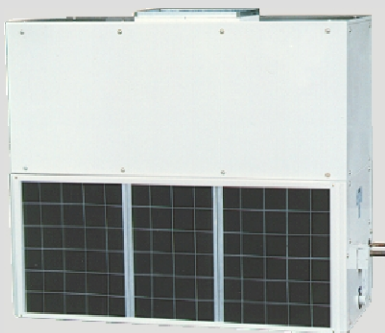


DUNHAM-BUSH
Products that perform...By people who care



**INSTALLATION,
OPERATION &
MAINTENANCE
MANUAL**

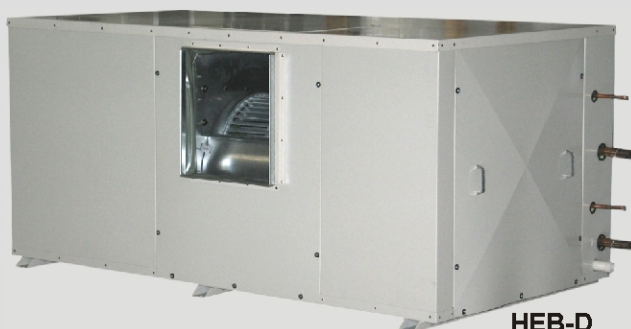
**Air - Cooled
Split System
Air Conditioner
with Scroll
Compressors**



VEB-D



ACCS



HEB-D

50 Hz

R22 / R407C

- **COOLING**
- **HEAT PUMP**

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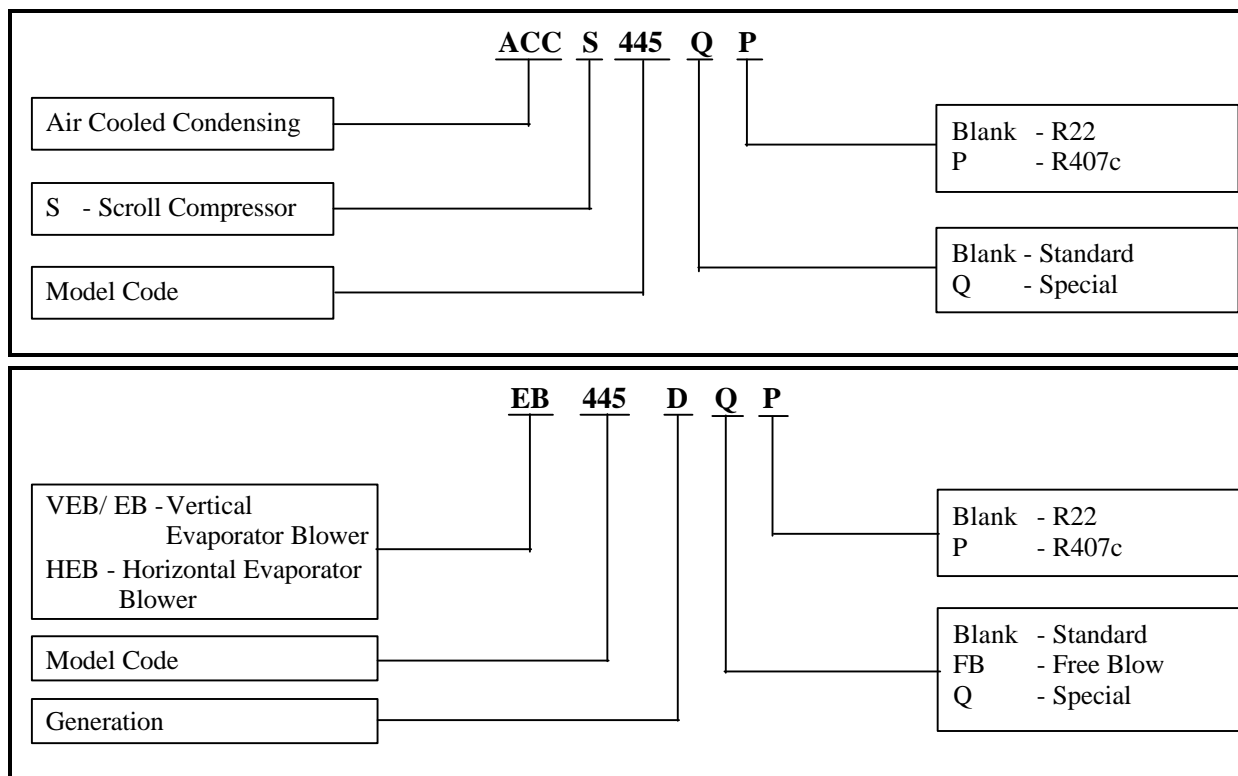
1.0 INTRODUCTION

The Dunham-Bush air-cooled split system air conditioner and heat-pumps are designed, matched, manufactured tested and ready for installation when it reached the site. The evaporator unit consists mainly of a direct expansion evaporator coil(s) with factory package thermal expansion valve, to be coupled with air cooled condenser unit consisting of scroll compressor(s) and large heat rejection condenser coil with integral subcooling circuit(s). Factory standard units also incorporate important safety and operating controls which includes manual reset high and low pressure cutout and compressor motor protectors for each compressor(s).

Every Dunham-Bush air-cooled split air-conditioner and heat pumps have been subject to stringent quality control and accurately testing as a final verification of reliability. If it is correctly installed, operated and maintained, it will provide many years of satisfactory and efficient performance.

Note: These instructions are general in nature and are for standard units only. Non-standard units may vary in some respects from these instructions to suit particular applications.

1.1 NOMENCLATURE



2.0 GENERAL INFORMATION

2.1 RECEIVING, INSPECTION AND PACKAGING

As soon as the unit is received, it should be inspected if there is any damage during transit. Make a separate written request if there is any damage on the carrier's delivery order. Also, the unit should be inspected for any missing or short shipped components. Standard items and accessories that come with the unit are:

2.1.1 AIR-COOLED CONDENSING UNITS (ACCS)

- 1.) Compressor(s) c/w rubber grommet.
- 2.) Condenser coil(s).
- 3.) Condenser fan(s)- Refer to physical data for sizes and quantity.
- 4.) Condensers fan motor(s)- Refer to physical data for horsepower and quantity.
- 5.) Fan grille.
- 6.) High and Low pressure switch.
- 7.) Reversing valve, check valve suction accumulator and compressor crankcase heater (standard for heat pump only).
- 8.) Optional accessories (if any).
 1. IEC-DOL (Direct On Line) starter, wired
 2. Low ambient fan cycling (standard for Heat-Pump).
 3. Hot gas bypass
 4. Stop valves
 5. Mains isolator
 6. Hydrophilic condenser coil fins (standard for Heat Pump)
 7. Indicator lights
 8. Stainless steel bolts and nuts

2.1.2 EVAPORATOR BLOWER UNITS (HEB-D/ VEB-D/ EB-D)

- 1.) Blower(s) wheel.
- 2.) Evaporator coil.
- 3.) Thermal expansion valve(s) and distributor(s).
- 4.) Bearings and shaft.
- 5.) Optional accessories.
 1. Double wall casing
 2. Hot water heating coil
 3. Electric heater coil
 4. Thermostat, unit mounted for cooling only

5. Thermostat, remotely mounted for cooling only and heat pump
6. Discharge plenum and return air grille

2.2 RIGGING AND UNCRATING

Each unit has been tested, inspected and properly packed or crated prior to delivery. It is very important that precaution is taken in handing the units by the installers, movers and riggers. When lifting with slings, use spreader bars across the top of the unit to prevent any damage to the frame and panels. Rigging should be done in a manner to avoid any severe strain or stress on the unit which will scratch the paint works and damage the panels and framework. Avoid possible surface damage by not removing the packaging material until the unit is at or near the final location and soon to be installed. Check the weight of the unit before rigging. Place the rigging cable such that the weight is evenly distributed.

2.3 LIMITATIONS

- 1.) Avoid low return air temperature on evaporator coil which might cause condensate to freeze up the surface of the evaporator coil.
- 2.) Avoid moisture carry over and excessive noise, limit evaporator coil face velocity to 3.05 m/s [600FPM].
- 3.) Unit must be operated on the correct electrical supply as specified on unit nameplate. Voltage limitation for compressor(s) and fan motor must be observed.
- 4.) Avoid low return air temperature on the condensing coil which might cause low discharge pressure (heat pump unit is equipped with fan cycling to maintain the head pressure). Refer to Table 2.3.

TABLE 2.3 LIMITATION (AIR TEMPERATURE °F[°C])

		DB	WB
INDOOR	MAX.	95 [35]	72 [22]
	MIN.	66 [19]	57 [14]
OUTDOOR	MAX.	115 [46]	-
	MIN.	66 [19]	-

3.0 INSTALLATION

3.1 CONDENSING UNITS INSTALLATION

In installing the condensing units, considerations should be given to the following:

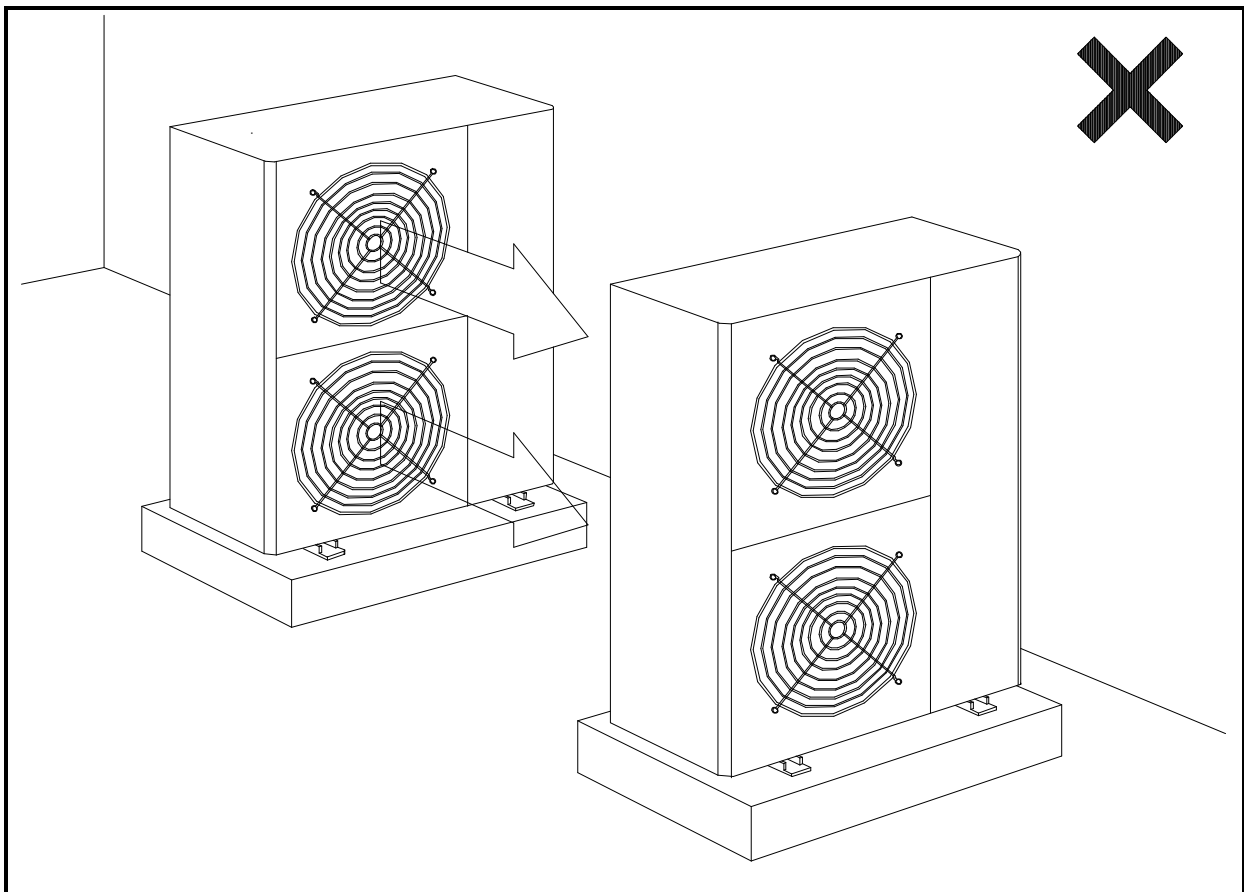
- 1.) Installed outside the building or ensure sufficient air to the condenser.
- 2.) Strong foundation to withstand the unit's weight and vibration. If the base was not leveled, use concrete blocks as base. It is also suggestable to provide rubber or spring isolators to isolate the units vibration.
- 3.) Sufficient space for wiring and maintenance as per local legislation.
- 4.) Location where air is allowed to circulate.

