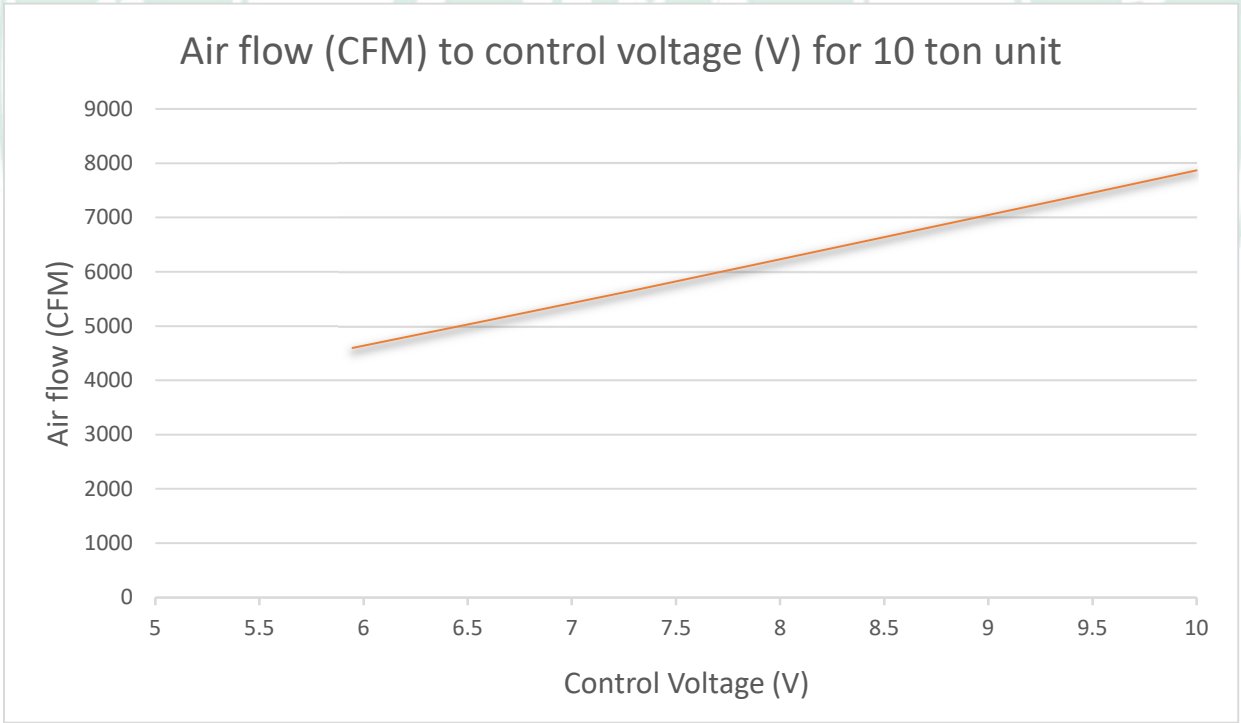
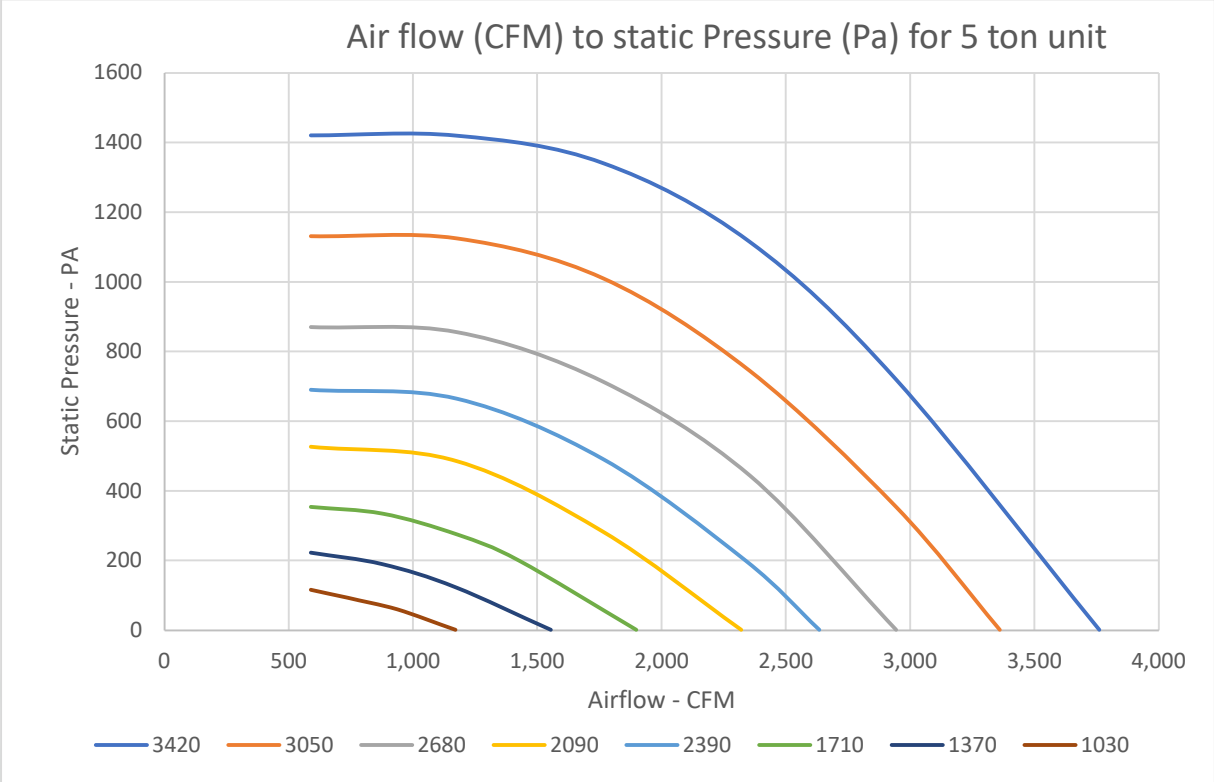
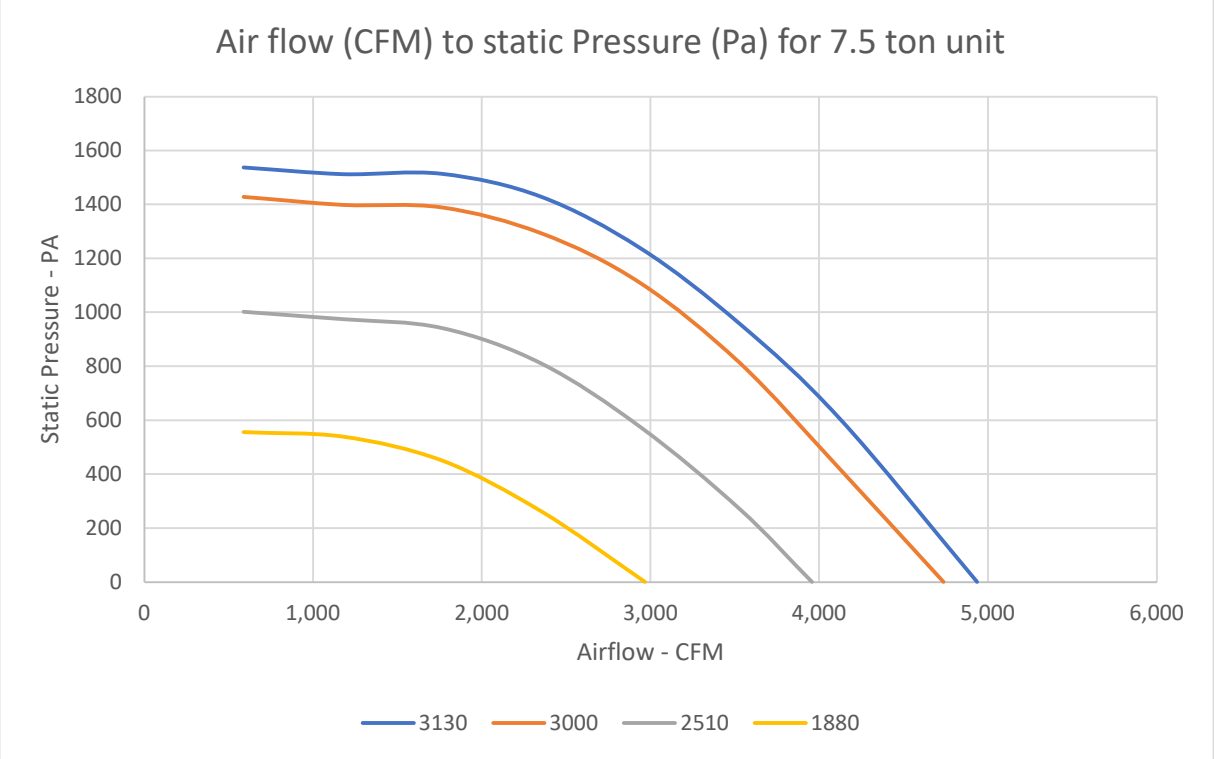


Fig. 9 —— Airflow CFM and Control voltage Vdc of Supply Fan


Air flow (CFM) to static Pressure (Pa) for 5 ton unit
Static Pressure - PA
1600
1400
1200
1000
800
600
400
200
0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Airflow - CFM
3420
3050
2680
2090
2390
1710
1370
1030


Air flow (CFM) to static Pressure (Pa) for 7.5 ton unit
Static Pressure - PA
1800
1600
1400
1200
1000
800
600
400
200
0
0
1,000
2,000
3,000
4,000
5,000
6,000
Airflow - CFM
3130
3000
2510
1880

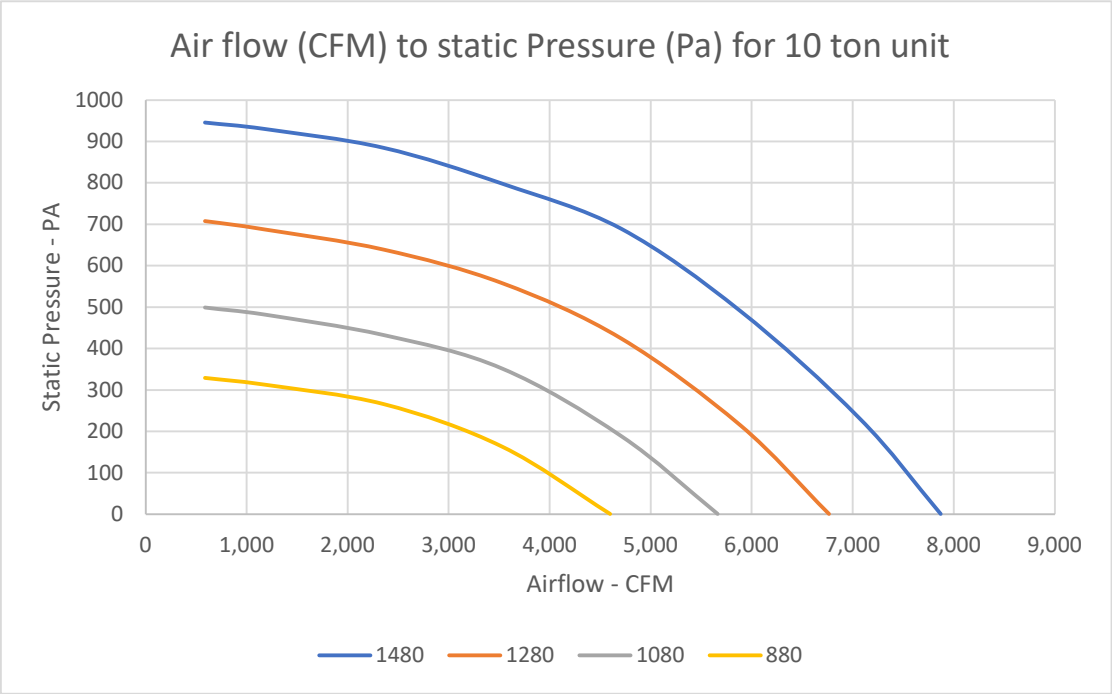


Fig. 10 —— Airflow and Static Pressure of Supply Fan

IV. TROUBLESHOOTING THE EC MOTOR

EC motors are designed with several built-in protections included in the motor software. If the motor detects a fault it will safely shut down. For temperature related faults the motor requires a line voltage reset to continue operation. For all others, the motor will resume operation automatically as soon as the fault condition is cleared. See Table 2 for the complete list

Type of error	Possible cause	Remedial measures
Fan does not run (anymore)	Mains voltage failure Failure of a phase Under - or overvoltage	Check mains voltage
	Earth fault	Check the motor connection and mains voltage
	Coil closure	Replace fan
	thermal motor protection has trig-gered (motor is overheated)	Check for free air passages; remove foreign bodies if necessary See "Impeller blocked or dirty" Check supply air temperature Check voltage
	Impeller blocked or dirty	- Disconnect the motor from the power supply and secure it against switching back on - Check safe isolation from supply - Remove protective grille - Remove foreign bodies or dirt - Reinstall protective grille - proceed as described in the Commissioning chapter
Fan does not start	Temperature too low for bearing grease	Insert bearing with cold greasing
	Air stream wrong direction (Motor turns in wrong direction at high speed)	Check air stream (see behaviour in rotation by air current in reverse direction)
	see "Fan does not run"	
Fan turns too slowly	Impeller / blade drags / scrapes	When indicated clear foreign bodies / dirt from the fan
	Active temperature management effective (Motor or electronics overheated)	Check for free air passages; remove foreign bodies if necessary See "Impeller blocked or dirty" Check supply air temperature Check installation space (air speed over heat sink)
Air flow too low	Fan turns too slowly	see "Fan turns too slowly"
	Airways blocked	Check for free air passages (supply/exhaust air flaps, filters) See "Impeller blocked or dirty"
	Pressure loss different to projec-tion	Check fan selection
Vibrations	Imbalance	Check blades for damage, soiling or ice (see "Impeller blocked or dirty")
	No or wrong vibration dampers (only in radial)	Install correct vibration dampers
Unusual noises	Bearing damaged / worn	Change bearings In motor size 055"(Z" / "B" at cross flow) and 072 (O) change the fan.
	Impeller / blade drags / scrapes	When indicated clear foreign bodies / dirt from the fan (see "Impeller blocked or dirty")
	Operation beyond tear-off point (for axial fans)	Check for free air passages (supply/exhaust air flaps, filters)
	Wrong overlap on nozzle (for centrifugal fans)	Observe the installation instructions

STATUS OUT WITH FLASH CODE
Status LED in the lid of the terminal compartment.
Output A1 Status Out OC ⟶ Electrical installation.