If installing two units together, make sure that the discharge air from one unit were not circuited by the other unit. (Figure 3.1.)

- 5.) Location where there is no direct heat source such as near a generator. This is because if the entering air temperature is high, then the unit will operate at high condensing temperature and subsequently trip on high pressure (during cooling mode).
- 6.) Location where the unit is not exposed to oily area, salty atmosphere, and sulphide gaseous area.

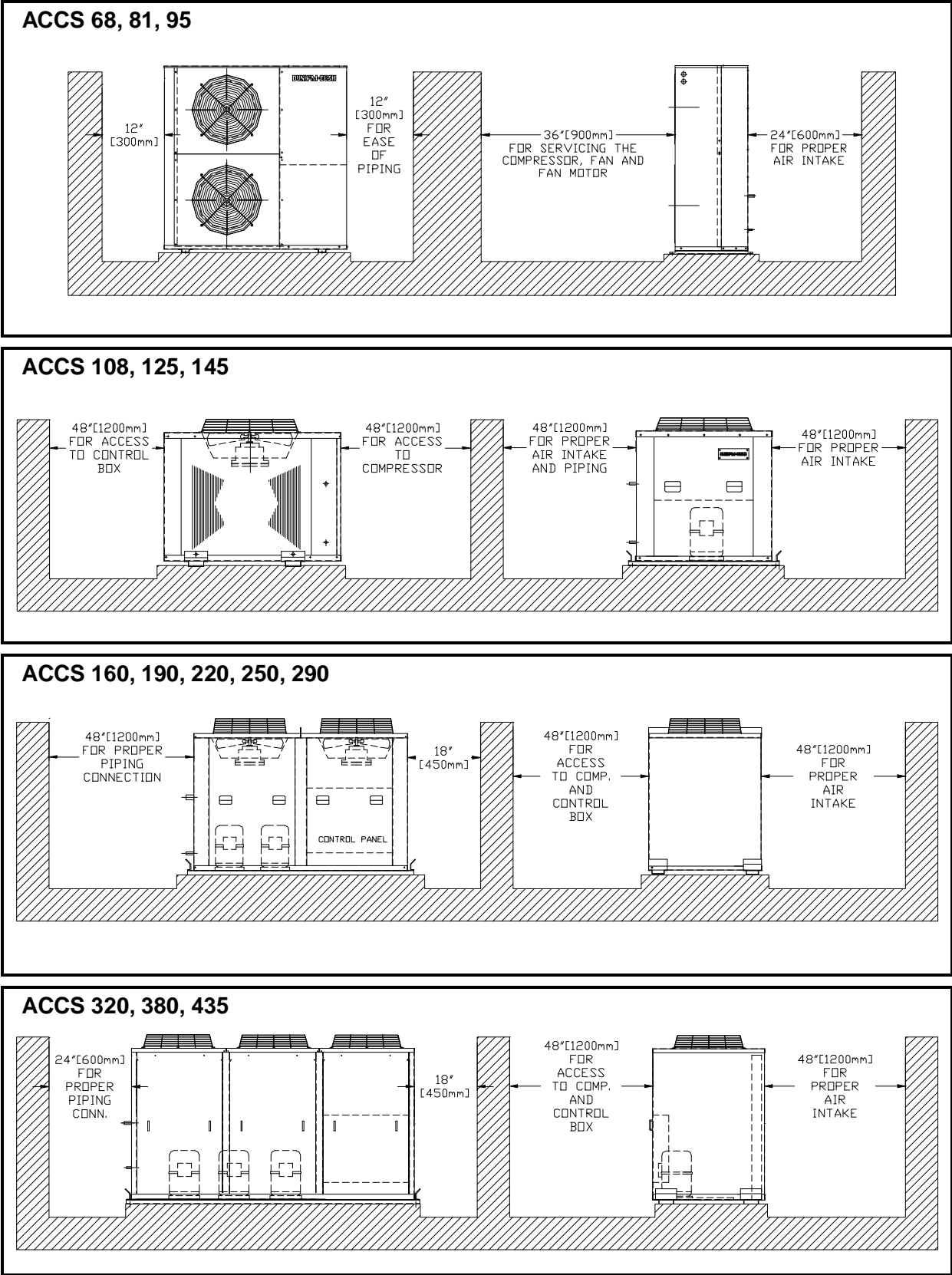
Note: Condenser fans are of the propeller type and not suitable for use with ductwork.