1 Cover for terminal compartment
2 Cable glands (2 x M16x1.5)
seal insert with two holes 5 mm for two cables applicable if necessary
3 Do not loosen the safety screws from the housing!
4 Connection control system
5 Connection alarm relay and voltage supply
6 Status LED

Fig. 11 —— Status LED on the EC Motor

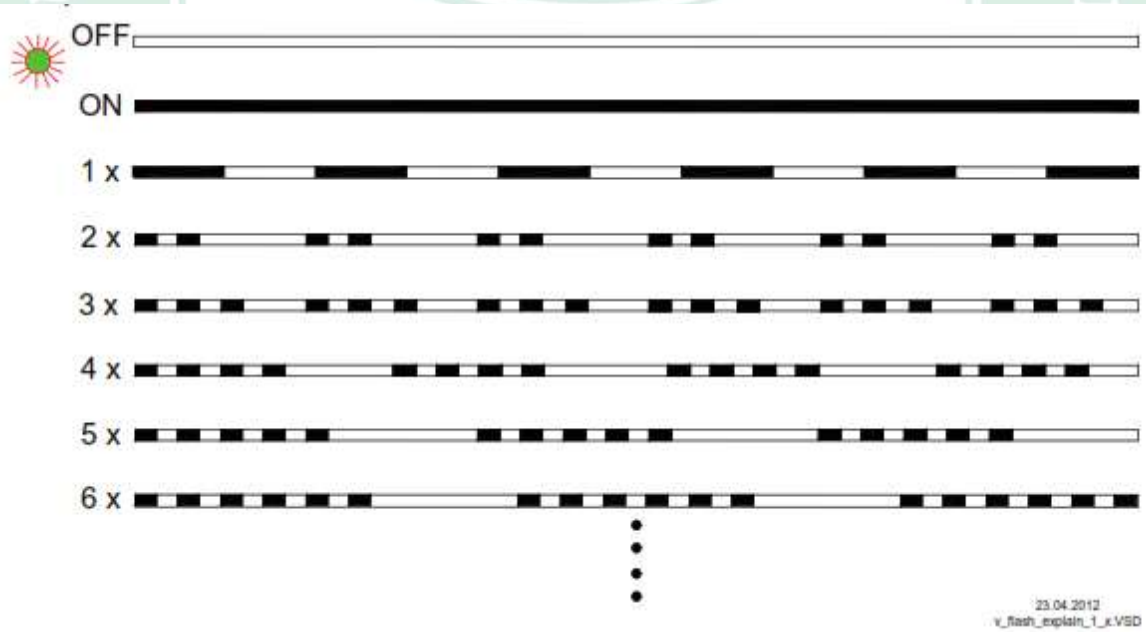


Fig. 12 —— Status LED diagram

Table 3 —— Status LED Diagnostic

LED Code	Relays K1*	Cause Explanation	Reaction of Controller Remedial measures
OFF	de-energized, 11 - 14 interrupted	Mains voltage failure	Line voltage available? Unit switch OFF and automatically ON when the voltage has been restored
ON	energized, 11 - 14 bridged	Normal operation without fault	
1 x	energized, 11 - 14 bridged	**No enable = OFF** Terminals "D1" - "10 V" (Digital In 1) not bridged or switch off by Bus.	Switch-off ☞digital input or Bus
2 x	energized, 11 - 14 bridged	**Temperature management active** The device has an active temperature management to protect it from damage due to too high inside temperatures. In case of a temperature rise above the fixed limits, the modulation is reduced linearly. To prevent the complete system being switched off externally (in this operation permissible for the controller) in case of reduced operation due to too high an internal temperature, no fault message is sent via the relay.	With a drop in temperature the modulation rises again llinear. Check installation of the device and cooling of the controller.
3 x	de-energized, 11 - 14 interrupted	**HALL-IC** Incorrect signal from the Hall-ICs, error in the commutation. Internal plug connection faulty.	The controller switches the motor off. Automatic restart if no faults are recognised. Replace fan / motor
5 x	de-energized, 11 - 14 interrupted	**Motor blocked** If after 8 seconds of commutation no speed is measured > 0, the fault "Motor blocked" is released.	EC-Controller switches off, renewed attempt to start after about 2.5 sec. Final shutoff, when fourth starting test fails. It is then necessary to have a reset by disconnecting the line voltage. Check if motor is freely rotatable.
6 x	de-energized, 11 - 14 interrupted	**IGBT Fault** Short circuit to earth or short circuit of the motor winding.	EC-Controller switches off, renewed attempt to start after about 60 sec. ☞ Code 9. Final shutoff, if - following a second starting test – a second fault detection is detected within a period of 60 seconds. It is then necessary to have a reset by disconnecting the line voltage.
7 x	de-energized, 11 - 14 interrupted	**ZK overvoltage** If the DC-link voltage drops below a specified limit the device will switch off.	If the DC-link voltage rises above the limit within 75 seconds, then the cotroller will attempt to start. Should the DC-link voltage stay for more than 75 seconds below the limit, the device will switch off with a fault message.

LED Code	Relays K1*	Cause Explanation	Reaction of Controller Remedial measures
8 x	de-energized, 11 - 14 interrupted	**ZK overvoltage** If the DC-link voltage increases above a specified limit, the motor will switch off. Reason for excessively high input voltage or alternator motor operation.	If the DC-link voltage drops below the limit within 75 seconds, then the cotroller will attempt to start. Should the DC-link voltage stay above the limit for more than 75 seconds, the device will switch off with a fault message.
9 x	energized, 11 - 14 bridged	**IGBT cooling phase** IGBT cooling down period for approx. 60 sec. Final shutoff after 2 cooling-off intervals ☞ Code 6	IGBT cooling down period for approx. 60 sec. Final shutoff after 2 cooling-off intervals ☞ Code 6.
11 x	de-energized, 11 - 14 interrupted	**Error motor start** If a starting command is given (enable available and Setpoint > 0) and the motor does not start to turn in the correct direction within 5 minutes, then an error message will appear.	If it is possible to start the motor in the target direction of rotation after the error message, the error message will disappear Should a voltage interruption occur in the meantime, the time taken up to the switch off will begin again. Check if motor is freely rotatable. Check if the fan is driven in reverse direction by an air stream (☞ Behaviour in rotation by air current in reverse direction).
12 x	de-energized, 11 - 14 interrupted	**Line voltage too low** If the line voltage drops below a specified limit the device will switch off.	If the line voltage rises above a specified limit within 75 seconds, then the controller will attempt to start. Should the line voltage stay below the specified limit for more than 75 seconds, the device will switch off with an error message.
14 x	de-energized, 11 - 14 interrupted	**Error peak current** If the motor current increases above the specified limit (even in a short time-frame) the device will switch-off.	After a switch off the controller waits for 5 seconds then the controller attempt a start. Arises within 60 sec. in series 5 further disconnections a final switch off with fault indication follows. Should no further switch off be exceeded in 60 s the counter will be reset.
17 x	de-energized, 11 - 14 interrupted	**Temperature alarm** Excess of the max. permissible inside temperature.	Controller switches off motor. Automatic restarting after cooling down. Check installation of the device and cooling of the controller.

REMOVING THE MOTOR AND FAN ASSEMBLY

NOTE: When there is noise or fan blade collision, the fan can be disassembled to check and readjust the gap between the blades and the air intake.
Due to press fit design of composite rotor on motor, it is highly recommended that any time a motor is replaced the fan rotor is replaced as well. The rest of the assembly may be reused. See Fig. 13 for removing motor and fan assembly

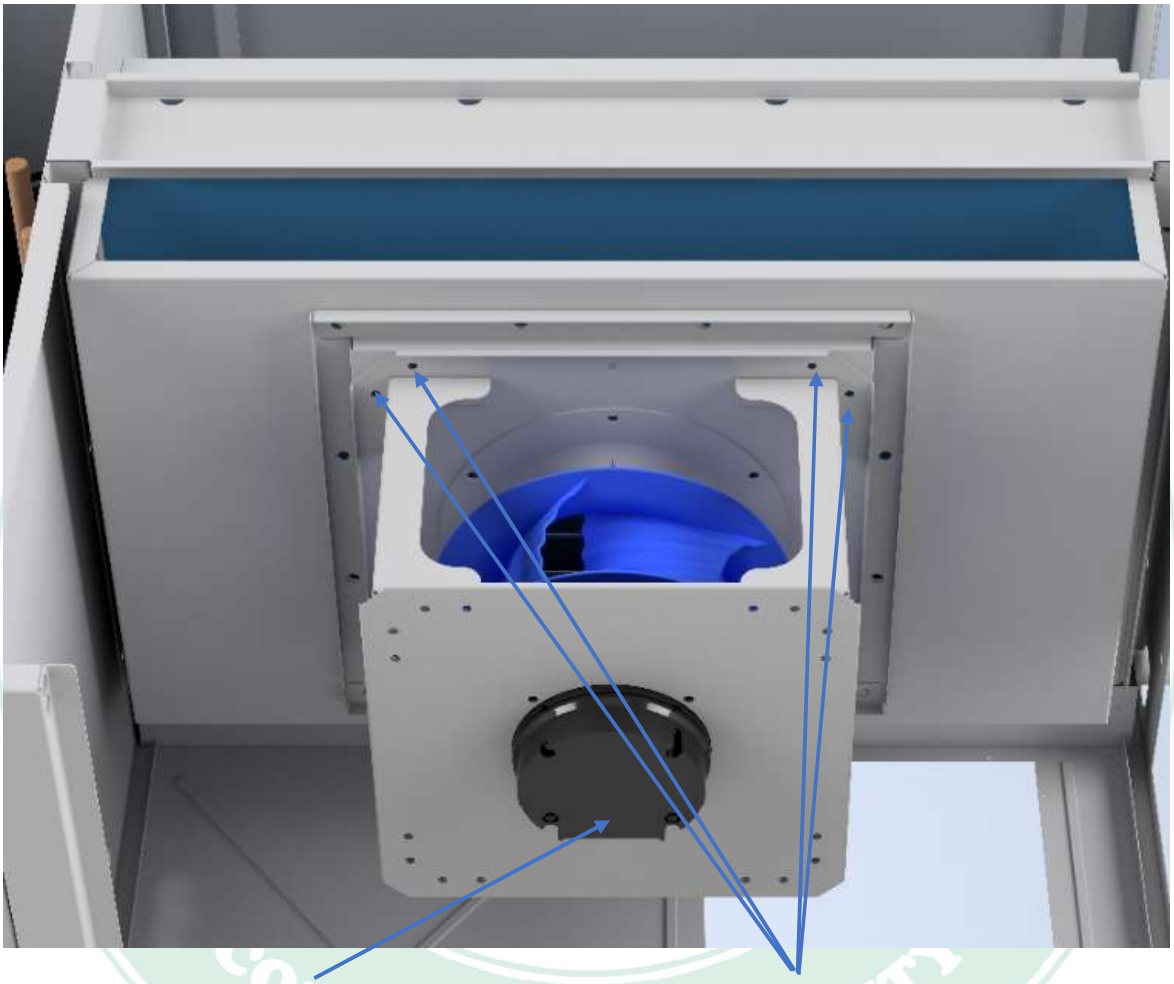


Fig. 13 —— Removing the Motor and Fan Assembly

1. Unplug motor harness from control box harness and cut wire tie at the fan deck. Disconnect power and control wire as Fig. 14