FIGURE 3.1: INSTALLING TWO UNITS TOGETHER



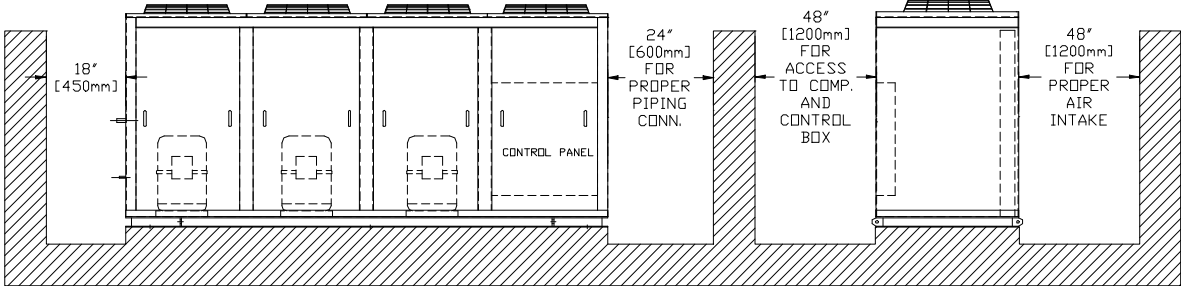
3.0 INSTALLATION

3.2 AIR-COOLED CONDENSING UNITS CLEARANCE (SUGGESTED)

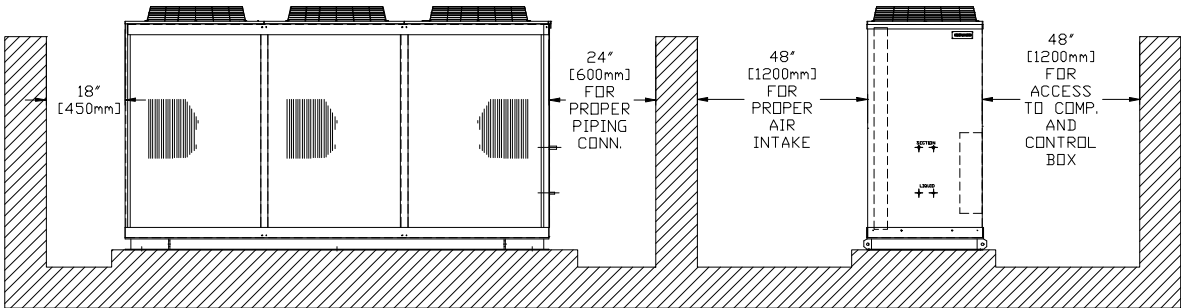


3.0 INSTALLATION

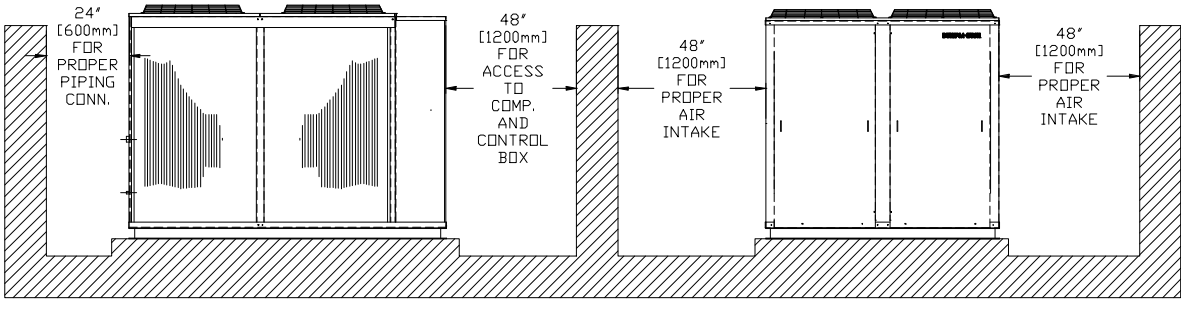
ACCS 480, 510, 570



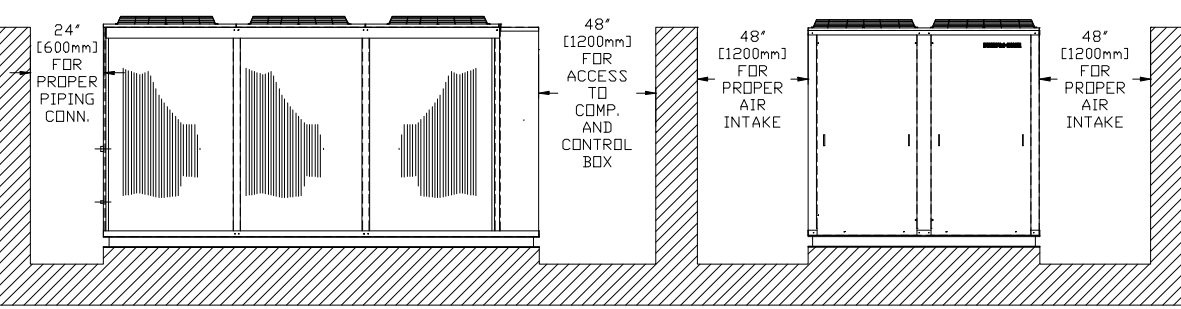
ACCS 640, 700, 760



ACCS 800, 890, 960



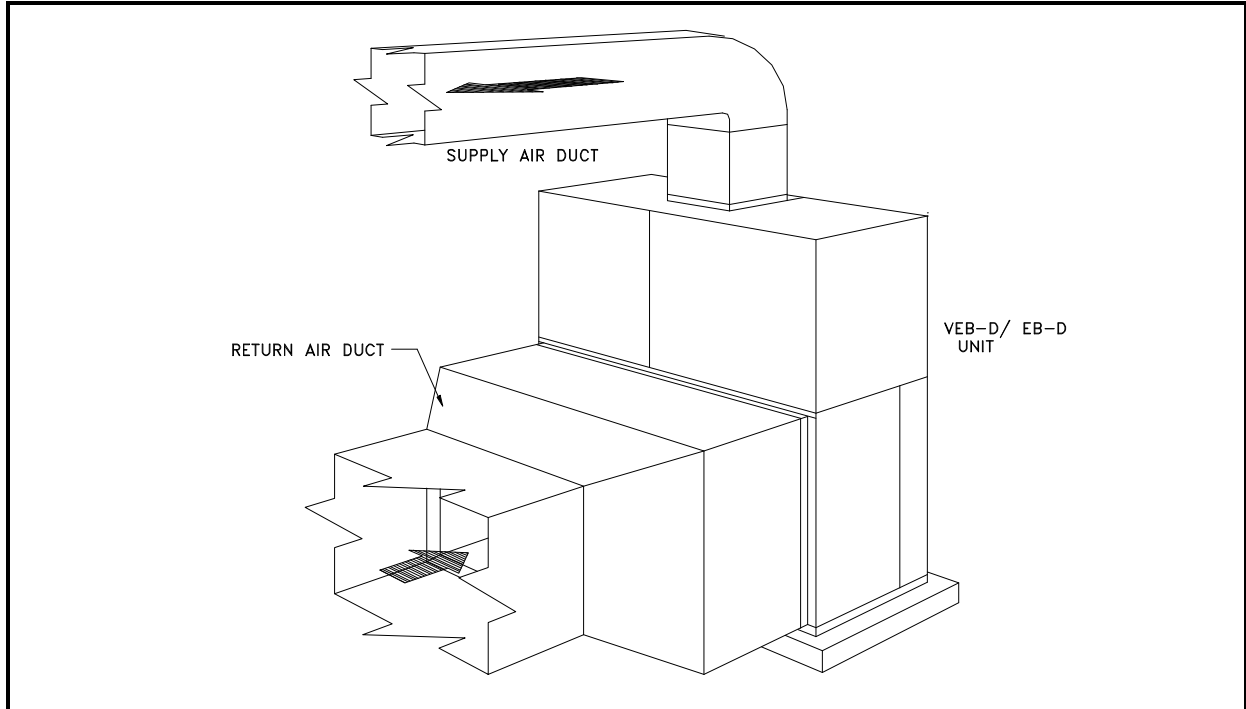
ACCS 1020, 1140, 1340, 1520



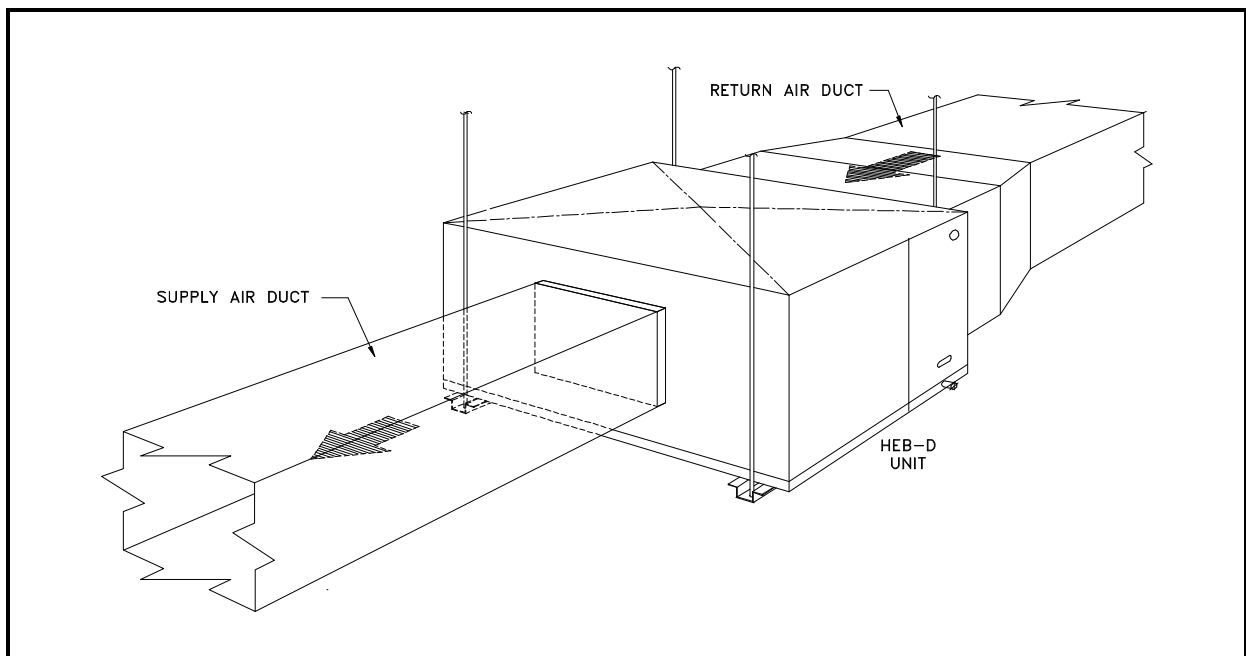
3.0 INSTALLATION

3.3 EVAPORATOR BLOWER UNITS INSTALLATION

3.3.1 TYPICAL VEB-D / EB-D DUCTING SYSTEM



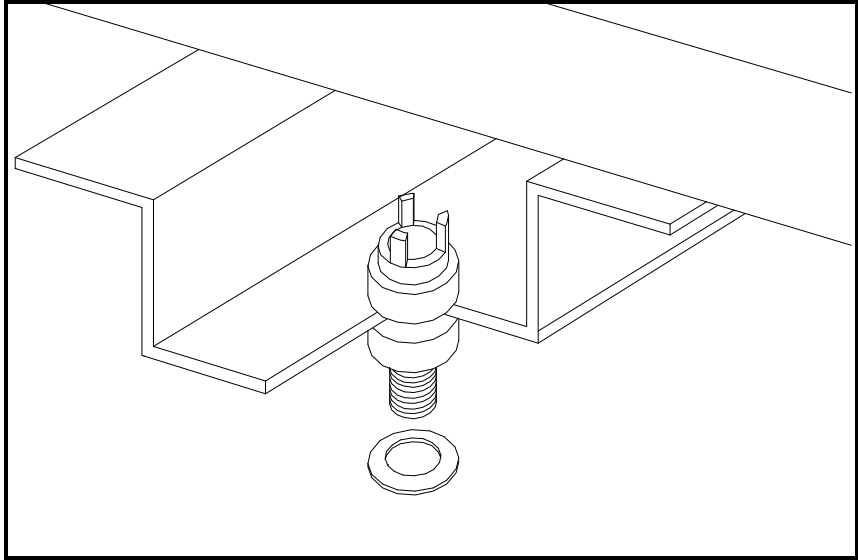
3.3.2 TYPICAL HEB-D DUCTING SYSTEM



Leave the unit in its packaging until it reaches the final destination. This unit is designed for indoor installation only. In installing the unit, these suggestions should be given consideration so that the unit will operate with optimum capacity and also to ease the installation and future services.

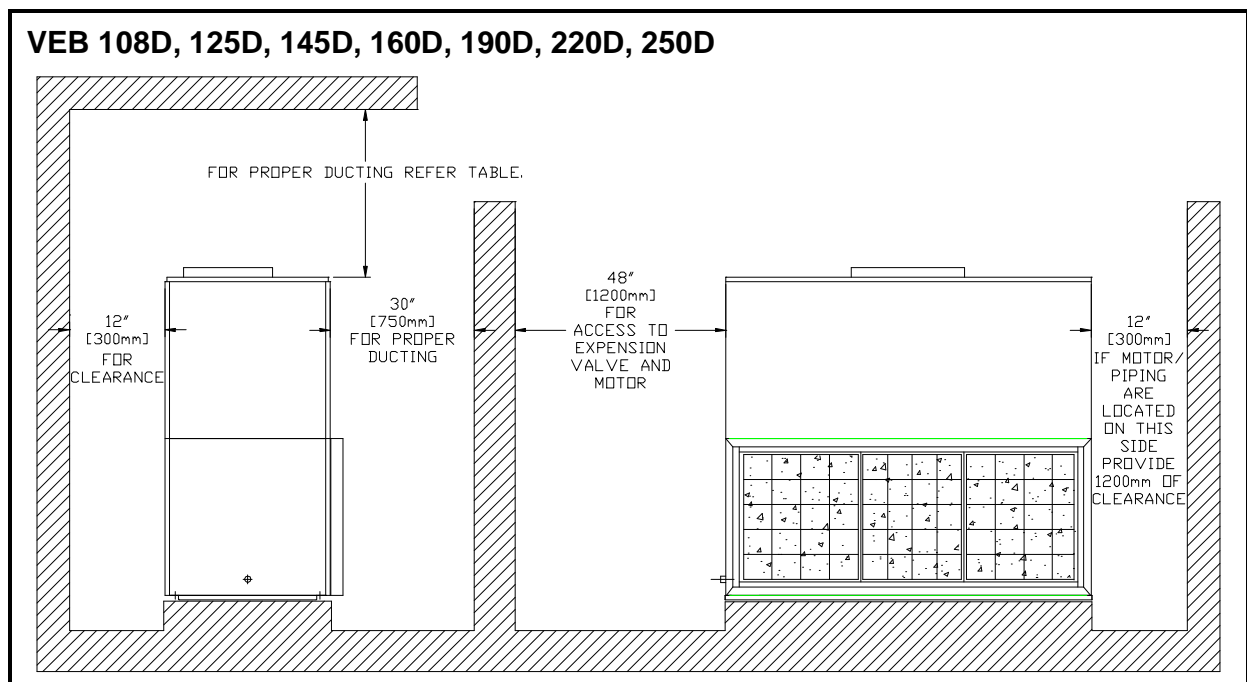
3.0 INSTALLATION

- 1.) Location that can withstand the unit's weight.
 - a.) Sometimes it is necessary to reinforce the ceiling with crossbeam or framework.
 - b.) Use suspension bolts to install the unit and make sure the bolts can withstand the weight distribution.
- 2.) Location that minimize the drain piping and field piping distance.
- 3.) Location that minimize the ducting length.
- 4.) Location where there is no direct heat and air is allowed to circulate.
- 5.) It is suggestable to place the unit higher than the floor level, for ease of drain piping. The base should be 4" [100mm] higher and leveled. Fix the unit to the base with anchor bolts. It is also suggestable to place vibrating isolation component between the unit and the base.
- 6.) Check the levelness of the ceiling using a level gauge.



3.4 EVAPORATOR BLOWER UNITS CLEARANCE

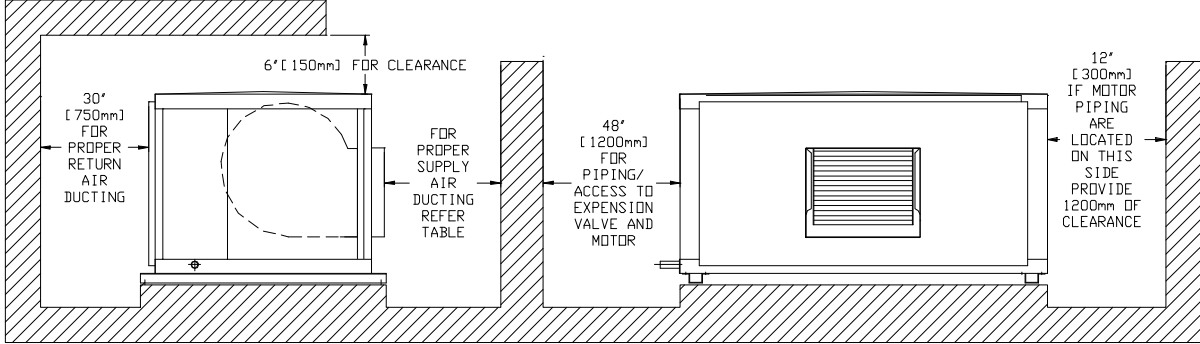
3.4.1. VERTICAL CASING TYPE- VEB



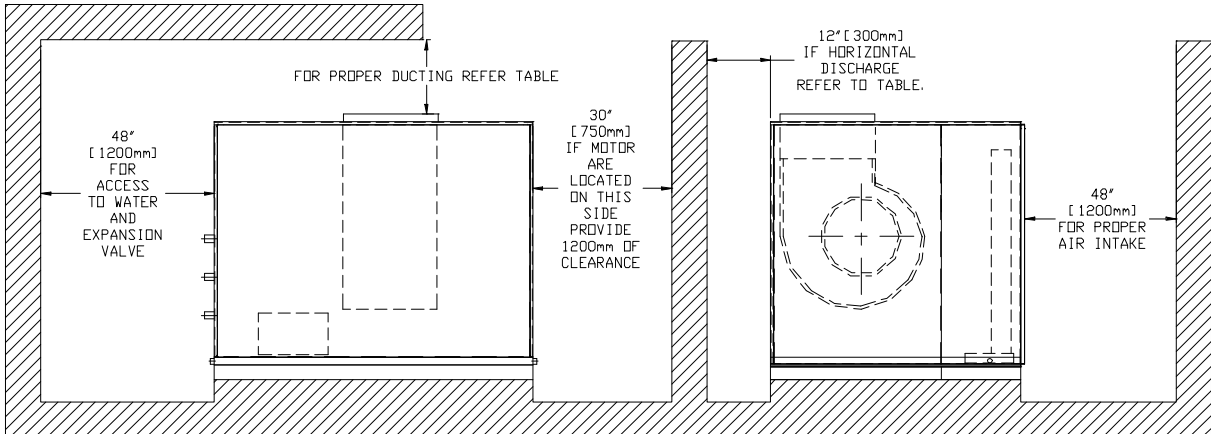
3.0 INSTALLATION

3.4.2. HORIZONTAL CASING TYPE- HEB, EB

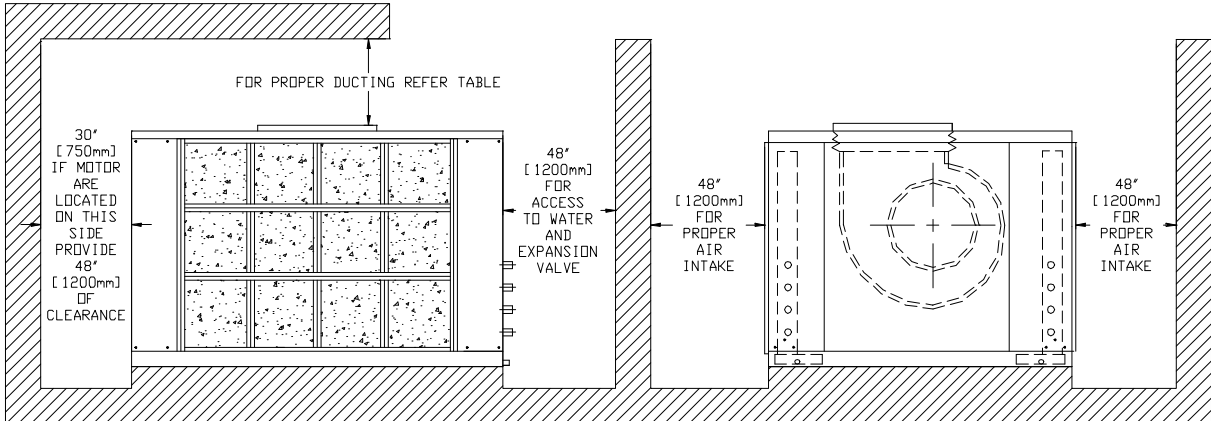
a.) HEB 68D, 81D, 95D, 108D, 125D, 145D, 160D, 190D, 220D



b.) EB 250D, 290D, 320D, 380D, 435D, 480D, 510D, 570D, 640D, 700D, 760D



c.) EB 800D, 890D, 960D, 1020D, 1140D, 1340D, 1520D.



3.0 INSTALLATION

3.5 DUCT CONNECTIONS

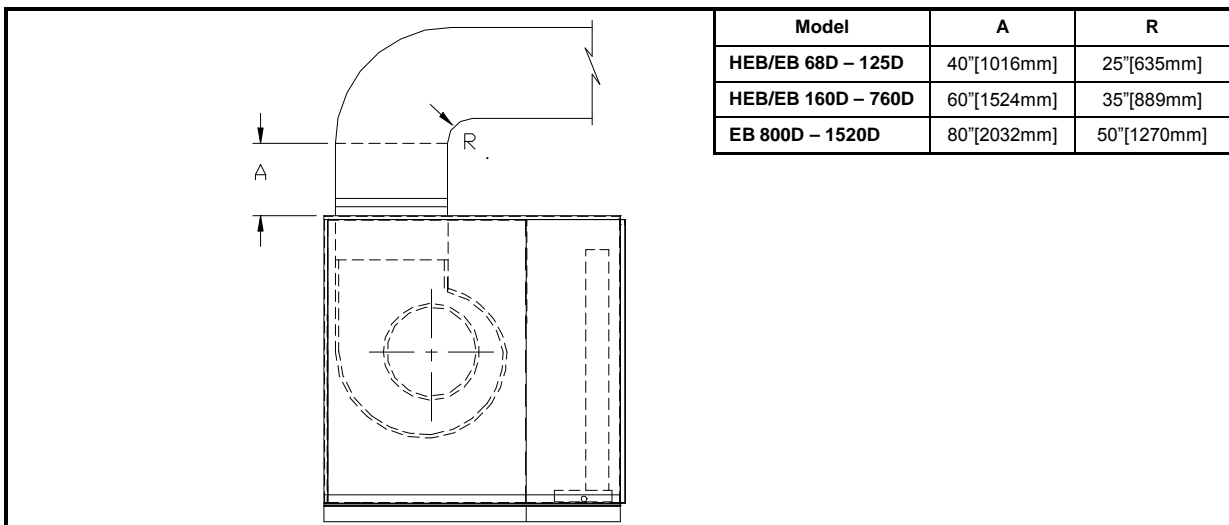
All ducts shall be made according to local and/or national codes and also with good duct installation practice. Minimize static losses by limiting the number of bends.

Suspended duct work with flexible hangers shall not be fastened directly to the unit.

A length of straight duct shall be installed as per Figure 3.5. This is to ensure uniform flow of discharge air. If an elbow need to be installed, then it shall be 1.5 of equivalent duct diameter. (Equivalent duct $\varnothing = (4ab/\pi)^{0.5}$).

Please refer to AMCA standard for proper ducting installation/ guidelines.

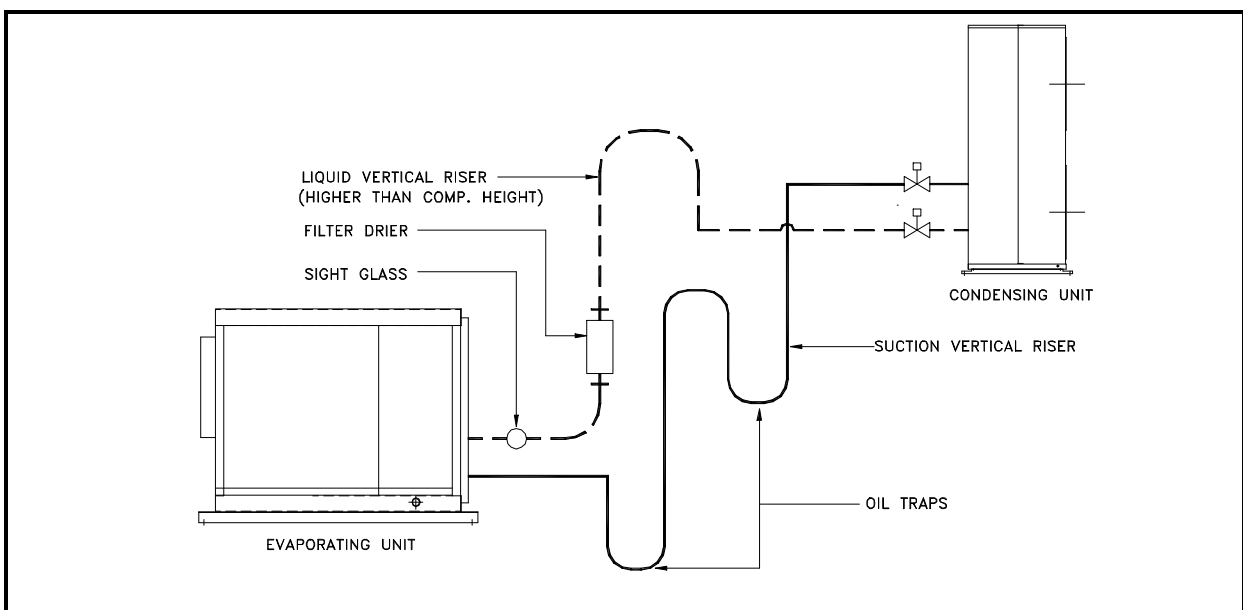
FIGURE 3.5: SUGGESTED METHOD FOR CONNECTING SUPPLY DUCT



Note: Transition element shall not be greater than 15° for converging elements nor greater 7° for diverging element.

3.6 FIELD PIPING

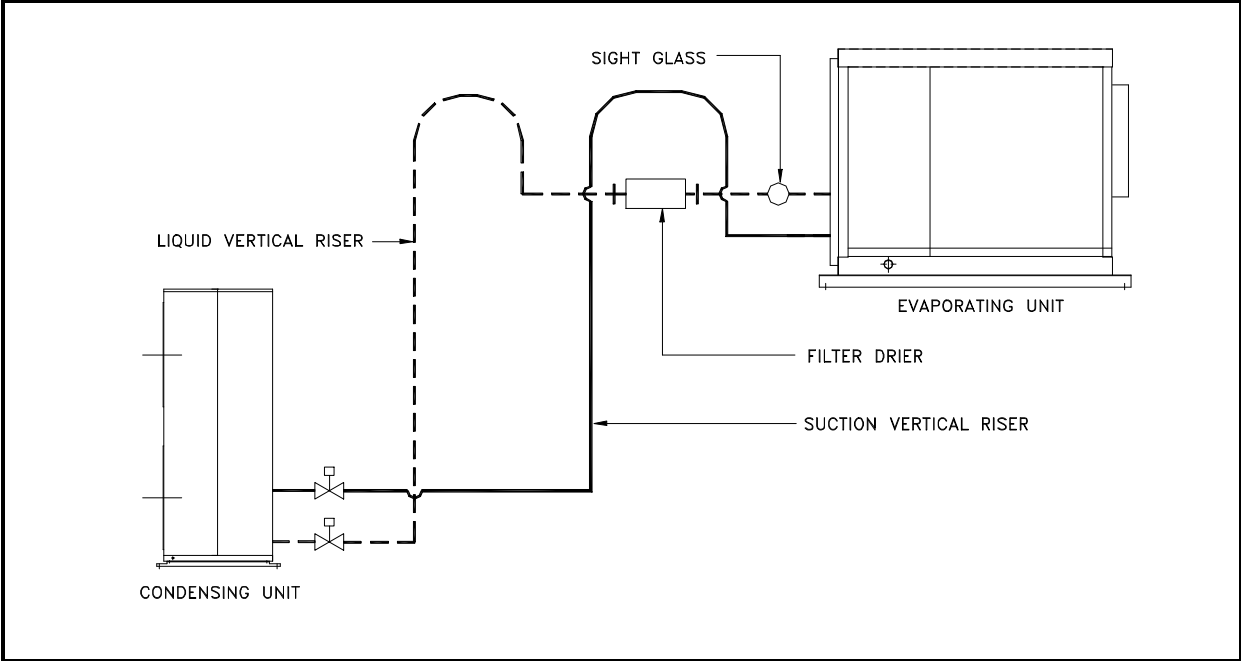
1.) COMPRESSOR (CONDENSING UNIT) IS ABOVE THE EVAPORATING UNIT.



Note: Traps should be provided for every 20 ft [6.1m] of vertical riser for proper oil movement.