Fig. 14 —— Disconnect power and control wire

2. Remove 8 nuts to take out the fan.

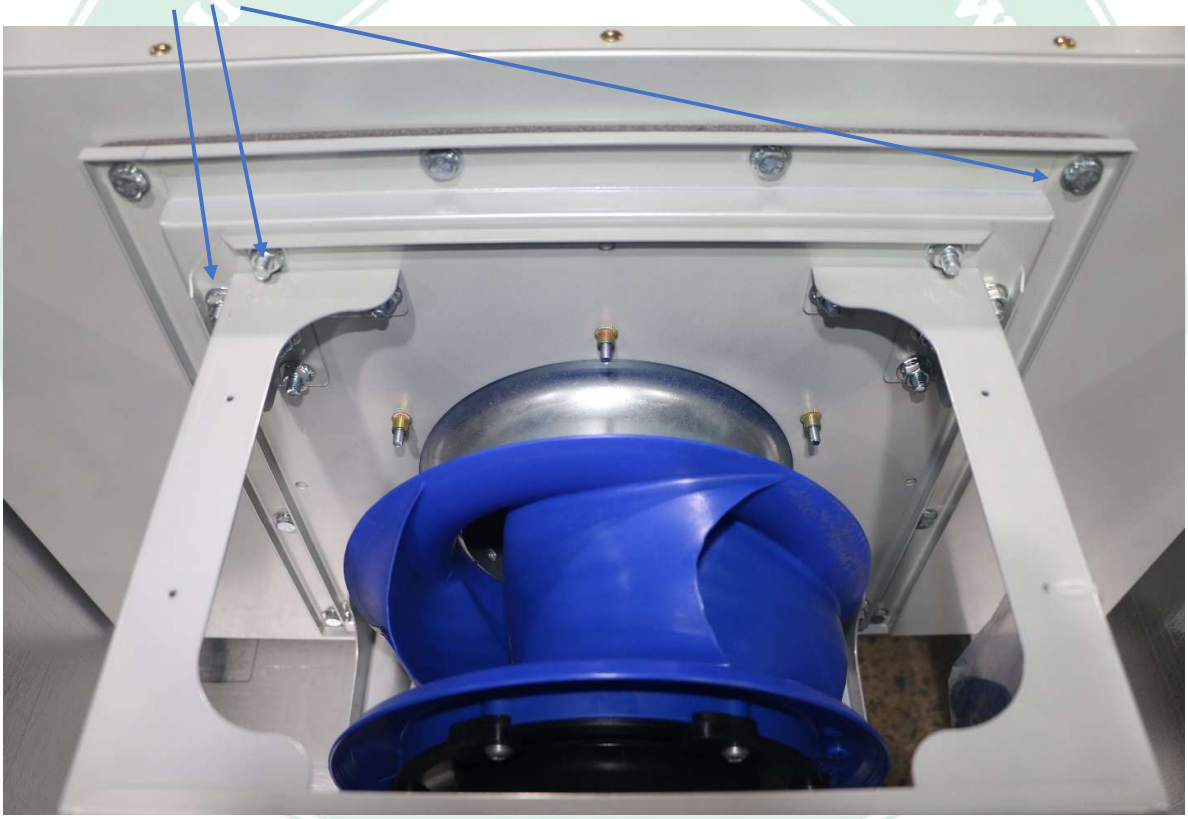


Fig. 15 —— Remove 8 nuts securing the fan

3. Check and readjust the gap between the blades and the air intake. Losen 6 screws securing the suction hole.

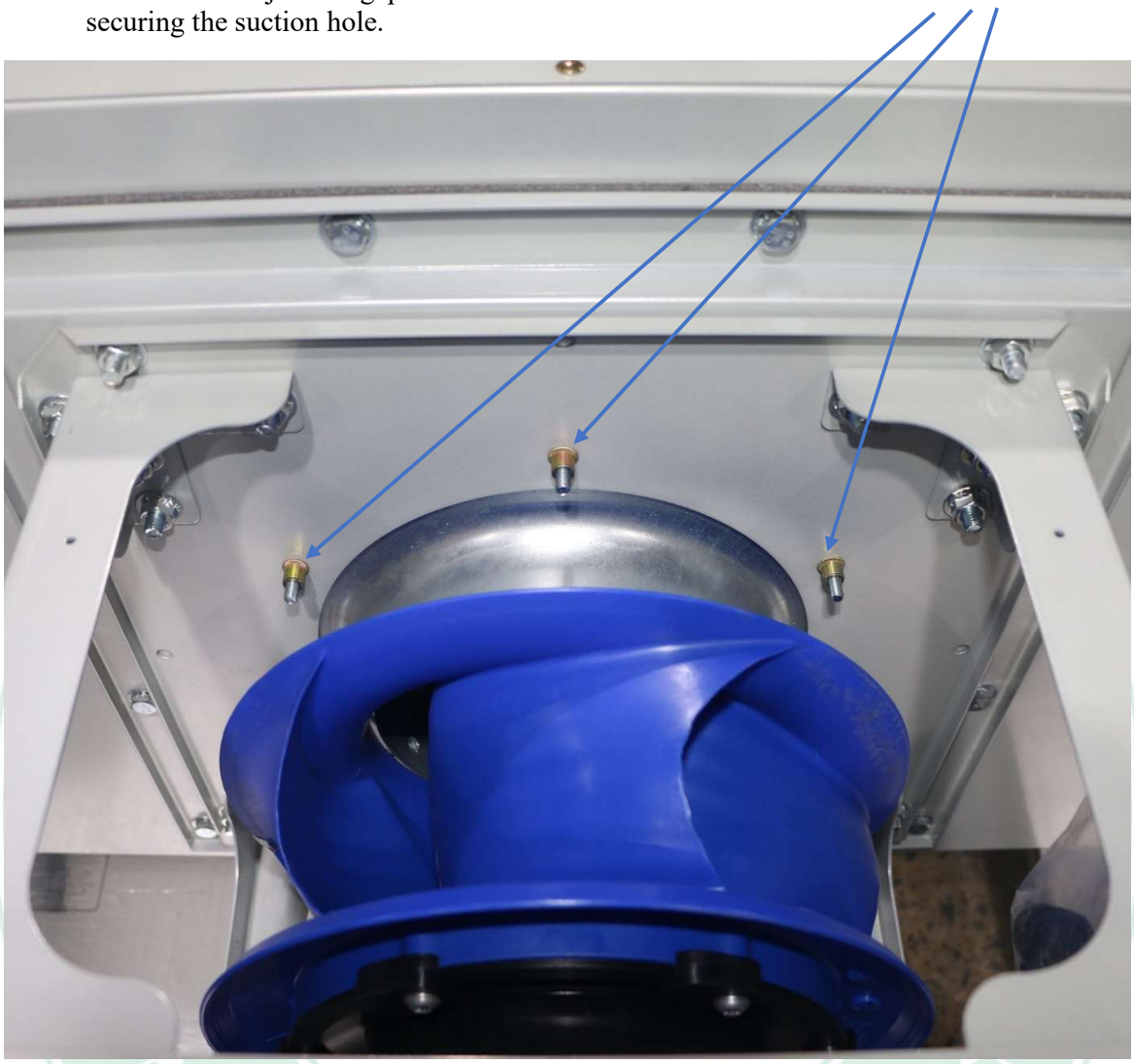


Fig. 16 —— Losing 6 screws securing the suction hole to readjust the gap between the blades and the air intake

V. COOLING

WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

This system uses R-454B refrigerant, which has higher pressures than R-22 and other refrigerants. No other refrigerant may be used in this system. Gauge set, hoses, and recovery system must be designed to handle R-454B refrigerant. If unsure about equipment, consult the equipment manufacturer.

CONDENSER COIL

The condenser coil is fabricated with round tube copper hairpins and plate fins of various materials and/or coatings (see Model Number Nomenclature in Appendix A to identify the materials provided in this unit). The coil may be one-row or composite-type two-row. Composite two-row coils are two single-row coils fabricated with a single return bend end tubesheet.

CONDENSER COIL MAINTENANCE AND CLEANING RECOMMENDATION

Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

REMOVE SURFACE LOADED FIBERS

Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non-metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges can be easily bent over and damage to the coating of a protected coil) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

PERIODIC CLEAN WATER RINSE

A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with a very low velocity water stream to avoid damaging the fin edges.

Monthly cleaning as described below is recommended. Rinsing coils in the opposite direction of airflow is recommended.

ROUTINE CLEANING OF COIL SURFACES

Periodic cleaning with Totaline ® environmentally balanced coil cleaner is essential to extend the life of coils. It is recommended that all coils, including standard aluminum, pre-coated,

copper/copper or e-coated coils be cleaned with the Totaline environmentally balanced coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

Avoid use of:

- coil brighteners
- acid cleaning prior to painting
- high pressure washers
- poor quality water for cleaning

Totaline environmentally balanced coil cleaner is nonflammable, hypo-allergenic, non-bacterial, and a USDA accepted biodegradable agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation.

Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

CLEAN COIL AS FOLLOWS:

1. Turn off unit power, tag disconnect. Remove the power cable of Condenser Fan Box
2. Remove all screws from the top panel except the screws securing the condenser fan to the top panel. See Fig. 17.

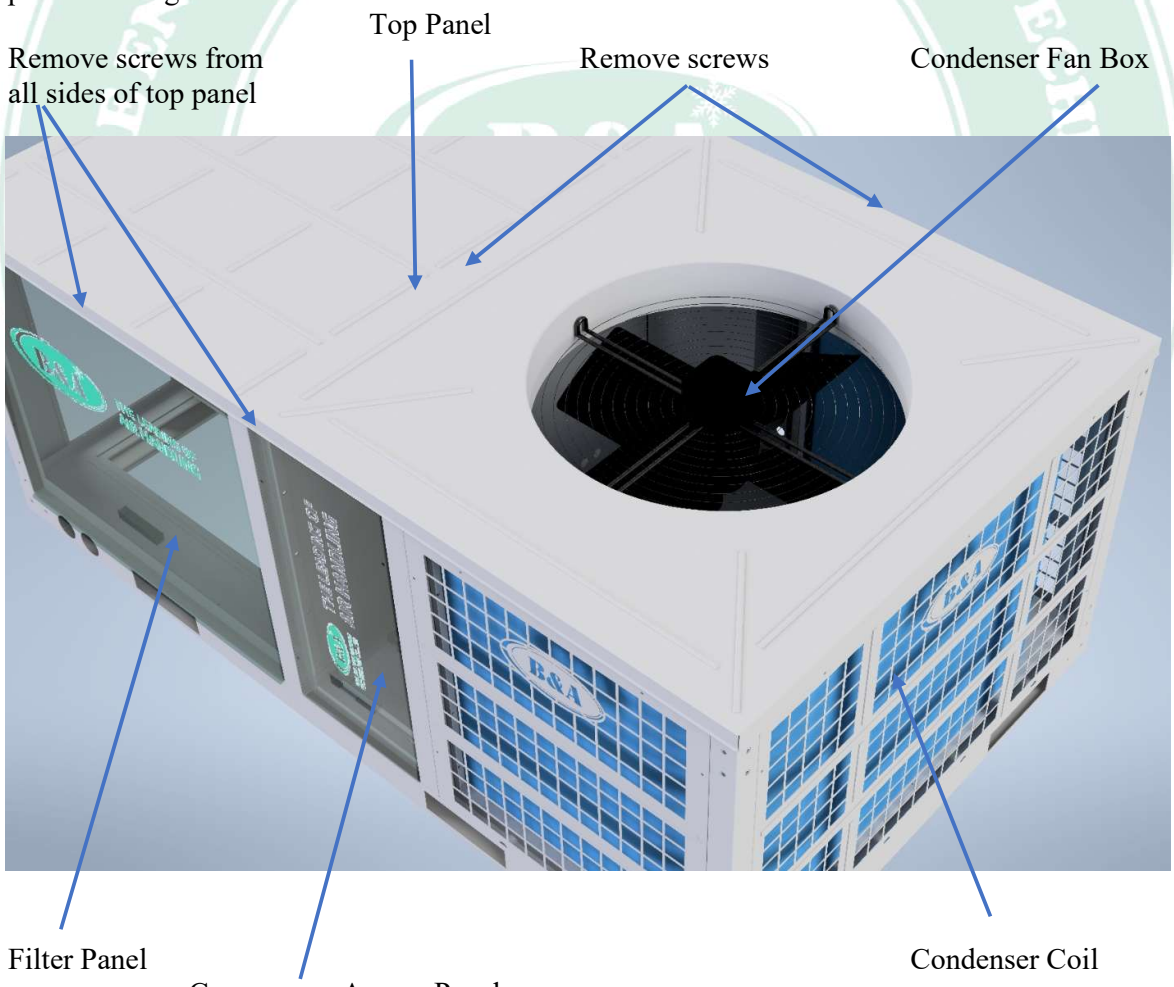


Fig. 17a —— Removing Top Panel of 5 ton unit

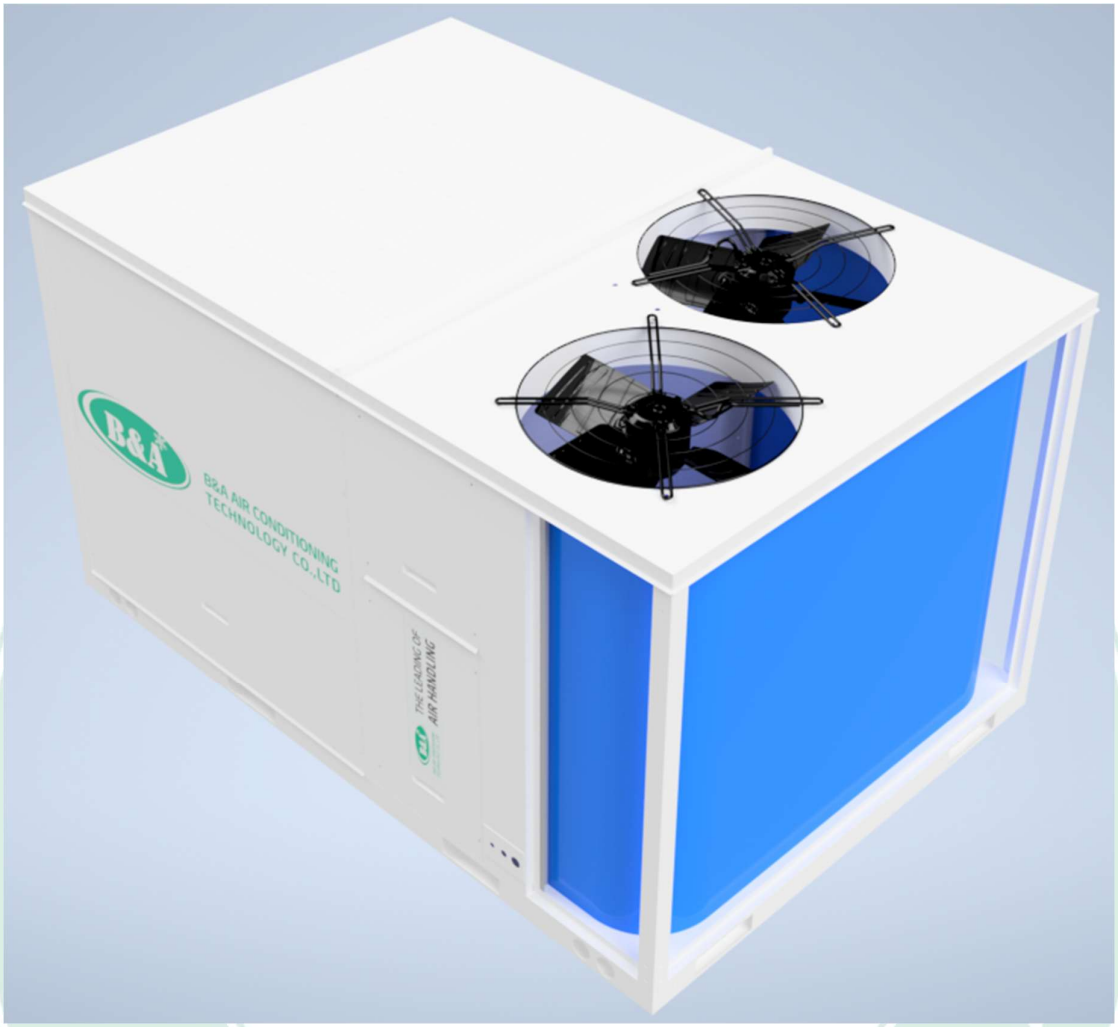


Fig. 17a —— Removing Top Panel of 7.5 ton and 10 ton units

3. Remove the compressor access panel to access the lower coilclip. See Fig. 18 for separating coil sections
4. Clean the outer coil surface to remove surface loaded fibers or dirt.
5. Use a water hose or other suitable equipment to flush down between the 2 coil sections to remove dirt and debris. If a coil cleaner is used be sure to rinse the coils completely before reassembly.

Top View

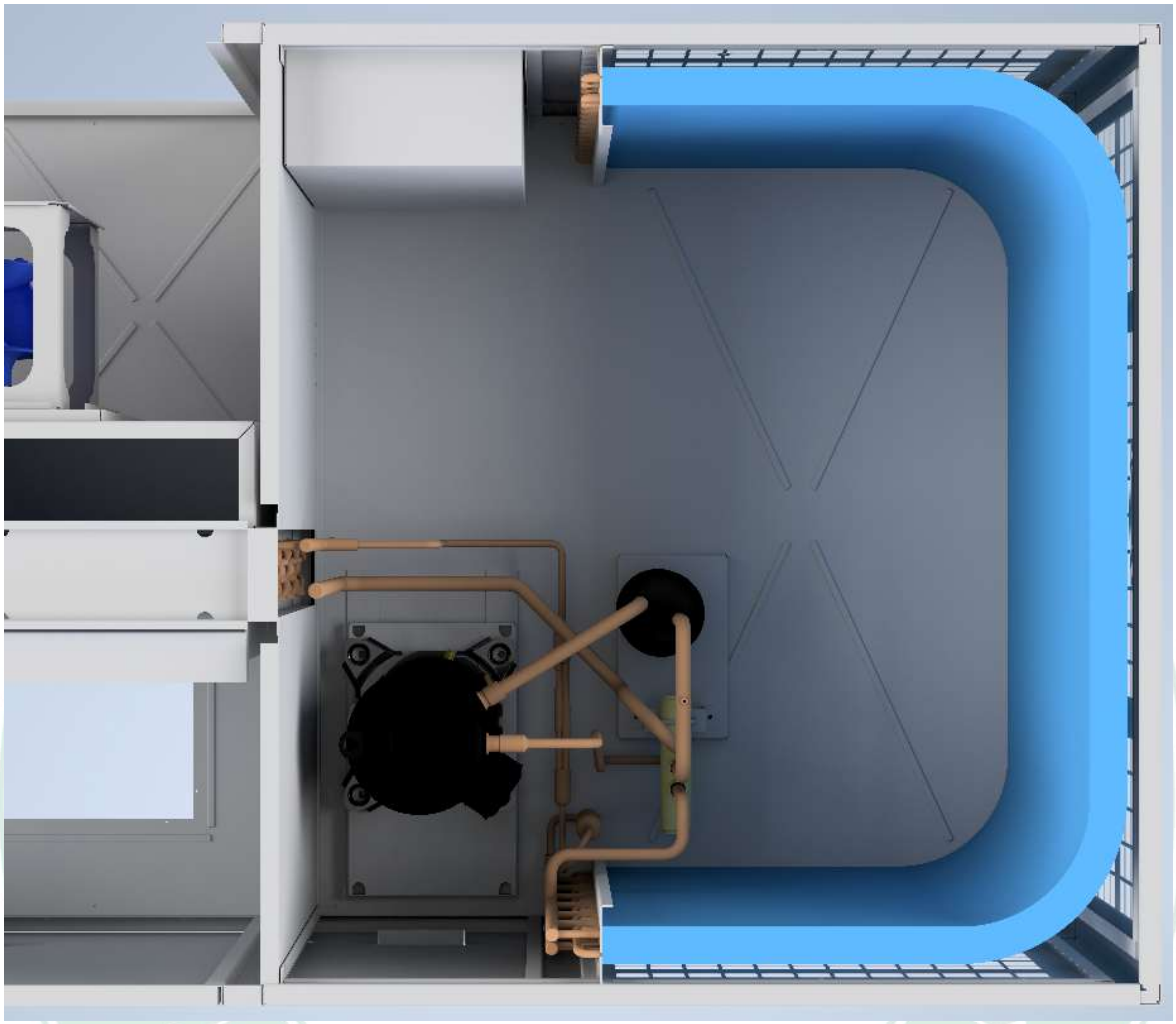


Fig. 18 —— Separating Coil Sections

WARNING

UNIT DAMAGE HAZARD

Failure to follow this caution may result in reduced unit performance or unit shutdown.

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop.

WARNING

CAUTION
UNIT DAMAGE HAZARD
Failure to follow this caution may result in accelerated corrosion of unit parts.
Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indoor coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the environmentally balanced coil cleaner.

TOTALINE ENVIRONMENTALLY BALANCED COIL CLEANER APPLICATION EQUIPMENT
• 2-1/2 gallon garden sprayer
• Water rinse with low velocity spray nozzle

TOTALINE ENVIRONMENTALLY BALANCED COIL CLEANER APPLICATION INSTRUCTIONS
1. Proper eye protection such as safety glasses is recommended during mixing and application.
2. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
3. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
4. Mix Totaline environmentally balanced coil cleaner in a 2-1/2 gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100°F.

NOTE: Do NOT USE water in excess of 130°F, as the enzymatic activity will be destroyed.
5. Thoroughly apply Totaline environmentally balanced coil cleaner solution to all coil surfaces including finned area, tube sheets and coil headers.
6. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up-and-down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage.
7. Ensure cleaner thoroughly penetrates deep into finned areas. Interior and exterior finned areas must be thoroughly cleaned. Finned surfaces should remain wet with cleaning solution for 10 minutes. Ensure surfaces are not allowed to dry before rinsing. Reapply cleaner as needed to ensure 10-minute saturation is achieved.
8. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

EVAPORATOR COIL

CLEANING THE EVAPORATOR COIL
1. Turn unit power off. Install lockout tag. Remove filter access panel. See Fig. 19
2. Slide filters out of unit by lift up filter clip.
3. Clean coil using a commercial coil cleaner or dishwasher detergent in a pressurized spray canister. Wash both sides of coil and flush with clean water. For best results, backflush toward

return-air section to remove foreign material. Flush condensate pan after completion.
4. Reinstall filters.
6. Reconnect wiring.
7. Replace access panels.

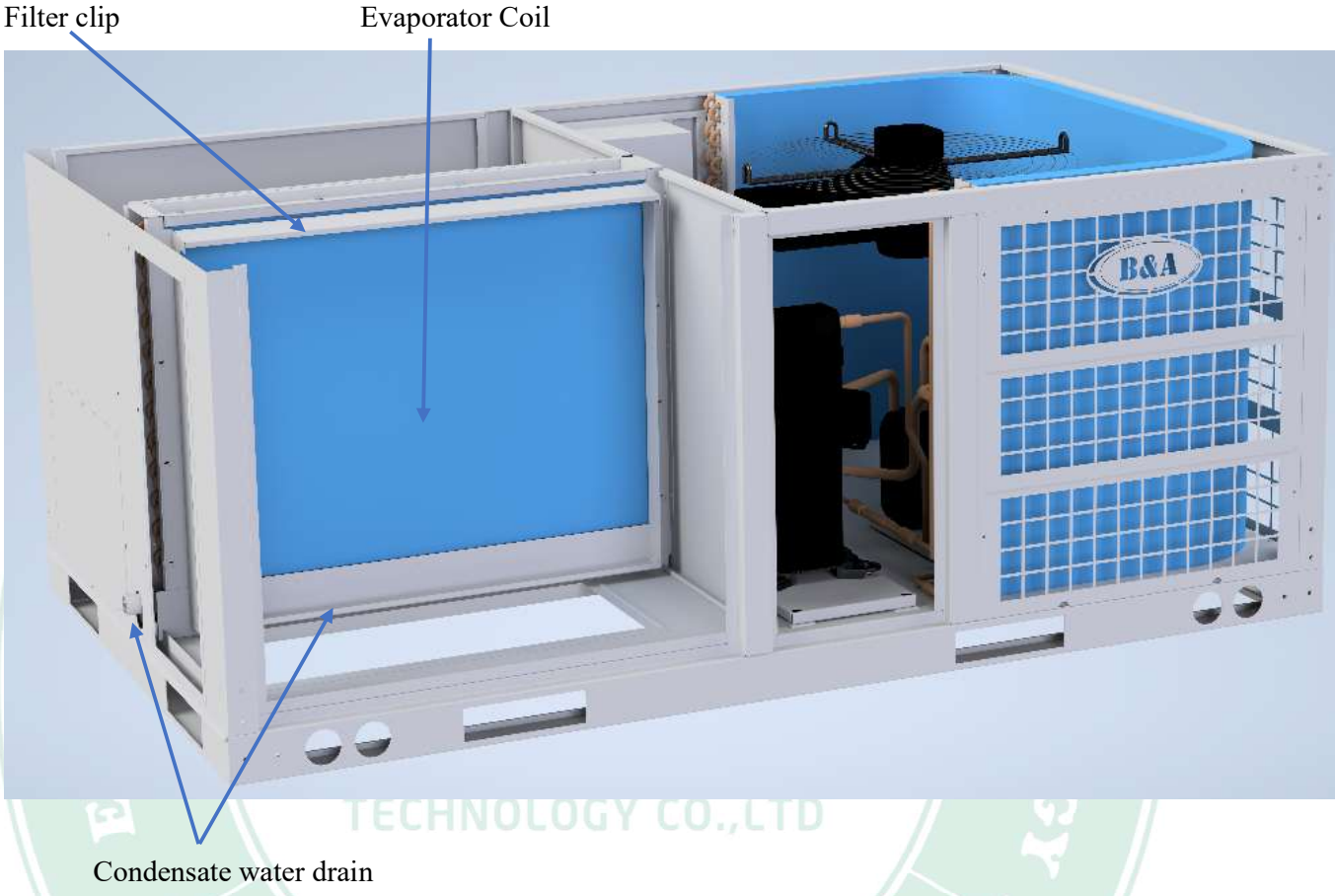


Fig. 19 —— Evaporator Coil Sections

VI. REFRIGERANT SYSTEM PRESSURE ACCESS PORTS

There are 3 access ports in the system: on the suction tube near the compressor and on the discharge tubes near the compressor. See Fig. 20
These are brass fittings with brass caps. The hose connection fittings are standard 1/4-in. SAE male flare couplings.
The brass fittings are two-piece high flow valves, with a receptacle base brazed to the tubing and an integral spring-closed check valve core screwed into the base. This check valve is permanently assembled into this core body and cannot be serviced separately; replace the entire core body if necessary. Service tools allow the replacement of the check valve core without having to recover the entire system refrigerant charge. Apply compressor refrigerant oil to the check valve core's bottom o-ring. Install the fitting body with 96 ± 10 in.-lb (10.85 ±1.1 Nm) of torque; do not over-tighten.

Access port of suction tube

Access ports of discharge tube

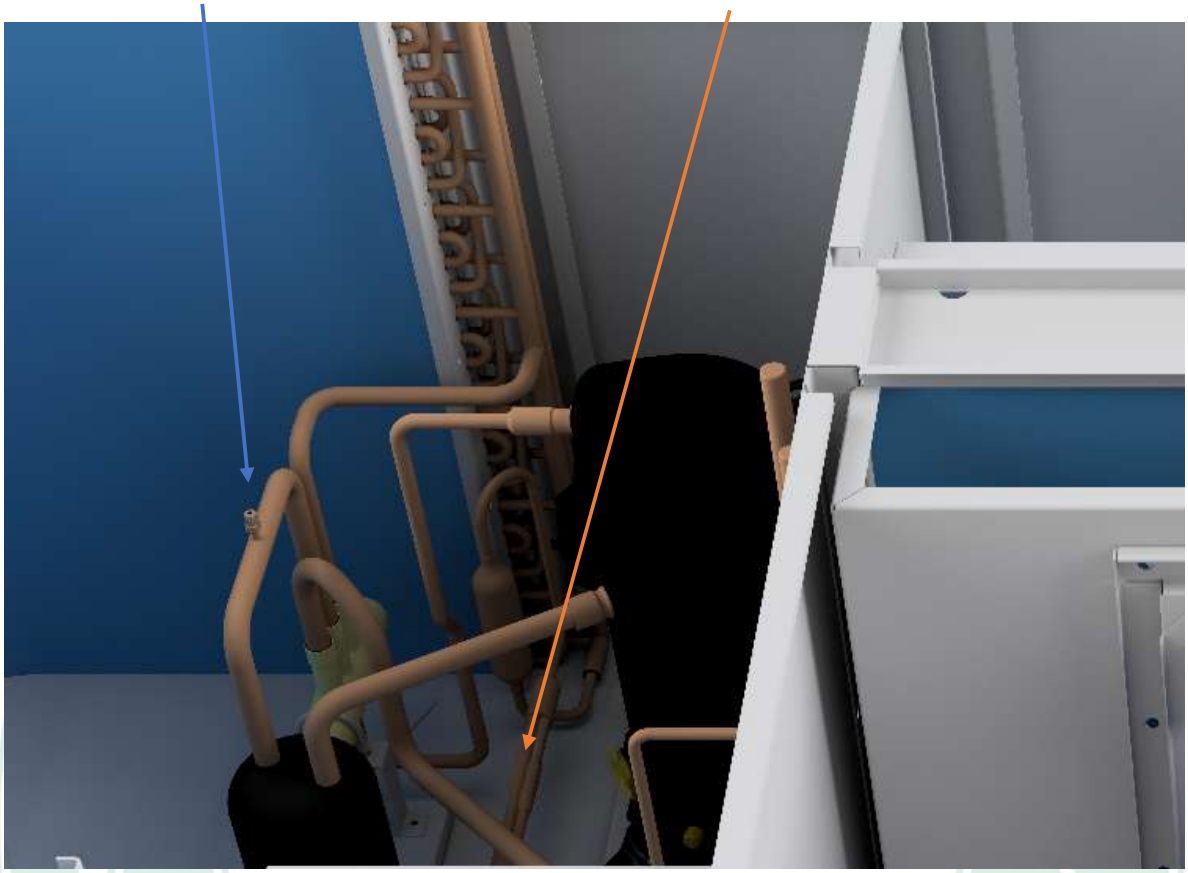


Fig. 20 —— Compressor Sections

VII. OPTEON XL41 (R-454B) REFRIGERANT

This unit is designed for use with **Opteon™** XL41(R-454B) refrigerant.
Do not use any other refrigerant in this system.

Opteon™ XL41(R-454B) refrigerant is provided in light green gray grey colored cylinders with a red line to indicate A2L group. These cylinders are available with and without dip tubes; cylinders with dip tubes will have a label indicating this
feature. For a cylinder with a dip tube, place the cylinder in the upright position (access valve at the top) when removing liquid refrigerant for charging. For a cylinder without a dip tube, invert the cylinder (access valve on the bottom) when removing liquid refrigerant.

Because **Opteon™** XL41(R-454B) refrigerant is a blend, it is strongly recommended that refrigerant always be removed from the cylinder as a liquid. Admit liquid refrigerant into the system in the discharge line. If adding refrigerant into the suction line, use a commercial metering/expansion
device at the gauge manifold; remove liquid from the cylinder, pass it through the metering device at the gauge set and then pass it into the suction line as a vapor. Do not remove **Opteon™** XL41(R-454B) refrigerant from the cylinder as a vapor.

REFRIGERANT CHARGE
Amount of refrigerant charge is listed on the unit's nameplate. Unit panels must be in place when unit is operating during the charging procedure.

NO CHARGE
Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant.

LOW-CHARGE COOLING
Using Cooling Charging Charts, Fig. 21, vary refrigerant until the conditions of the appropriate chart are met. Note the charging charts are different from type normally used. Charts are based on charging the units to the correct sub-cooling for the various operating conditions. Accurate pressure gauge and temperature sensing device are required.
Connect the pressure gauge to the service port on the liquid line. Mount the temperature sensing device on the liquid line and insulate it so that outdoor ambient temperature does not affect the reading. Indoor-air cfm must be within the normal operating range of the unit.