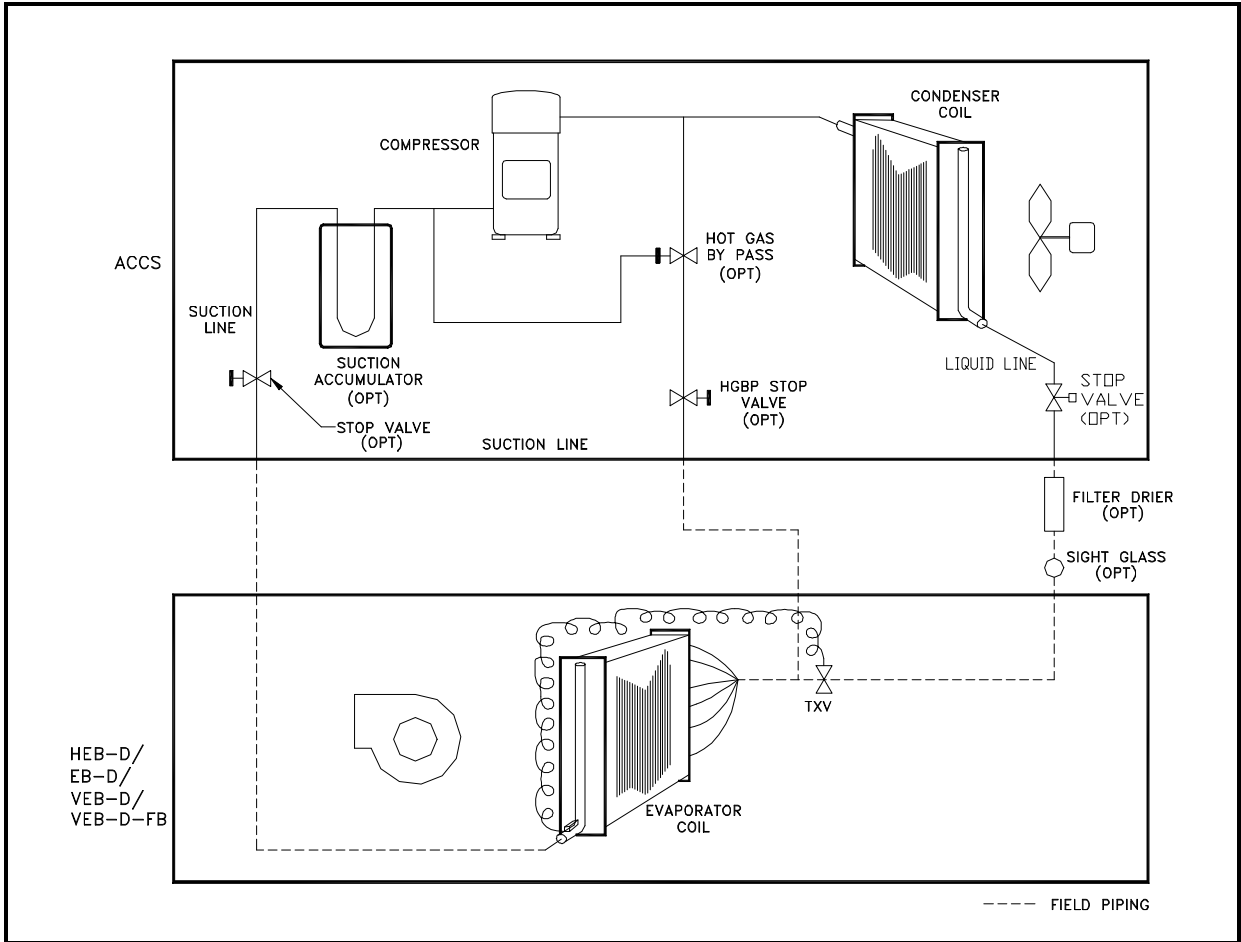
3.0 INSTALLATION

2.) EVAPORATING IS ABOVE THE COMPRESSOR.



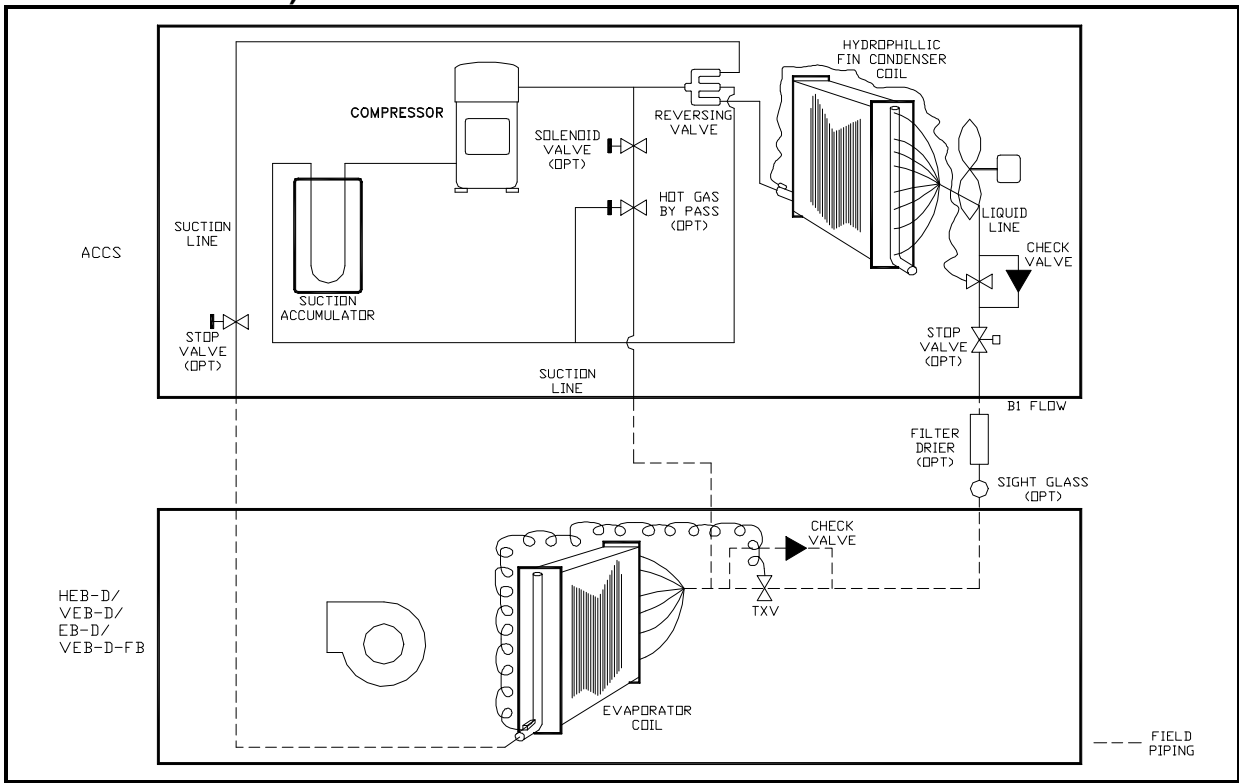
Note : Traps should be provided for every 20ft [6.1m] of vertical riser for proper oil movement.

3a.) TYPICAL PIPING SCHEMATIC (WITH OPTIONAL ACCESSORY AS INDICATED)



3.0 INSTALLATION

3b.) TYPICAL PIPING SCHEMATIC – HEAT PUMP (WITH OPTIONAL ACCESSORY AS INDICATED)



3.7 REFRIGERANT PIPING

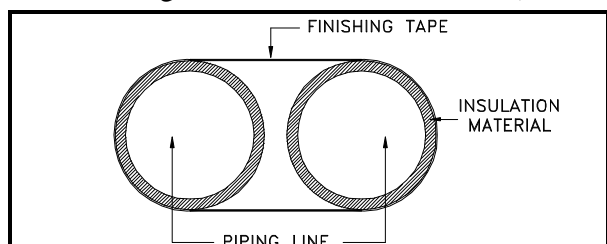
- 1.) Prior to connecting the tubes, make sure to apply blind caps or water proof tape to prevent dust or water from getting into the tubes.

Model	Max. Allowable Piping Length (L)	Elevation Difference Between Two Units
ACCS 68-1520	75 ft [22.9m]	30 ft [9.2m]

- 2.) Horizontal discharge and suction lines should be sloped in the direction of flow at a rate of 1" [25.4mm] for every 20ft [6.1m] in order to aid oil drainage. If there is a vertical riser of more than 5ft [1.5m] on the suction line, there should be a trap at the bottom. For long suction vertical riser, additional trap is recommended for each 20ft [6.1m] of riser to insure proper oil return.
- 3.) The suction and liquid line should be sized according to the manufacturers standard.
- 4.) Minimize the exposure time to atmosphere during brazing.
- 5.) Drain pipe size should be the same or bigger than the existing pipe. The pipe should be installed in downward slope so that water is drained by gravity. A trap

must be provided on the pipe so that condensate will drain and not overflowing the drain pan. In addition, upon start-up, the water will not be sucked by the blower. In addition, the evaporator coil is located before the intake of the centrifugal blowers and operates below atmospheric pressure. Thus, to compensate for this pressure differential, a trap is required.

- 6.) Suction line must be insulated to prevent condensation. It is also suggestable to insulate the liquid line. Insulating these line will prevent unnecessary heat losses/gains.
- 7.) This unit is designed to run up to max pipe length (single distance) 75ft [22.9m]. For length exceeding 75ft [22.9m], consult factory for assistance (piping size need to be changed and oil need to be added.).



3.0 INSTALLATION

3.8 LEAK TEST (SYSTEM PRESSURE TEST)

- 1.) Leak test pressure is at 200psig [1380kPa]. Disconnect or shut off all devices which may be damaged by 200psig [1380 kPa] test pressure.
- 2.) Open all valves in system so that entire system can be pressurized and connect refrigerant cylinder to charging connection.
- 3.) Charge in freon vapor to the system until 50psig [345 kPa] and then pressurize with dry nitrogen until 200psig [1380 kPa]. Stop charging gas if noise of escaping gas is heard. Skip to sequence (6.)

Caution: Always use inert gas such as nitrogen for testing. Never use other gases such as Oxygen or acetylene which may be inflammable.

- 4.) With pressure at 200psig [1380kPa], shut off the valve connecting nitrogen cylinder to the system. Disconnect nitrogen cylinder and leave pressure gauge indicating 1380kPa connected to system.
- 5.) With halide torch or electronic leak detector, leak check every valve, joint, pressure control, coils and headers. Mark every leak and record down as remarks.
- 6.) When all leaks have been found, blow off charge through tube to outside to prevent refrigerant accumulation around the system.
- 7.) Repair all leaks (check off on your remarks): If rebrazing is required, feed nitrogen through into the system at slightly excessive pressure (leave system open and make sure nitrogen flows through).
- 8.) After repairing leaks, re-check as per procedure 1 through 7.
- 9.) When system tight after leak test, keep pressurized at 200psig [1380kPa] and hold for 12 hours. Full in pressure should be negligible (some may be due to temperature change only.)

- 10.) When system is tight, proceed with vacuum test and dehydration.

3.9 VACUUM TEST AND DEHYDRATION

The purpose of evacuation is to evacuate the system when it is known or suspected that the system has been exposed to atmosphere, and there is a possibility that moisture has entered the system.

- 1.) Blow-off charge or pump down the refrigerant.
- 2.) Connect vacuum pump the liquid line valve and carefully check the unit piping to ensure all passages are open. (NEVER USE SYSTEM COMPRESSOR TO EVACUATE).
- 3.) Start vacuum pump operation and pull vacuum to about 2 to 2.5mmHg [0.26 to 0.33 kPa] absolute pressure. During evacuation the pressure may remain steady for sometime at about 0.5" or 12mmHg [1.69 kPa] absolute pressure. This is caused by moisture evaporating in the system. This "boiling off" or "evaporation period" last about the same period of time as it took from initial start to reach this point.
- 4.) When the "boiling off" period lasts longer that indicated under 3, break vacuum with refrigerant or nitrogen gas to sweep moisture out and evacuate and dryer shells, etc., up to a temperature of 100°F [37.8°C].
- 5.) Break vacuum with refrigerant or nitrogen gas until pressure is 0psig [0 kPa].
- 6.) Re-evacuate to 1mmHg [0.133kPa] absolute pressure.
- 7.) Disconnect vacuum pump and leave system standing for 6 hours. There should be no change in vacuum during this period. If there is a change repeat 1 to 7.

3.0 INSTALLATION

3.10 INSTALLATION OF DRIERS OR SIGHT GLASS

- 1.) Break vacuum with nitrogen.
- 2.) When permanently brazed drier or sight glass is used, open one valve on system to atmosphere while maintaining slight nitrogen flow.
- 3.) When flare connected drier or sight glass is used, use similar procedure as under 2. However, no valve need to be left open to atmosphere.
- 4.) When replaceable dryer core is used follow procedure as under 3. Insert drier core(s). Tighten cap screws.
- 5.) Re-evacuate system to 1mmHg [0.133 kPa] absolute.

3.11 CHARGING

- 1.) Connect refrigerant cylinder through charging connection to charging valve.
- 2.) Loosen flare nut on other end of charging connection and blow air out with refrigerant. Tighten flare nut on charging connection.
- 3.) Weight refrigerant cylinder.
- 4.) Open charging valve and charge in refrigerant vapor through suction access valve until about 150psig [1034 kPa]. Switch to liquid line access valve and charge in liquid refrigerant. Continue charging with liquid refrigerant until clear glass is observed.
- 5.) Shut off refrigerant charging valve but keep connected. Check charging valve flare nut for leak. Check and record down discharge and suction pressure. If more than one system to be charged, follow procedure 1 through 4 for each system. After all the systems have been done up to step 4, proceed with 5 and 6.

- 6.) Shut off the system (compressor, fans, pumps) and leave for 24 hours.

3.12 LUBRICATION

The scroll compressor use mineral oil 3GS, for R22 compressors and POE (Polyol ester) oil for HFC refrigerants (R134a, R407c etc) compressors. Please refer to compressor name plate for original oil charge. Recharge shall be 118ml less than the original charge. The condenser fan used a direct-drive permanent split capacitor motor. The motor should be lubricated with 30 to 40 drops of SAE #20 non-detergent oil as follows depending on service:

LIGHT DUTY -After 25,000 operating hours.

NORMAL DUTY -Annually after three years or 8,000 operating hours.

HEAVY DUTY -Annually after one year or at least every 1500 operating hours.

CAUTION: DO NOT OVER OIL

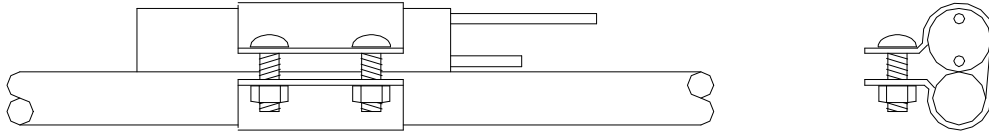
3.13 SENSING BULB LOCATION

- 1.) Sensing bulb is not installed for the evaporator unit due to limited space and for precautionary reasons.
- 2.) The sensing bulb should be attached to a horizontal suction line at the evaporator outlet.
- 3.) If more than one TXV is used on evaporator sections, make sure that the sensing bulb of each valve is applied to the suction line of the evaporator fed by that valve.
- 4.) On suction lines 7/8" [22.2mm] OD and larger, it is recommended that the bulb be installed at 4 or 8 o'clock on the side of the horizontal line and parallel with respect to the direction of flow. On smaller lines, the bulb should be mounted on the top of the line. See Figure 3.13.

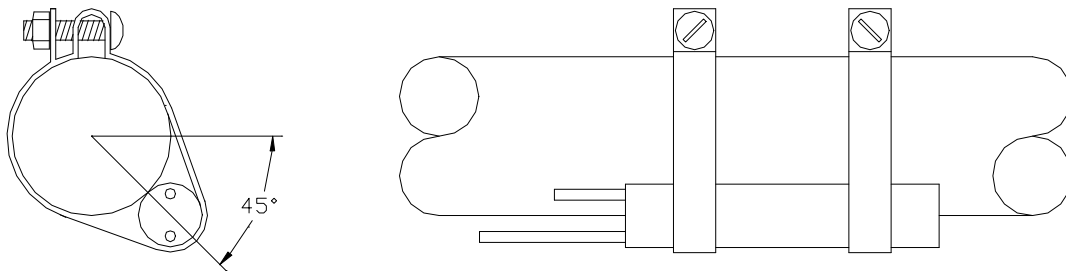
3.0 INSTALLATION

FIGURE 3.13: REMOTE BULB

1. Remote Bulb Small Suction Line (Smaller Than 7/8" [22.2mm])



2. Remote Bulb On large Suction Line (7/8" [22.2mm] and Larger)



5.) For good thermal contact, the bulb should be securely fastened with two bulb straps to a clean, straight section of the suction line. It should be insulated with cork tape to prevent the effect of surrounding environment.

3.14 EXTERNAL EQUALIZER CONNECTION

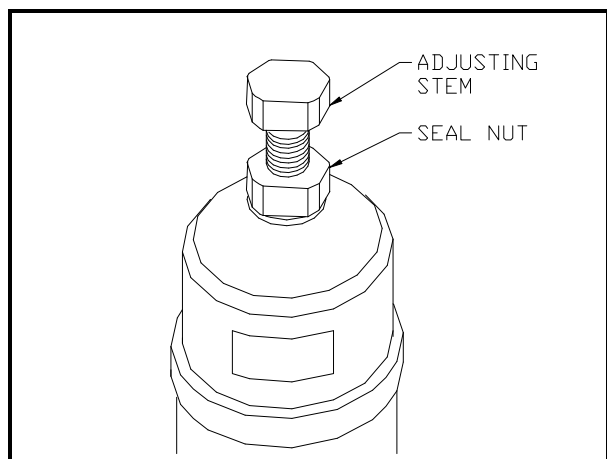
The equalizer connection should be made at a point that will most accurately reflect the pressure existing in the suction line at the bulb location. Generally, the connection is as close to bulb on the downstream side.

3.15 HOT GAS BYPASS

The purpose of the hot gas by pass is to create artificial load in the system by means of injecting hot gas into the inlet of the distributor. This would prevent the suction pressure from falling below the desired settings and thus causing frequent compressor cycling. The valve is pressure actuated, where it allows the discharge gas to bypass if the downstream pressure is below the setting. The setting could be changed by adjusting the stem

on the valve body. To set the pressure, loose the seal nut as shown below and turn the adjusting stem clockwise to raise the pressure or counter clockwise to lower the pressure. One turn of the stem equals to 16psig [110.3kPa]. The adjustment range for the valve is between 10"Hg [33.8kPa] to 120psig [827 kPa].

It is important that the setting to be performed under actual operating condition, i.e. under minimal system load conditions so that it could maintain the minimum desired suction pressure. Hot gas flow could be detected by listening the gas flowing through the valve or by touching the outlet pipe.



3.0 INSTALLATION

3.17 TIGHTENING OF PULLEY SET SCREW

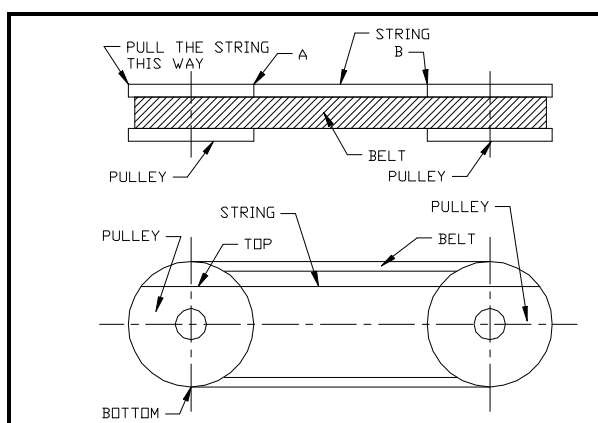
Apply one or two drops of thread locked 243 to the engagement area of set screws before tightening the pulleys according to the recommended torque.

Set Screw Size	Tightening Torque
5/16" [7.9mm]	10 Lbs.ft [13NM]
3/8" [9.5mm]	19 Lbs.ft [26NM]

3.18 PULLEY ALIGNMENT

- 1.) Insert one end of the string inside the gap between belt and pulley.
- 2.) Rotate the pulley so that string is clipped between the pulley and the belt.
- 3.) Pull the other end of the string as per figure below.

FIGURE 3.17:

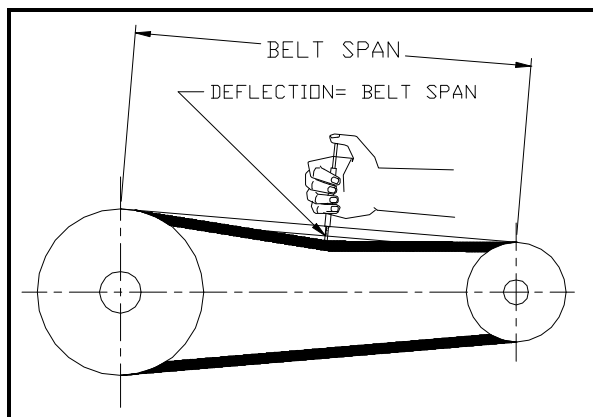


- 4.) Inspect for any gap between the string and pulley at A and B.
- 5.) If find any gap then adjust either pulley to make the gap as small as possible.
- 6.) Repeat steps 1, 2, 3, 4 and 5 for bottom of the same side, top and bottom of the other side. (As shown as Figure 3.17)

3.18 BELT TENSION INSPECTION GUIDE

- 1.) Measure the belt span (See Figure 3.18).
- 2.) Position of the "O" ring on the span scale at the measure belt.
- 3.) Set the "O" ring on the deflection force scale to zero.

FIGURE 3.18: BELT SPAN



- 4.) Place the tension meter squarely on the belt at the belt span. Apply a force on the plunger and perpendicular to the belt span until the bottom of the "O" ring even the top of the next belt or with the bottom of a straight edge laid across the sheaves.
- 5.) Remove the tension meter and read the force applied from the bottom of the "O" ring on the deflection force scale.
- 6.) Compare the force you have applied with the values in Table 3.18a and 3.18b.

Note: A new drive should be tensioned to the higher value. After the drive has been running for 30 minutes, the tension should be checked and readjust to the higher value, if necessary.

Table 3.18a:

Belt Span Lt (cm)	Deflection Td (cm)
25 - 30	0.4
31 - 36	0.5
37 - 42	0.6
43 - 48	0.7
49 - 54	0.8
55 - 60	0.9
61 - 66	1.0
67 - 72	1.1
55 - 60	1.2
79 - 84	1.3
85 - 90	1.4
91 - 96	1.5
97 - 102	1.6
103 - 108	1.7
109 - 114	1.8

Table 3.18b:

Belt Type	Small Pulley Diameter - inches [mm]	Maximum Deflection - lbs [Kg]
A	3.0 - 5.5 [76 - 140]	2.2 - 3.3 [1.0 - 1.5]
B	5.0 - 8.0 [127 - 203]	4.4 - 6.8 [2.0 - 3.1]
C	8.0 - 16.0 [203 - 406]	9.0 - 13.4 [4.1 - 6.1]

4.0 OPERATION

4.1 PHASE ROTATION

Avoid running in reverse rotation. If during initial start up the compressor does not build up pressure, noise is abnormally loud and power consumption is minimal, then there is a possibility that the unit is operating at reverse rotation. Shut down the power and connect phase to the proper terminals. Running reverse may damage the compressor (s).

4.2 CYCLE LIMIT RATE

Each compressors must not be cycle on-off for more than 12 times per hour. The higher number of starts per hour will reduce the life of the compressor. Thus, it is suggested that anti short cycle timer is provided in the system.

4.3 FAN CYCLING (OPTIONAL, STANDARD FOR HEAT PUMP)

During cooling only, the head pressure control would allow the unit to operate at lower ambient temperature by building up the discharge pressure through cycling of fans (for single fan unit, this is achievable by reducing the fan speed). If there is demand for cooling. The unit would run on cooling until the manual charge over is set to heating. Please observe the lowest ambient for cooling mode. For heat pump units fan cycling is standard.

4.4 DEFROST CYCLE (STANDARD FOR HEAT PUMP)

During heating, a defrost controller would initiate the defrost cycle once there is demand for it. The sensor from the controller would sense the suction pressure and if the pressure is lower then the preset value, Then a signal

would be sent to the control panel which then relay the signal to the reversing valve to reverse the cycle. Now, the outdoor coil would be discharging hot air and defrosting the ice on the fins surface. The standard factory set timer for the defrost cycle is 10 minutes which could be adjusted according to the site condition.

4.5 CRANKCASE HEATER (STANDARD FOR HEAT PUMP)

Refrigerant tend to migrate to colder section of the unit. During winter, the compressor compartment is at lower temperature than the evaporator and thus refrigerant tend to accumulate in the compressor compartment. Connect power source to the unit a few hours prior to compressor start up so that the refrigerant would be forced out of the compressor compartment. It is good practice to let the crankcase heater to be energized continuously, independent of compressor operation.

4.6 STOP VALVE

Inspect all stop valves prior to start up. They shall be in open position.

4.7 HYDROPHILIC CONDENSER COIL (STANDARD FOR HEAT PUMP)

Hydrophilic fins assist condensation to be removed faster and therefore reduced the possibility of icing on the coil.