USING COOLING CHARGING CHARTS
Take the outdoor ambient temperature and read the liquid pressuregauge. Refer to chart to determine what liquid temperature should be. If liquid temperature is low, add refrigerant. If liquid temperature is high, carefully recover some of the charge. Recheck the liquid pressure as charge is adjusted.

COOLING CHARGING CHARTS

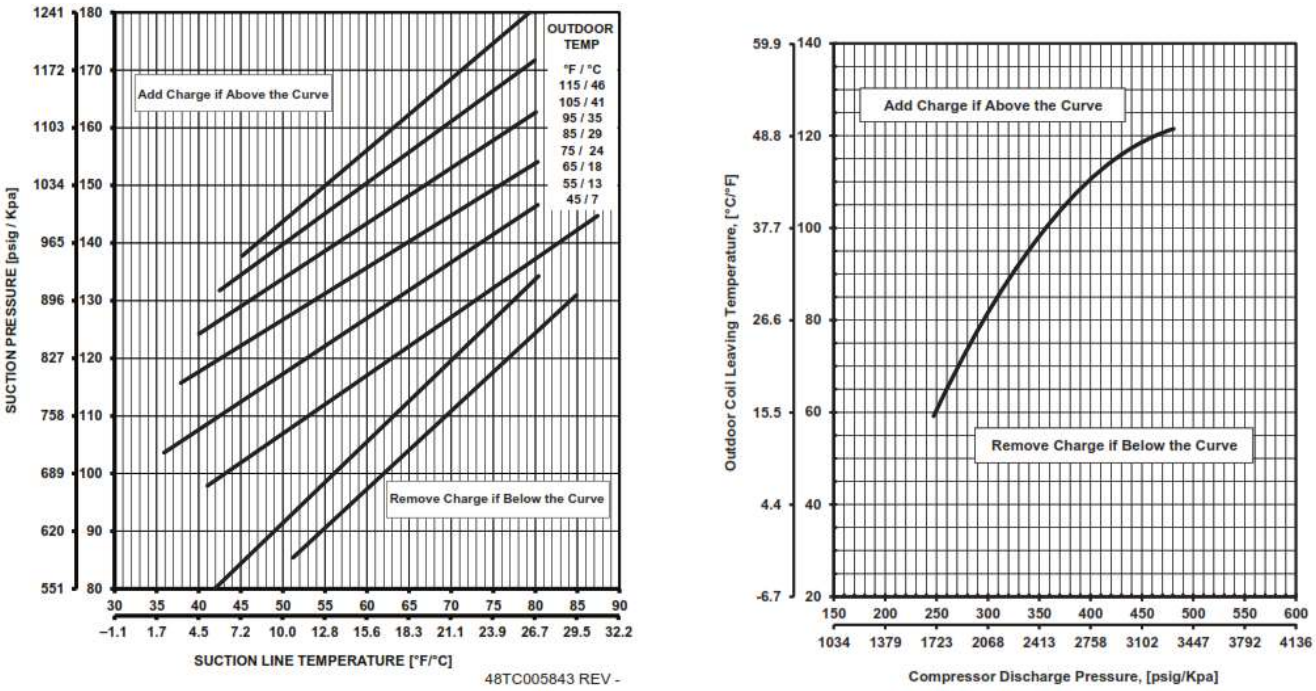


Fig. 21 —— Cooling charging charts

VIII.COMPRESSOR

LUBRICATION

The compressor is charged with the correct amount of oil at the factory.

WARNING

UNIT DAMAGE HAZARD

Failure to follow this caution may result in damage to components.

The compressor is in a R-454B refrigerant system and uses a polyolester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Avoid exposure of the oil to the atmosphere.

WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use air or gases containing oxygen for leak testing or foroperating refrigerant compressors. Pressurized mixtures of airor gases containing oxygen can lead to an explosion.

WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury and/or property damage.

Never use non-certified refrigerants in this product. Noncertified refrigerants could contain contaminates that could lead to unsafe operating conditions. Use ONLY refrigerants that conform to AHRI Standard 700.

REPLACING COMPRESSOR

NOTE: Only factory-trained service technicians should remove and replace compressor units.

WARNING

CAUTION INSTALLATION SITE DAMAGE

Failure to follow this caution can result in damage to equipment location site.

R-454B refrigerant contains polyolester (POE) oil that can damage the roof membrane. Caution should be taken to prevent POE oil from spilling onto the roof surface.

The factory also recommends that the suction and discharge lines be cut with a tubing cutter instead of using a torch to remove brazed fittings.

COMPRESSOR ROTATION

NOTE: When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

WARNING

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution can result in premature wear and damage to equipment.

Scroll compressors can only compress refrigerant if rotating in the right direction. Reverse rotation for extended times can result in internal damage to the compressor. Scroll compressors are sealed units and cannot be repaired on site location.

On 3-phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

NOTE: If the suction pressure does not drop and the discharge pressure does not rise to normal levels, the evaporator fan is probably also rotating in the wrong direction.

4. Turn off power to the unit.
5. Reverse any two of the three unit power leads.
6. Reapply electrical power to the compressor. The suction pressure should drop and the discharge pressure should rise which is normal for scroll compressors on start-up.
7. Replace compressor if suction/discharge pressures are not within specifications for the specific compressor.

The suction and discharge pressure levels should now move to their normal start-up levels.

CONDENSER-FAN ASSEMBLY

1. Shut off unit power supply. Install lockout tag. Remove power cable of condenser fan box.
2. Remove condenser-fan assembly (grille, motor, and fan). See Fig. 22.
3. Replace condenser-fan assembly. When replacing the condenser-fan assembly follow the screw pattern sequence shown in Fig. 23. The screws must be replaced in the sequence shown in the figure.
4. Tighten set screw to 60 in.-lb (6.78 Nm).

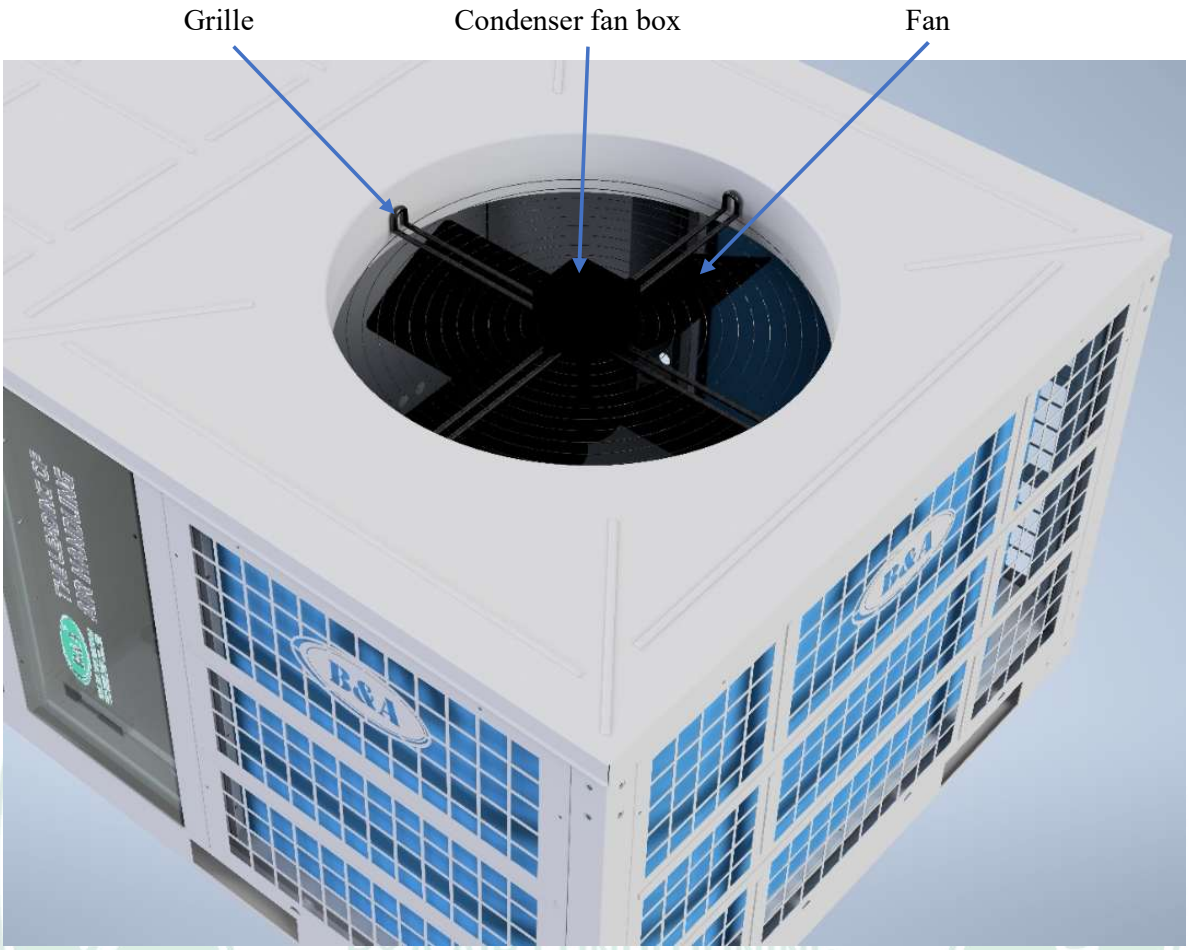


Fig. 22a —— Condenser Fan Assembly of 5 ton unit

Fig. 22a —— Condenser Fan Assembly of 7.5 ton and 10 ton units

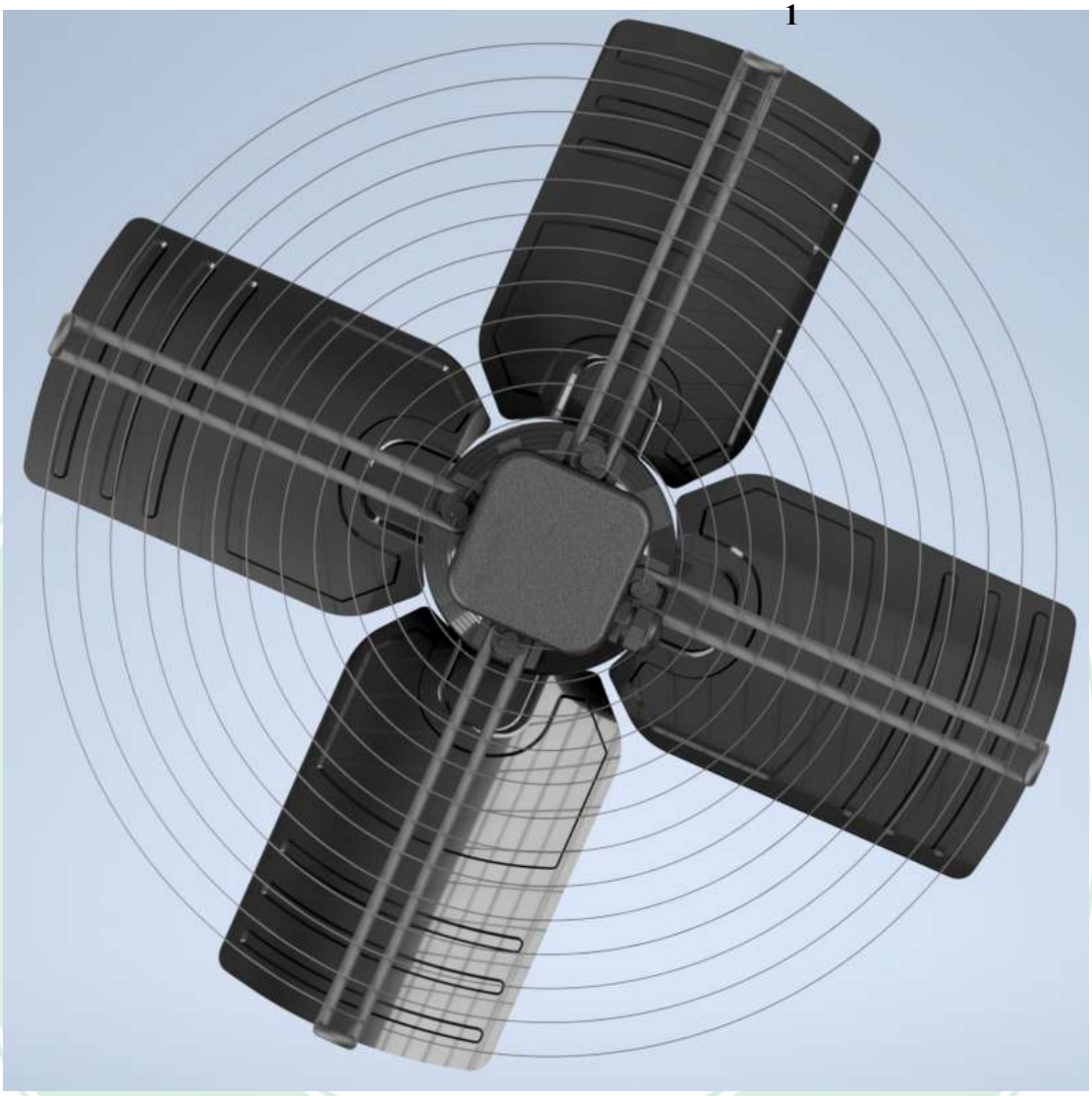


Fig. 23 —— Condenser Fan Assembly - Screw pattern sequence

IX. TROUBLESHOOTING COOLING SYSTEM

Refer to Table 4 for additional troubleshooting topics.