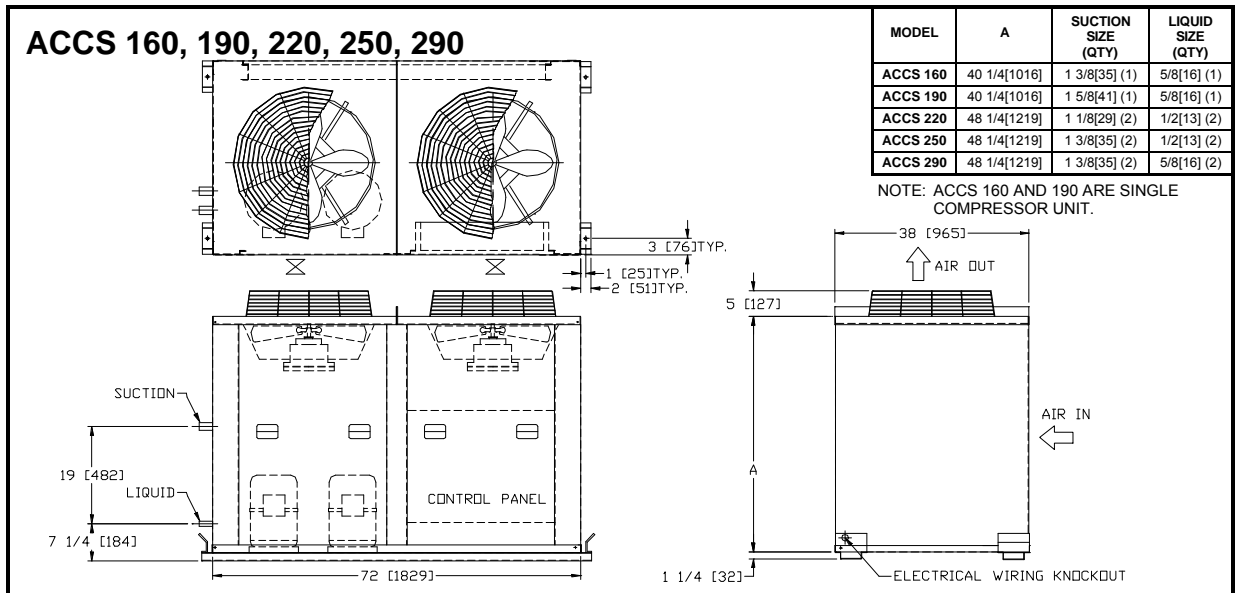
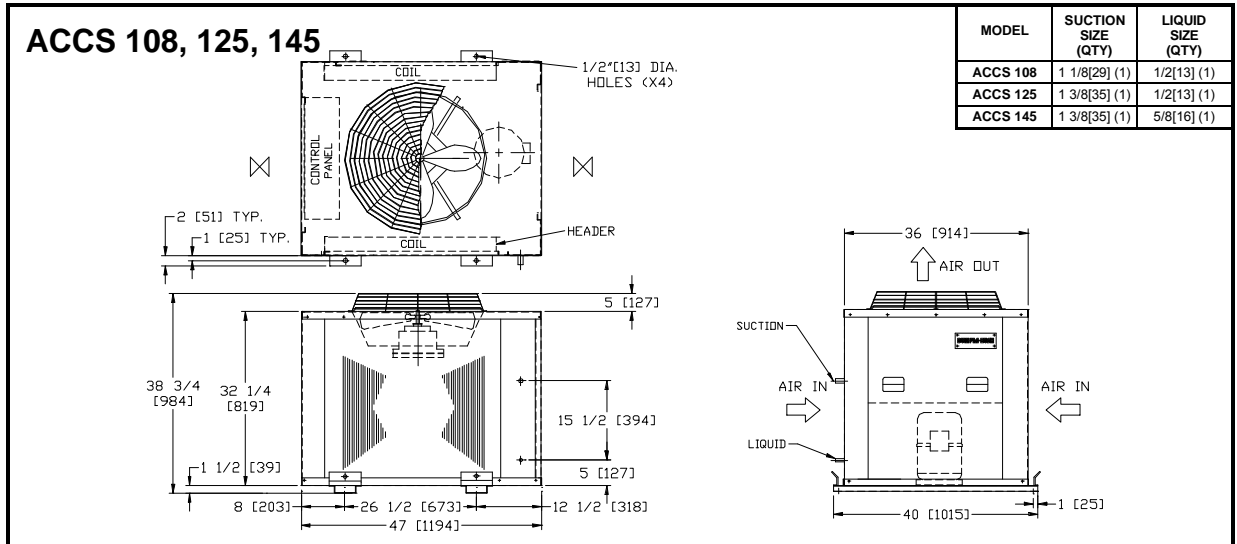
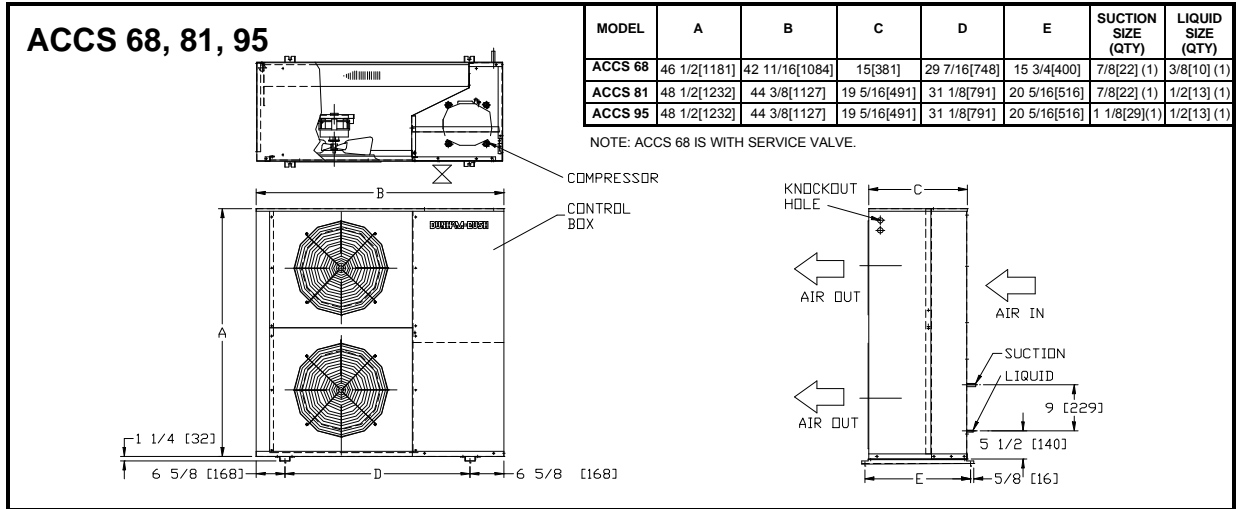
4.8 STAINLESS STEEL BOLTS AND NUTS

Reduce the possibility of corrosion especially when the environment is corrosive.

4.0 OPERATION

4.9 DIMENSIONAL DATA

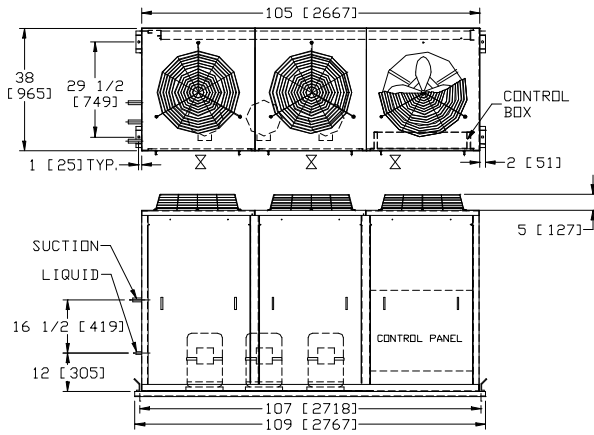
1.) Air Cooled Condensing Units



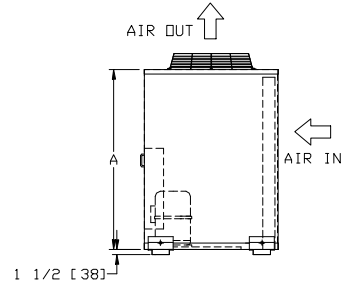
NOTE : ALL DIMENSIONS ARE IN INCHES [MM].

4.0 OPERATION

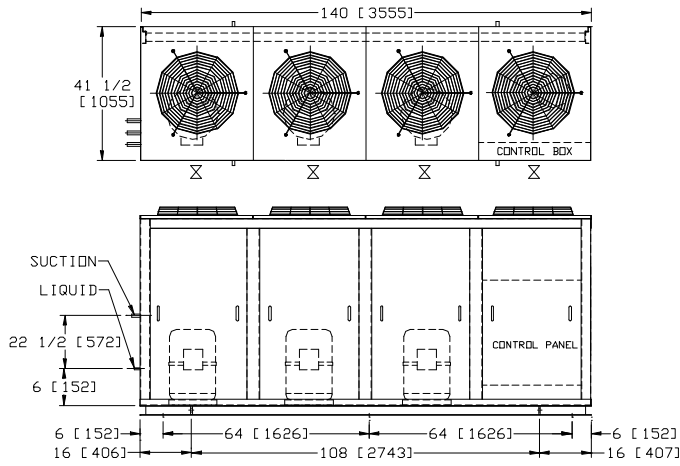
ACCS 320, 380, 435



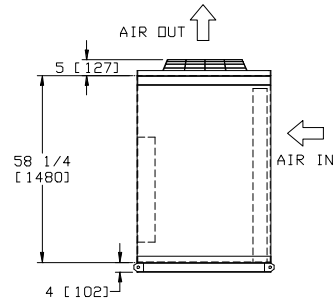
MODEL	A	SUCTION SIZE (QTY)	LIQUID SIZE (QTY)
ACCS 320	48 1/4[1226]	1 3/8[35] (2)	5/8[16] (2)
ACCS 380	56 1/4[1429]	1 5/8[41] (2)	5/8[16] (2)
ACCS 435	56 1/4[1429]	1 3/8[35] (3)	5/8[16] (3)



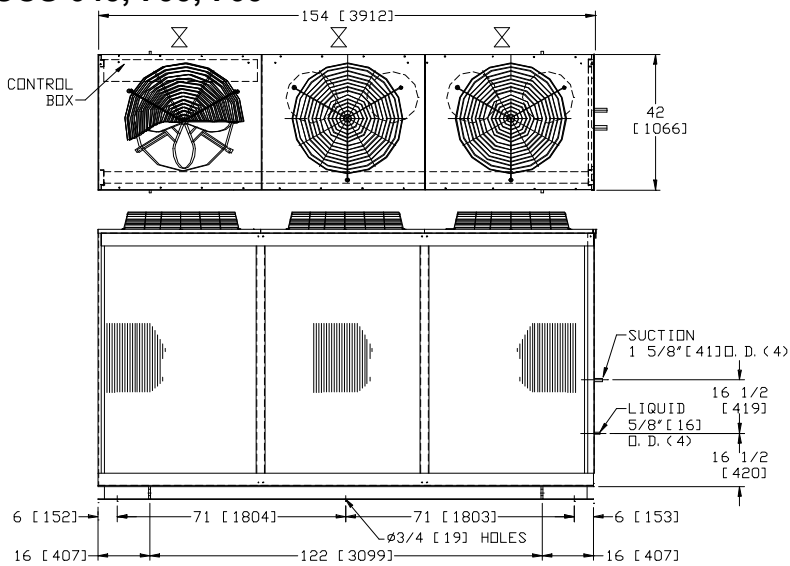
ACCS 480, 510, 570



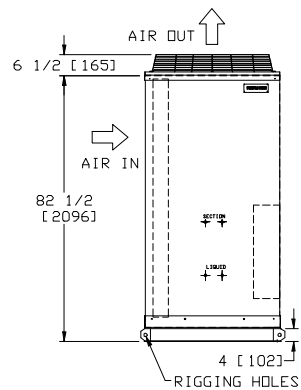
MODEL	SUCTION SIZE (QTY)	LIQUID SIZE (QTY)
ACCS 480	1 3/8[35] (3)	5/8[16] (3)
ACCS 510	1 5/8[41] (1), 1 3/8[35] (2)	5/8[16] (3)
ACCS 570	1 5/8[41] (3)	5/8[16] (3)