Table 4 —— Troubleshooting

SYMPTOM	CAUSE	SOLUTION
Compressor and Condenser Fan Will Not Start	Power failure	Call power company
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker. Determine root cause
	Defective thermostats, contactor, transformer, control relay, or capacitor.	Replacement component
	Insufficient line voltage	Determine cause and correct
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly
	Thermostat setting too high	Lower thermostat setting below room temperature
	High pressure switch tripped	See problem "Excessive head pressure"
	Low pressure switch tripped	Check system for leaks. Repair as necessary
	Freeze-up protection thermostat tripped	See problem "Suction pressure too low"
Compressor Will Not Star But Condenser Fan Runs	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace
	Compressor motor burned out, seized, or internal overload open	Determine cause. Replace compressor or allow enough time for internal overload to cool and reset
	Defective run/start capacitor, overload, start relay	Determine cause. Replace compressor or allow enough time for internal overload to cool and reset
	One leg of 3 phase power dead.	Replace fuse or reset circuit breaker. Determine cause
Compressor Cycles (Other than Normally Satisfying Thermostat)	Refrigerant overcharge or undercharge	Recover refrigerant, evacuate system, and recharge to nameplate
	Defective compressor	Replace and determine cause
	Insufficient line voltage	Determine cause and correct
	Blocked outdoor coil or dirty air filter	Determine cause and correct
	Defective Run/Start capacitor, overload, start relay	Determine cause and correct
	Defective thermostat	Replace thermostat
	Faulty outdoor fan (cooling) or indoor fan (heating) motor or capacitor	Replace faulty part
	Restriction in refrigerant system	Locate restriction and remove
	Defective loader plug	Determine cause and replace
Compressor Operates Continuously	Dirty air filter	Replace filter
	Unit undersized for load	Decrease load or increase unit size
	Thermostat set too low (cooling)	Reset thermostat.
	Low refrigerant charge	Locate leak, repair and recharge

	Air in system	Recover refrigerant, evacuate system, and recharge
	Outdoor coil dirty or restricted	Clean coil or remove restriction
Compressor Makes Excessive Noise	Compressor rotating in the wrong direction	Reserve the 3 phase power leads as described in Start Up
Excessive Head Pressure	Dirty outside	Replace filter
	Dirty outdoor coil (cooling)	Clean coil
	Refrigerant overcharged	Recover excess refrigerant
	Air in system	Recover refrigerant, evacuate system, and recharge
	Condensing air restricted or air short cycling	Determine cause and correct
Head Pressure Too Low	Low refrigerant charge	Check for leaks, repair and recharge
	Compressor scroll plates defective	Replace compressor
	Restriction in liquid tube	Remove restriction
Excessive Suction Pressure	High heat load	Check for source and eliminate
	Compressor scroll plates defective	Replace compressor
	Refrigerant overcharge	Recover excess refrigerant
Suction Pressure Too Low	Dirty air filter (cooling)	Replace filter
	Dirt or heavily iced outdoor coil (heating)	Clean outdoor coil. Check defrost cycle operation
	Low refrigerant charge	Check for leaks, repair and recharge
	Metering device or low side restricted	Remove source of restriction
	Insufficient indoor airflow (cooling mode)	Increase air quality. Check filter and replace if necessary
	Temperature too low in conditioned area	Reset thermostat
	Field- installed filter drier restricted	Replace
	Outdoor ambient temperature below 40’F (cooling)	Install low ambient kit
	Outdoor fan motor (s) not operating (heating)	Check fan motor operation

X. CONVENIENCE INLETS / OUTLETS

WARNING

ELECTRICAL OPERATION HAZARD
Failure to follow this warning could result in personal injury or death.
Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it.
Lock-out and tag-out this switch, if necessary.

HORIZONTAL AIR DUCTS

NOTE: Only factory -trained service technicians should install, remove and replace units.

Fig. 24 —— Horizontal air duct installation

For horizontal air duct, remove the inlet / outlet covers to connect the supply and return air ducts, using these covers to close the floor inlet / outlet air. See Fig. 24 and 25

Inlet / outlet covers are designed to use both floor supply / return air ducts and vertical supply / return air ducts.

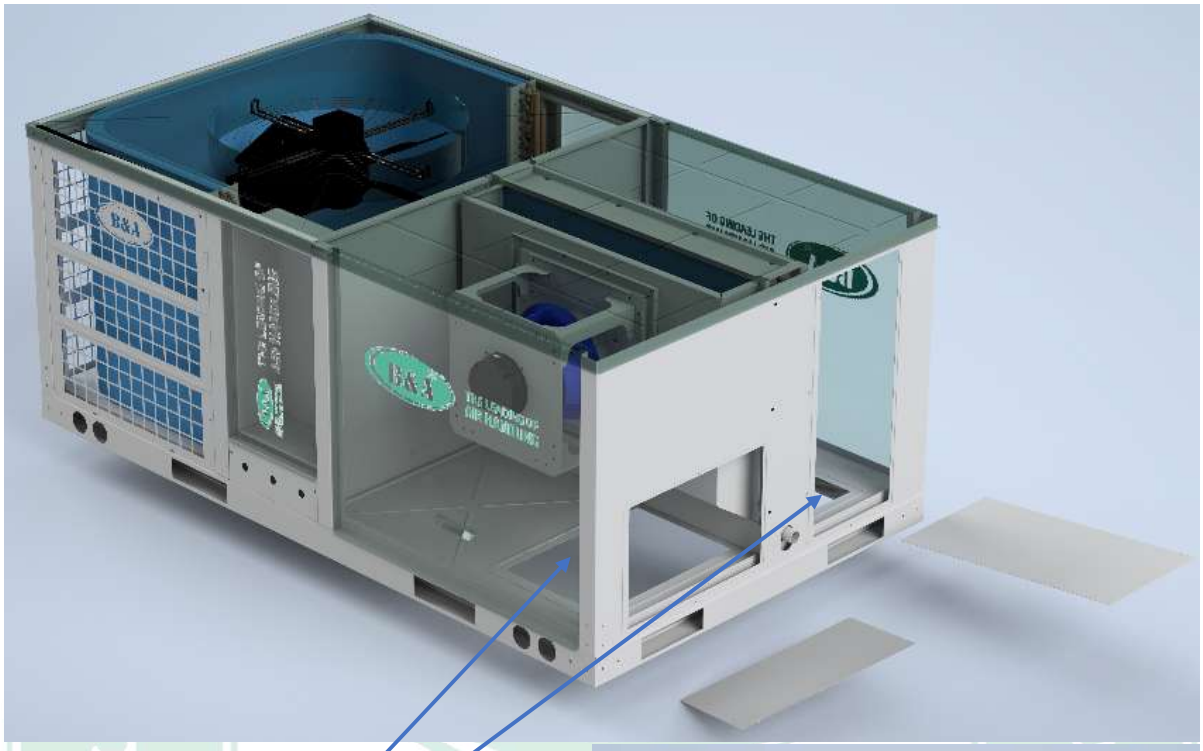


Fig. 25 —— Floor air ducts

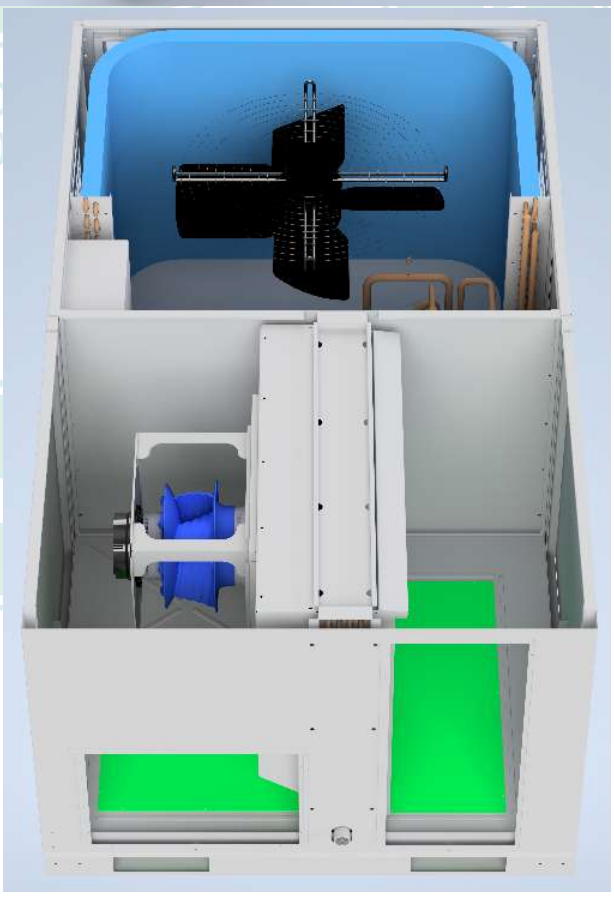


Fig. 26 —— Horizontal air duct installation

FLOOR AIR DUCTS

NOTE: Only factory -trained service technicians should install, remove and replace units.

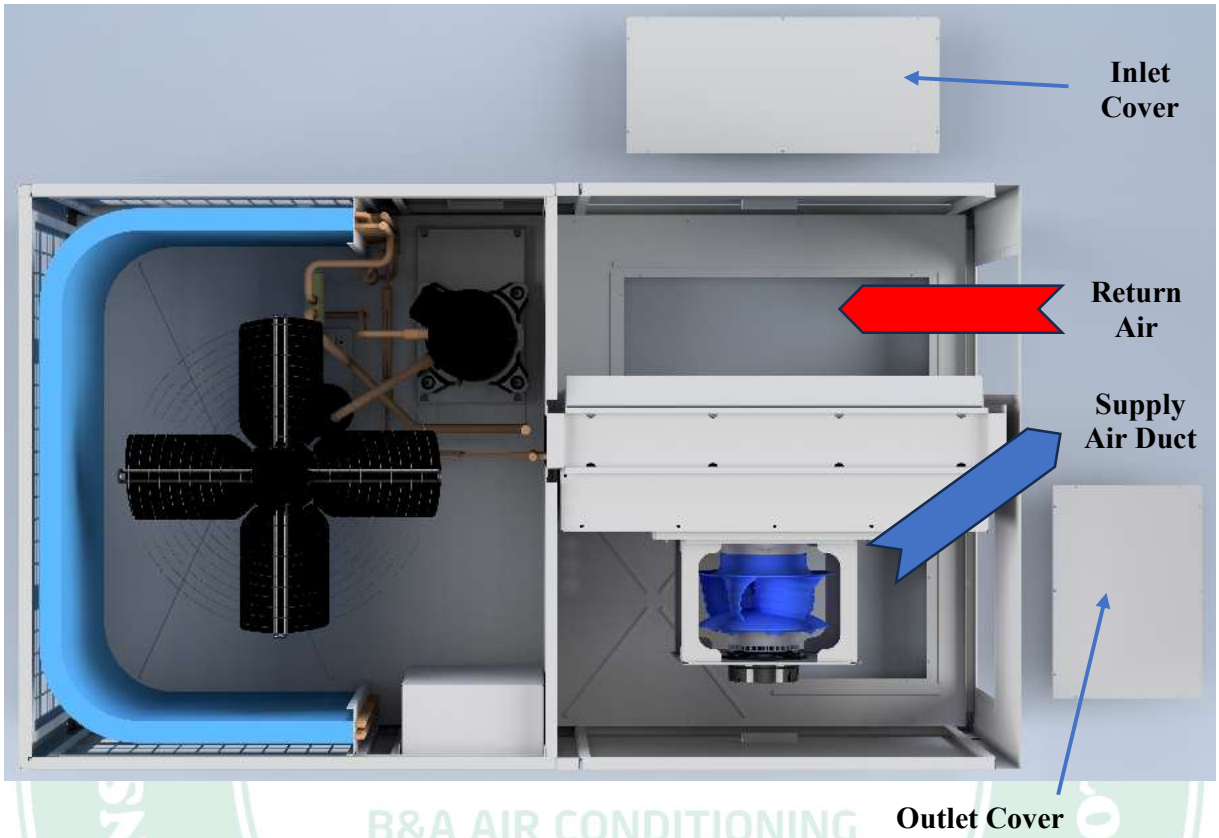
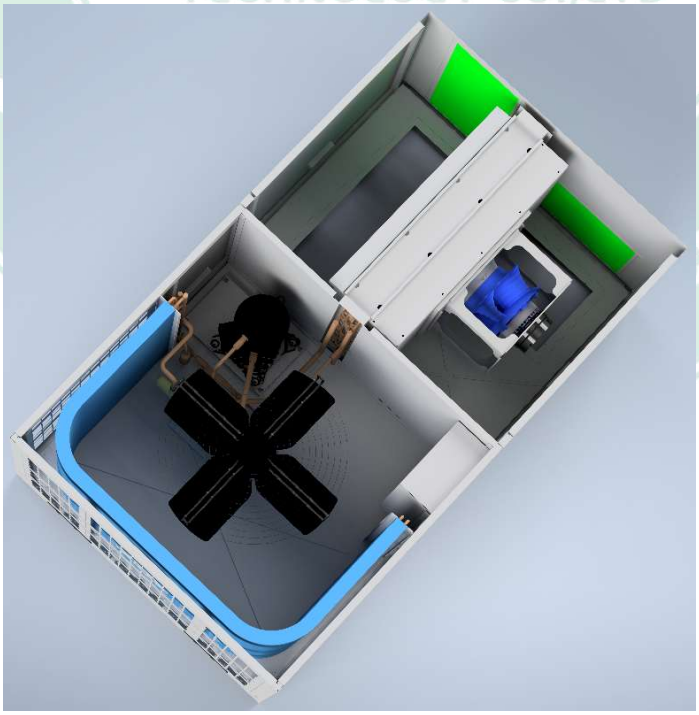


Fig. 27 - 28 —— Floor air duct installation



For floor air ducts, remove the floor inlet / outlet covers to connect the supply and return air ducts, using these covers to close the vertical inlet / outlet air. See Fig. 27 and 28

Inlet / outlet covers are designed to use both floor supply / return air ducts and vertical supply / return air ducts.

XI. ELECTRIC CONNECTION

WARNING

ELECTRICAL OPERATION HAZARD
Failure to follow this warning could result in personal injury or death.
Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it.
Lock-out and tag-out this switch, if necessary.

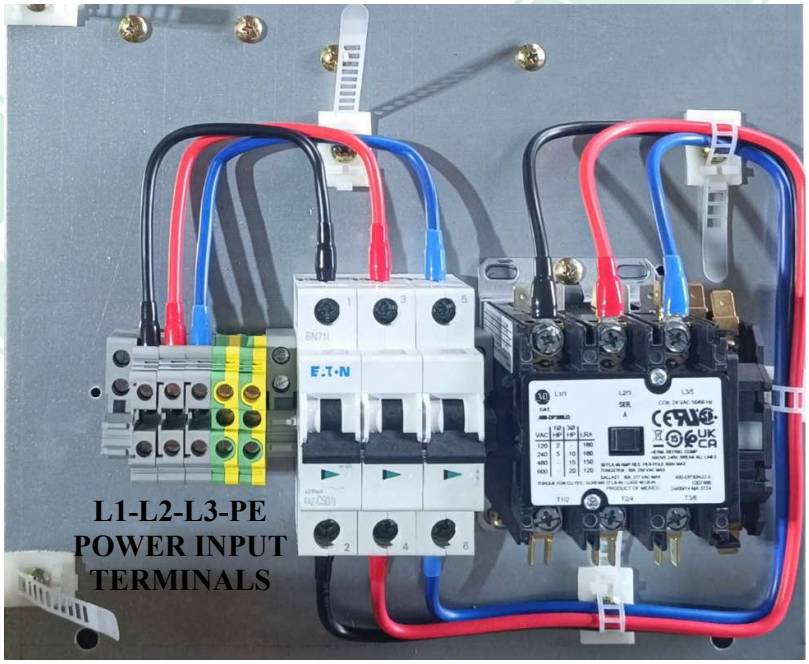
POWER CONNECTION

Connect 4 wire L1, L2, L3, PE to power input terminals. See Fig. 29. Check the power rating of machine's nameplate to connect 220V – 3 phase – 60Hz or 460V – 3 phase – 60Hz.

Please check the model and select the correct fixed wires as the Table 5.

Model	Nominal cross-sectional wires	
	(mm2)	(AWG/MCM)
RTUBA050HPM2	4.0	10
RTUBA050HPM4	4.0	10
RTUBA075HPM2	10.0	8
RTUBA075HPM4	4.0	10
RTUBA100HPM2	10.0	6
RTUBA100HPM4	4.0	10

Fig. 29 —— Power connections



COMPRESSOR ROTATION

NOTE: When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

⚠ WARNING

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution can result in premature wear and damage to equipment.

Scroll compressors can only compress refrigerant if rotating in the right direction. Reverse rotation for extended times can result in internal damage to the compressor. Scroll compressors are sealed units and cannot be repaired on site location.

On 3-phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

NOTE: If the suction pressure does not drop and the discharge pressure does not rise to normal levels, the evaporator fan is probably also rotating in the wrong direction.

4. Turn off power to the unit.
5. Reverse any two of the three unit power leads.
6. Reapply electrical power to the compressor. The suction pressure should drop and the discharge pressure should rise which is normal for scroll compressors on start-up.
7. Replace compressor if suction/discharge pressures are not within specifications for the specific compressor.

The suction and discharge pressure levels should now move to their normal start-up levels.

THERMOSTAT CONNECTION

Connect thermostat wires to Control board terminals. See Fig. 30. Check the use manual of thermostat to select wires with single speed or multi speeds.

Thermostat terminal: C – R – Y1 – W1 – G – Y2 -W2 – Y3 -W3 compliant to all types
See table 5 for thermostat pinout

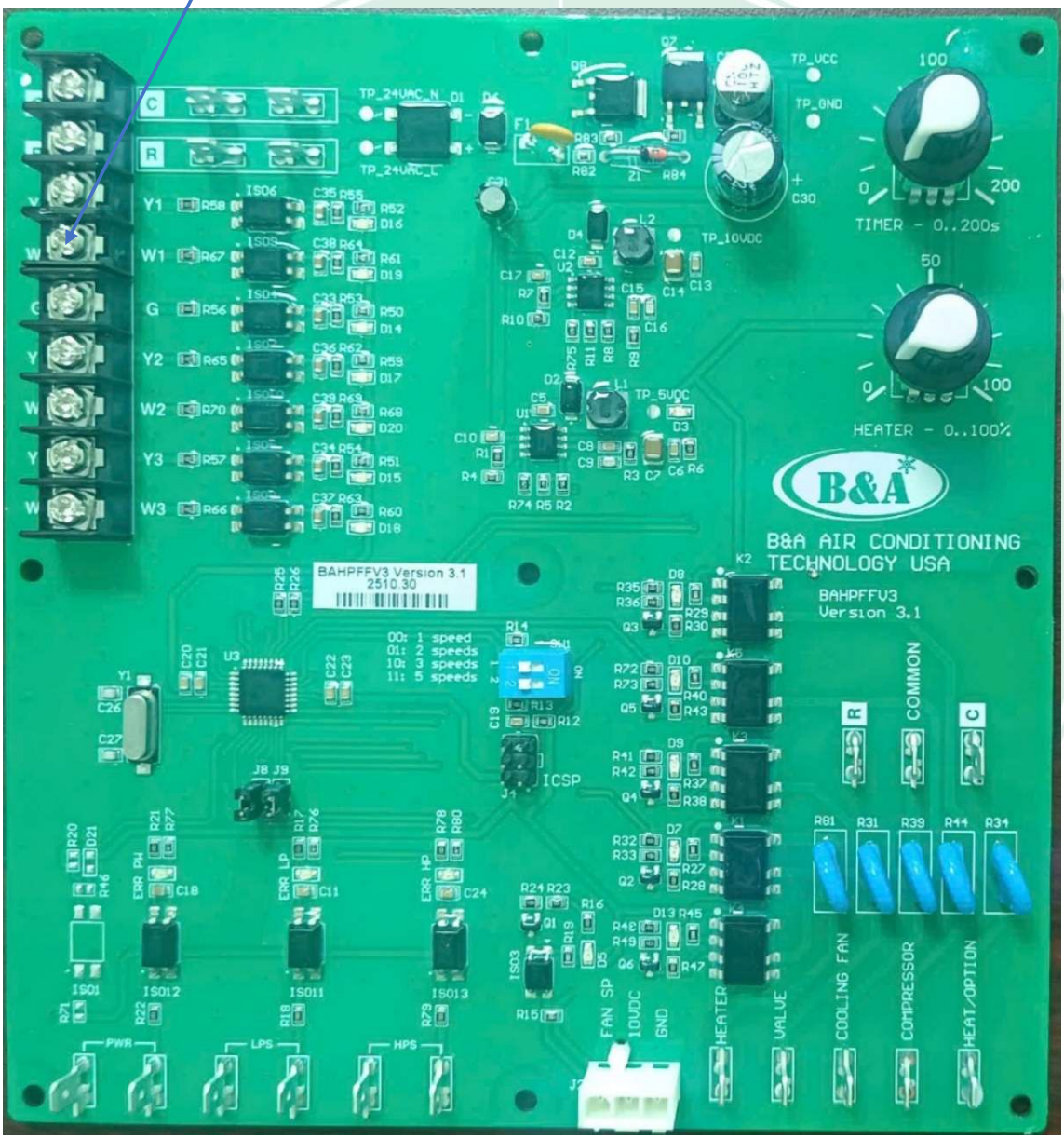


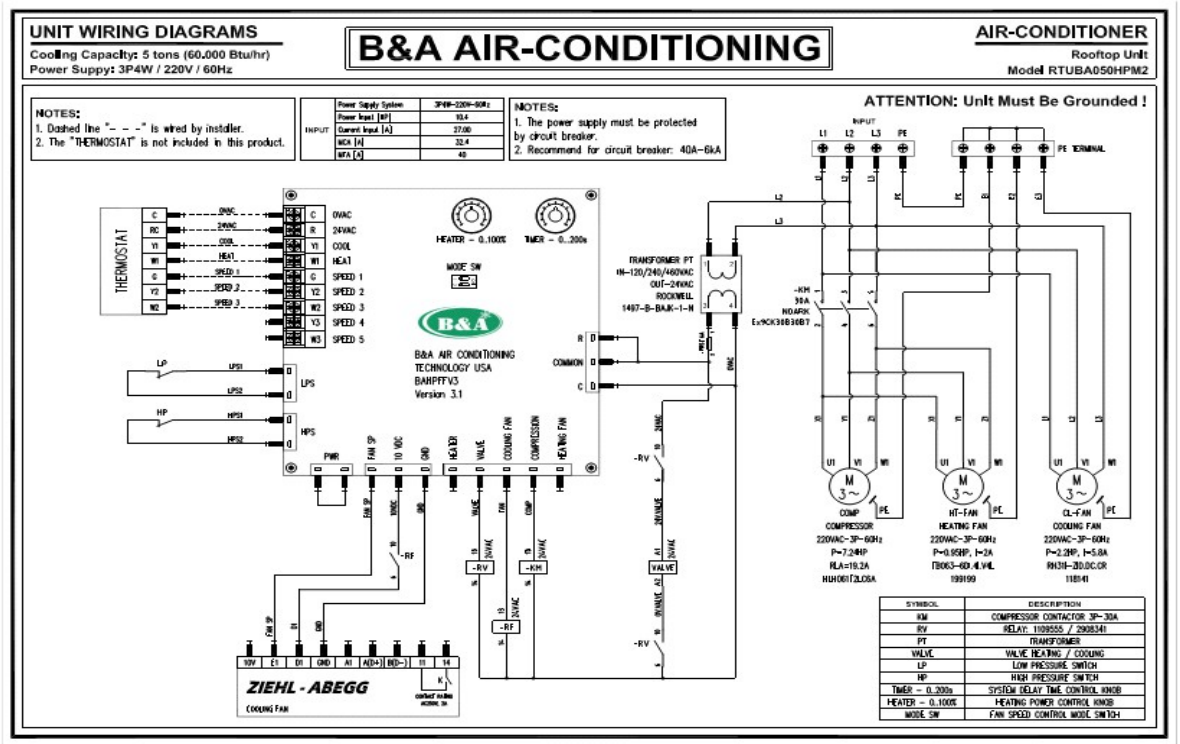
Fig. 30 —— Thermostat connections

Table 6 —— Thermostat connections

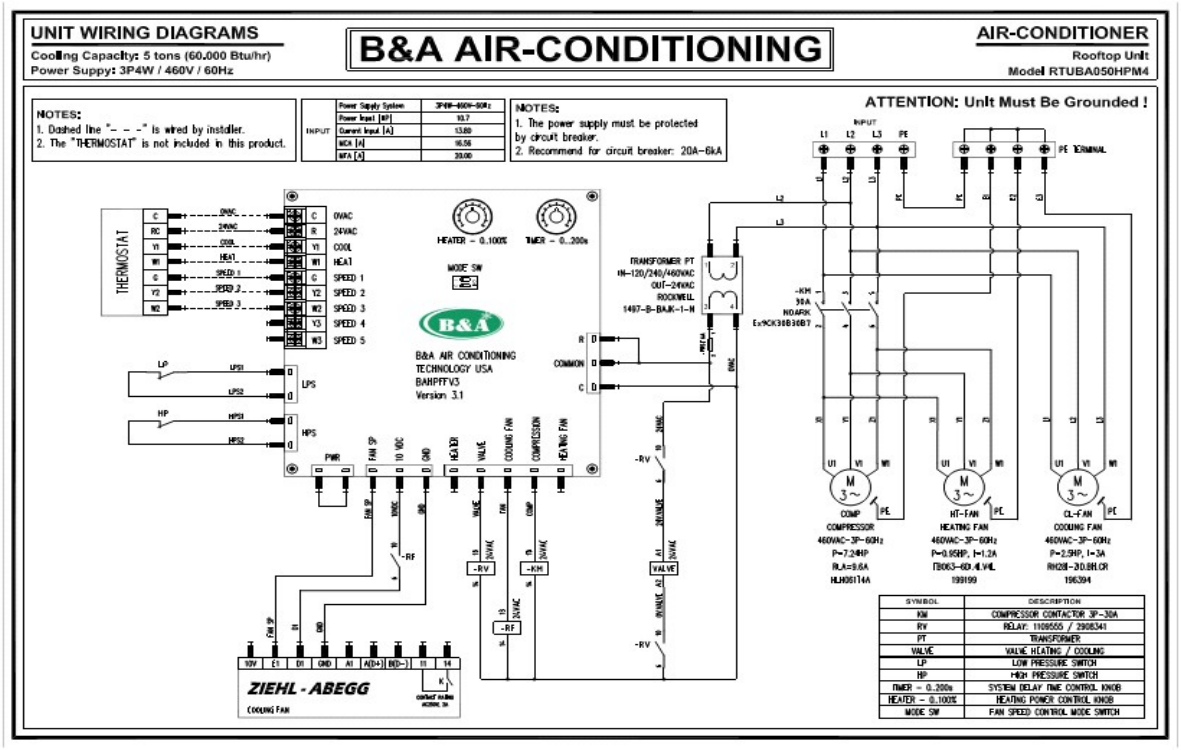
Signal	Mode	Function	Voltage
C	Power	Control power 24VAC 50/60Hz	24VAC
R	Power	Control power 0VAC 50/60Hz	0VAC
Y1	Cool	Cooling mode	24VAC
W1	Heat	Heat pump mode	24VAC
G	Single Fan Speed	Fan Speed	24VAC
G	Two Speed Fan (Low-High)	Low Fan Speed	24VAC
Y2		High Fan Speed	24VAC
G	Three Speed Fan (Low-Mid-High)	Low Fan Speed	24VAC
Y2		Mid Fan Speed	24VAC
W2		High Fan Speed	24VAC
G	Five Speed Fan (Low2-Low1-Mid-High1-High2)	Low 2 Fan Speed	24VAC
Y2		Low 1 Fan Speed	24VAC
W2		Mid Fan Speed	24VAC
Y3		High 1 Fan Speed	24VAC
W3		High 2 Fan Speed	24VAC

ELECTRIC DRAWING

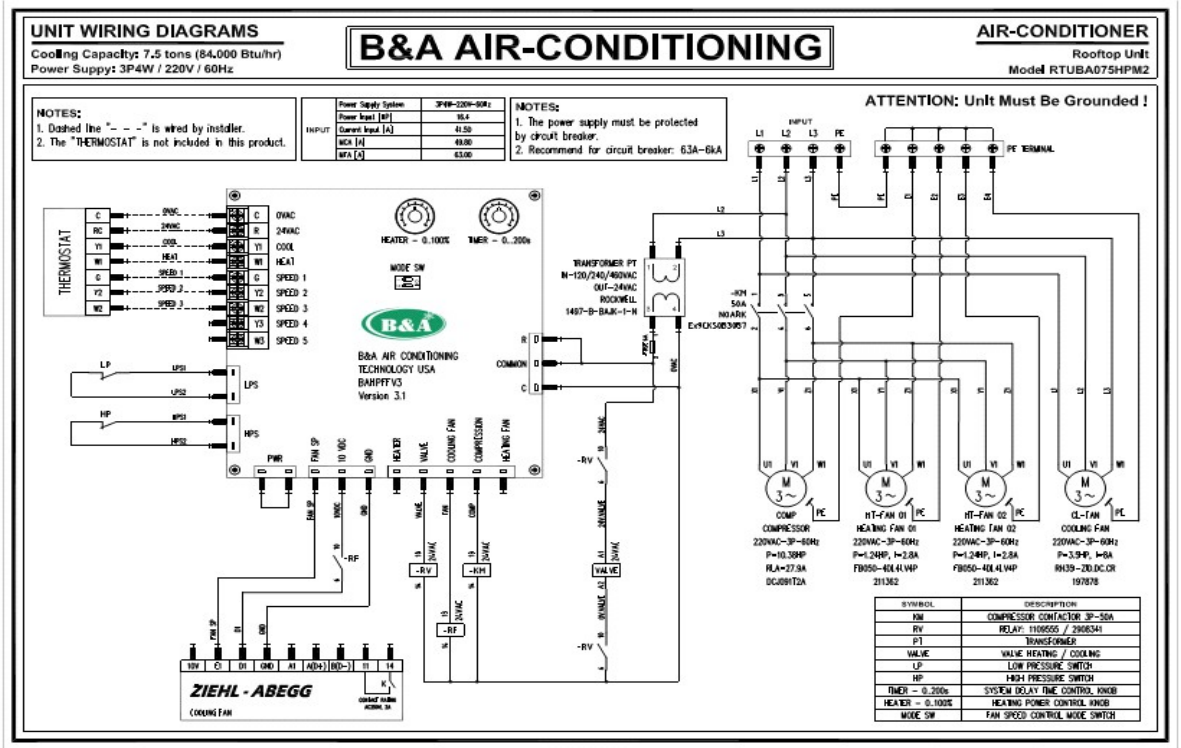
Model: RTUBA050HPM2



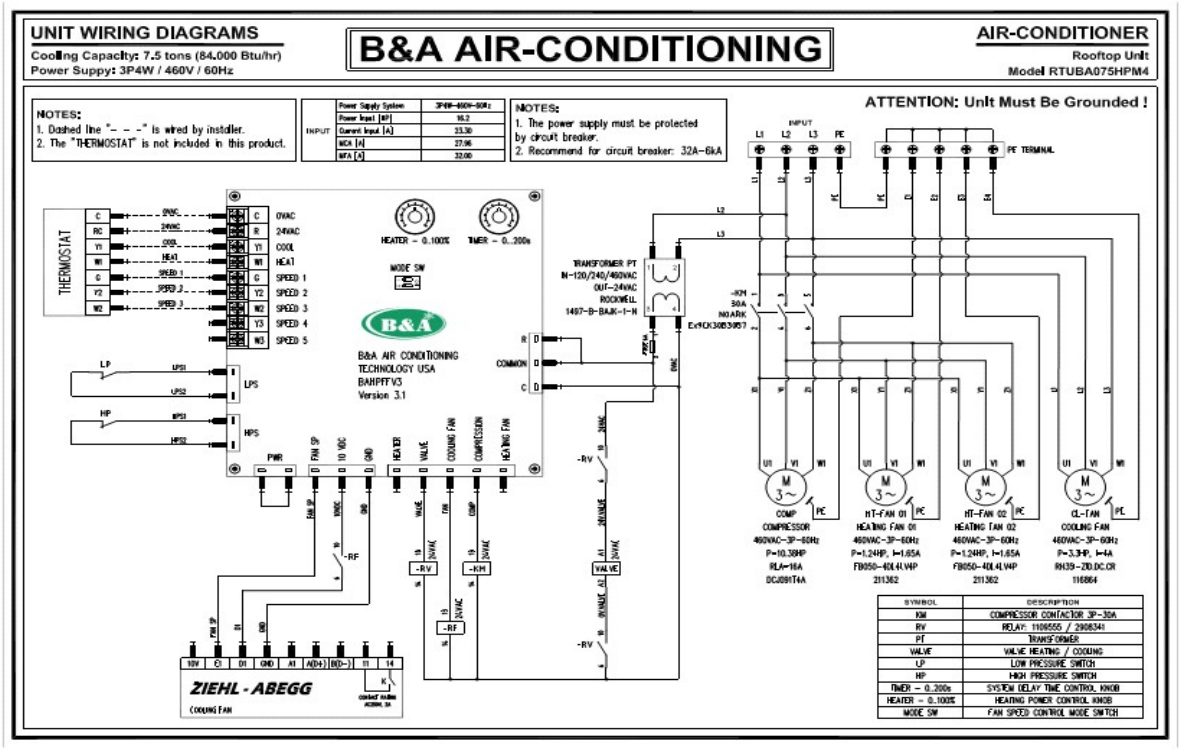
Model: RTUBA050HPM4



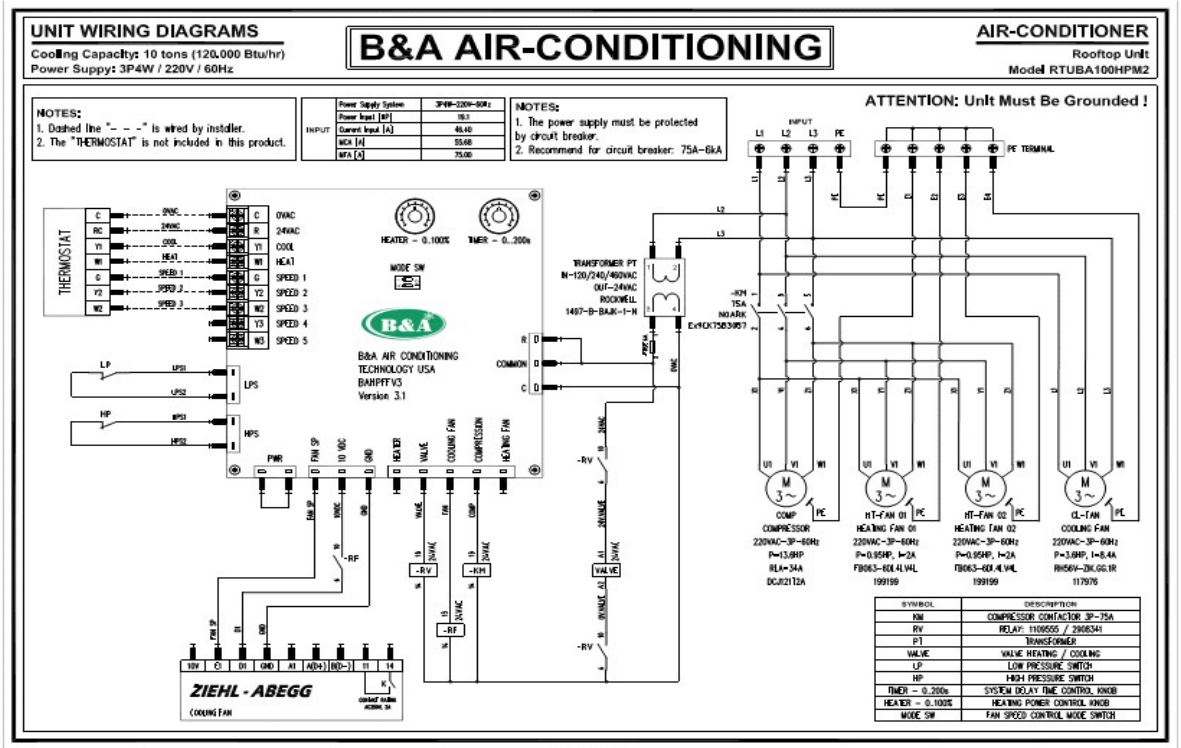
Model: RTUBA075HPM2



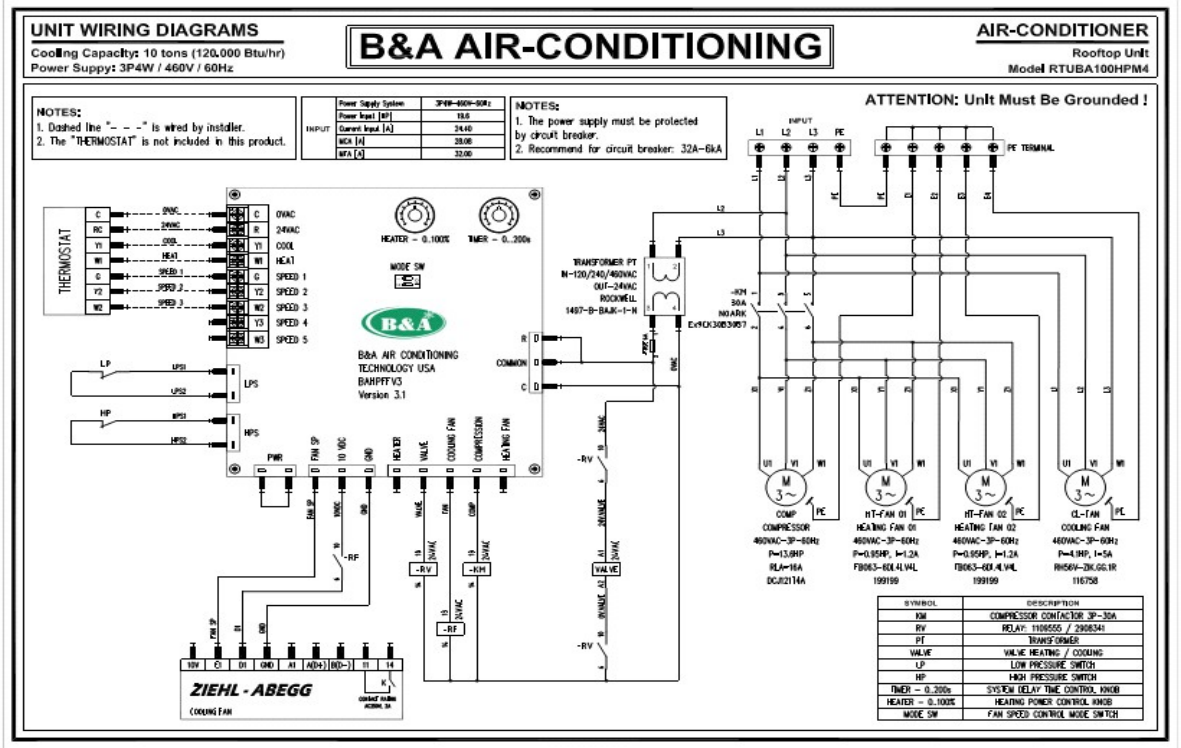
Model: RTUBA075HPM4



Model: RTUBA100HPM2



Model: RTUBA100HPM4



XII. APPENDIX A — MODEL NUMBER NOMENCLATURE

Product name:
RTU: Rooftop Unit

Product of B&A Factory

Cooling / Heat pump Capacity
050 : 5 tons
075 : 7.5 tons
100 : 10 tons
150 : 15 tons

Type of product:
Heat pump

Type of Compressor:
M : Mono
I : Inverter

Power supply:
2 : 220V, 3 phases
4 : 460V, 3 phases

XIII.APPENDIX B — PHYSICAL DATA

Physical Data \ Model	RTUBA050HPM2 RTUBA050HPM4
REFRIGERATION SYSTEM	
No. Compressors/Stage/Type	1 / 1 / Scroll
Opteon™ XL41(R-454B) Charge A/B (lb)	8-9
High-Pressure Trip / Reset (psig)	638 / 493
Low-Pressure Trip / Reset (psig)	20 / 43
EVAPORATOR COIL	
Material (Tube / Fin)	Cu / Al
Coil Type (in. RTPF)	3/8
Rows / FPI	4 /24
Total Face Area (ft square)	5.36
Condensate Drain Connection Size (in.)	1 – 1/3
CONDENSER COIL	
Material (Tube / Fin)	Cu / Al
Coil Type (in. RTPF)	3/8
Rows / FPI	4 /24
Total Face Area (ft square))	15.65
CONDENSER FAN	
Qty / Motor Drive Typ	1 / Direct
Motor HP / rpm	0.95 / 1060
Fan Diameter (in.)	24.8
EVAPORATOR FAN	
Motor Qty / Drive Type	1 / Direct
Maximum Cont HP	2.2 / 2.5
Rpm Range	750-2670
Fan Diameter (in.)	13.86
FILTERS	
RA Filter Qty / Size (in.)	2 / 24.6 x 15.8 x 1.8
OVERALL DIMENSION	
Weight (lb)	573
Dimension (WxHxD) (in.)	80.7 x 48.8 x 35.6
Physical Data \ Model	**RTUBA075HPM2 RTUBA075HPM4**
REFRIGERATION SYSTEM	
No. Compressors/Stage/Type	1 / 1 / Scroll
Opteon™ XL41(R-454B) Charge A/B (lb)	10-12
High-Pressure Trip / Reset (psig)	638 / 493
Low-Pressure Trip / Reset (psig)	20 / 43
EVAPORATOR COIL	
Material (Tube / Fin)	Cu / Al
Coil Type (in. RTPF)	3/8
Rows / FPI	4 /43
Total Face Area (ft square)	11.57
Condensate Drain Connection Size (in.)	1 – 1/3

CONDENSER COIL Material (Tube / Fin) Coil Type (in. RTPF) Rows / FPI Total Face Area (ft square))	 Cu / Al 3/8 2 /48 27.986
CONDENSER FAN Qty / Motor Drive Typ Motor HP / rpm Fan Diameter (in.)	 2 / Direct 1.24 / 1430 21.7
EVAPORATOR FAN Motor Qty / Drive Type Maximum Cont HP Rpm Range Fan Diameter (in.)	 1 / Direct 3.3.~3.5 750-3130 13.86
FILTERS RA Filter Qty / Size (in.)	 4 / 15 x 20 x 1.8
OVERALL DIMENSION Weight (lb) Dimension (WxHxD) (in.)	 1032 88.9 x 59.8 x 52.1
Model / **Physical Data**	**RTUBA100HPM2** **RTUBA100HPM4**
REFRIGERATION SYSTEM No. Compressors/Stage/Type **Opteon™** XL41(R-454B) Charge A/B (lb) High-Pressure Trip / Reset (psig) Low-Pressure Trip / Reset (psig)	 1 / 1 / Scroll 10-12 638 / 493 20 / 43
EVAPORATOR COIL Material (Tube / Fin) Coil Type (in. RTPF) Rows / FPI Total Face Area (ft square) Condensate Drain Connection Size (in.)	 Cu / Al 3/8 4 /43 12.73 1 – 1/3
CONDENSER COIL Material (Tube / Fin) Coil Type (in. RTPF) Rows / FPI Total Face Area (ft square))	 Cu / Al 3/8 2 /48 31.11
CONDENSER FAN Qty / Motor Drive Typ Motor HP / rpm Fan Diameter (in.)	 2 / Direct 0.95 / 1060 24.8
EVAPORATOR FAN Motor Qty / Drive Type Maximum Cont HP Rpm Range Fan Diameter (in.)	 1 / Direct 3.6~4.1 750-2670 13.86
FILTERS RA Filter Qty / Size (in.)	 4 / 20 x 20 x 1.8

OVERALL DIMENSION Weight (lb) Dimension (WxHxD) (in.)	 1481 88.9 x 59.8 x 52.1