ACCS 640, 700, 760



MODEL	SUCTION SIZE (QTY)	LIQUID SIZE (QTY)
ACCS 640	1 5/8[41] (2)	7/8[22] (2)
ACCS 700	2 1/8[54] (1), 1 5/8[41] (1)	7/8[22] (2)
ACCS 760	2 1/8[54] (2)	7/8[22] (2)

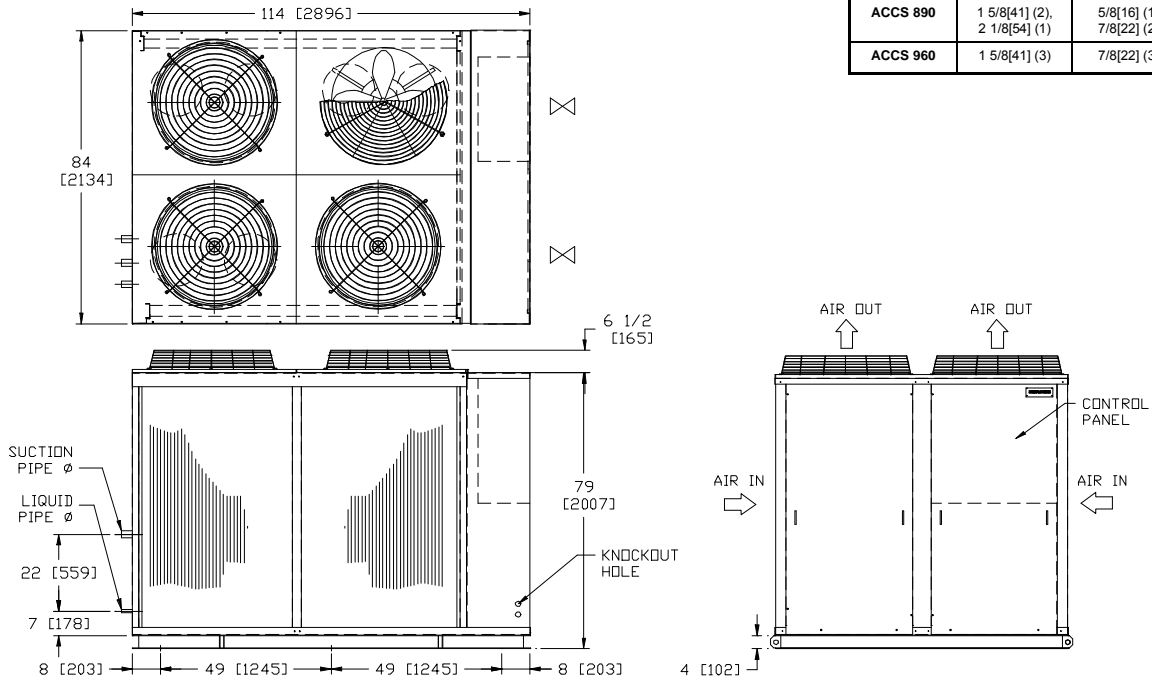


NOTE : ALL DIMENSIONS ARE IN INCHES [MM].

4.0 OPERATION

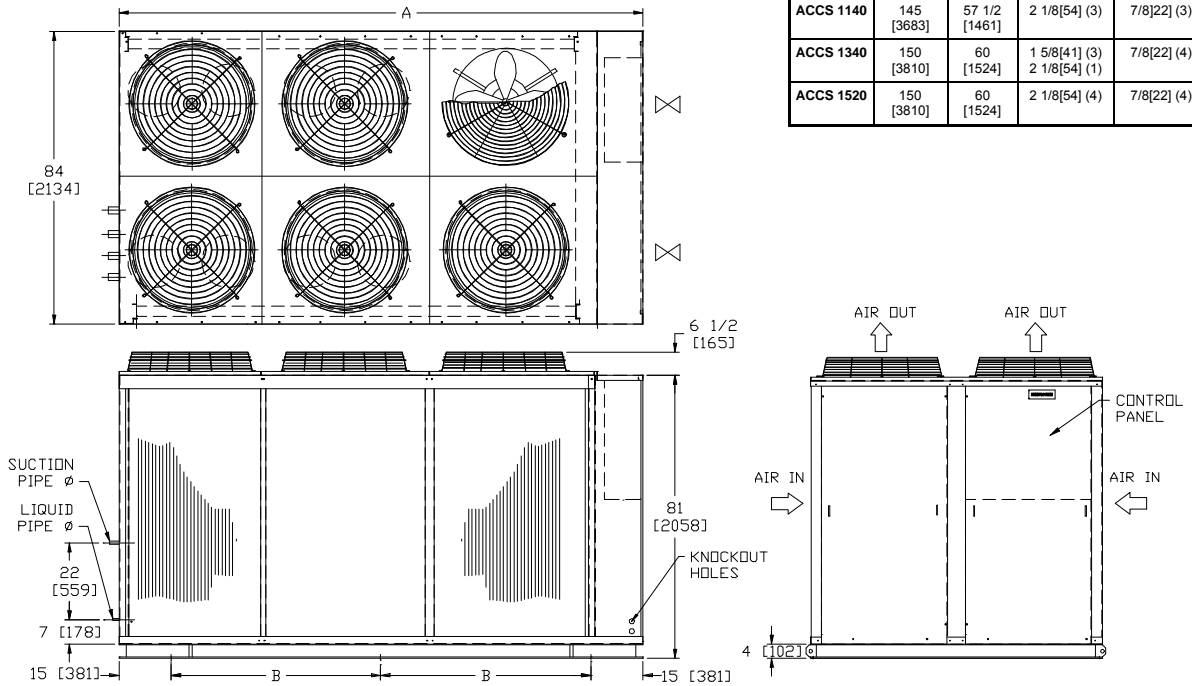
ACCS 800, 890, 960

MODEL	SUCTION SIZE (QTY)	LIQUID SIZE (QTY)
ACCS 800	1 3/8[35] (1) 1 5/8[41] (2)	5/8[16] (1) 7/8[22] (2)
ACCS 890	1 5/8[41] (2), 2 1/8[54] (1)	5/8[16] (1) 7/8[22] (2)
ACCS 960	1 5/8[41] (3)	7/8[22] (3)



ACCS 1020, 1140, 1340, 1520

MODEL	A	B	SUCTION SIZE (QTY)	LIQUID SIZE (QTY)
ACCS 1020	145 [3683]	57 1/2 [1461]	1 5/8[41] (2) 2 1/8[54] (1)	7/8[22] (3)
ACCS 1140	145 [3683]	57 1/2 [1461]	2 1/8[54] (3)	7/8[22] (3)
ACCS 1340	150 [3810]	60 [1524]	1 5/8[41] (3) 2 1/8[54] (1)	7/8[22] (4)
ACCS 1520	150 [3810]	60 [1524]	2 1/8[54] (4)	7/8[22] (4)



NOTE: ALL DIMENSIONS ARE IN INCHES [MM].

4.0 OPERATION

Evaporator Units

HEB 68D, 81D, 95D

Technical drawing showing side and top views of the evaporator unit. Dimensions include: 3/4 [19] TYP., 3 1/2 [89], 1 3/4 [44] TYP., 1 1/2 [38], 46 [1169], C, A, H, 1 1/2 [38]. Labels include: LIQUID, SUCTION, Ø1" [25] BARE DRAIN PIPE, and OPTIONAL BLOWER OPENING.

MODEL	A	B	C	W	H	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
HEB 68D	13 [330]	11 3/8 [289]	16 1/2 [419]	24 [610]	20 [508]	7/8 [22] (1)	3/8 [10] (1)
HEB 81D	13 [330]	11 3/8 [289]	16 1/2 [419]	24 [610]	20 [508]	7/8 [22] (1)	1/2 [13] (1)
HEB 95D	15 1/2 [394]	13 1/2 [343]	15 1/4 [387]	30 [762]	23 [584]	1 1/8 [29] (1)	1/2 [13] (1)

Top view diagram showing air flow directions: SUPPLY AIR and RETURN AIR. Dimensions include: 1 1/2 [38], W, B, 2 1/8 [54], W+5.

HEB 108D, 125D, 145D, 160D, 190D, 220D

Technical drawing showing side and top views of the evaporator unit. Dimensions include: 3/4 [19] TYP., 3 1/2 [89], 2 1/4 [64] TYP., 1 1/2 [38], L, A, C, H, 1 1/2 [38]. Labels include: LIQUID, SUCTION, Ø1" [25] BARE DRAIN PIPE, and OPTIONAL BLOWER OPENING.

MODEL	A	B	C	D	H	L	W	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
HEB 108D	16 [406]	13 1/2 [343]	21 1/4 [540]	5 1/2 [140]	27 [686]	50 [1270]	33 [838]	1 1/8 [29] (1)	1/2 [13] (1)
HEB 125D	16 [406]	13 1/2 [343]	21 1/4 [540]	5 1/2 [140]	27 [686]	50 [1270]	33 [838]	1 3/8 [35] (1)	1/2 [13] (1)
HEB 145D	16 [406]	13 1/2 [343]	21 1/4 [540]	5 1/2 [140]	27 [686]	50 [1270]	33 [838]	1 3/8 [35] (1)	5/8 [16] (1)
HEB 160D	18 1/2 [470]	16 [406]	24 3/8 [619]	2 3/4 [70]	29 [737]	58 [1448]	40 [1016]	1 3/8 [35] (1)	5/8 [16] (1)
HEB 190D	18 1/2 [470]	16 [406]	24 3/8 [619]	2 3/4 [70]	29 [737]	58 [1448]	40 [1016]	1 5/8 [41] (1)	5/8 [16] (1)
HEB 220D	18 1/2 [470]	16 [406]	30 [762]	4 3/4 [121]	29 [737]	78 [1981]	40 [1016]	1 1/8 [29] (2)	1/2 [13] (2)

Top view diagram showing air flow directions: SUPPLY AIR and RETURN AIR. Dimensions include: 1 1/2 [38], W, B, D, W+5.

EB 250D, 290D, 320D, 380D, 435D

Technical drawing showing side and top views of the evaporator unit. Dimensions include: 3/4 [19] TYP., 3 1/2 [89], 3 [76] TYP., 1 1/2 [38], L, A, B, H, 1 1/2 [38]. Labels include: LIQUID, SUCTION, Ø1 1/4" [32] BARE DRAIN PIPE.

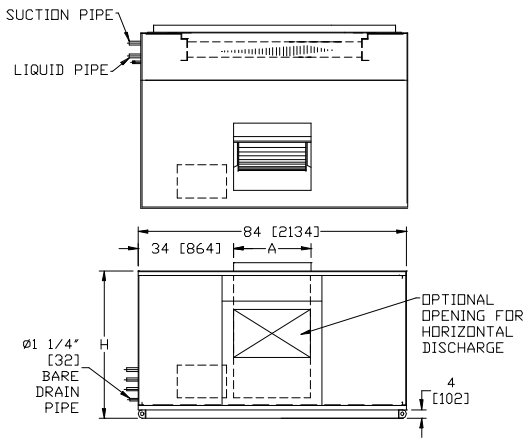
MODEL	A	B	C	D	H	L	W	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
EB 250D	18 1/2 [470]	30 [762]	16 [406]	4 [102]	29 [737]	78 [1981]	40 [1016]	1 3/8 [35] (2)	1/2 [13] (2)
EB 290D	17 [432]	33 1/2 [851]	19 [483]	4 1/2 [114]	38 [965]	84 [2134]	45 [1143]	1 3/8 [35] (2)	5/8 [16] (2)
EB 320D	17 [432]	33 1/2 [851]	19 [483]	4 1/2 [114]	38 [965]	84 [2134]	45 [1143]	1 3/8 [35] (2)	5/8 [16] (2)
EB 380D	22 [559]	37 [940]	19 [483]	4 1/2 [114]	48 [1219]	84 [2134]	45 [1143]	1 5/8 [41] (2)	5/8 [16] (2)
EB 435D	22 1/2 [572]	37 [940]	22 1/2 [572]	4 1/2 [114]	48 [1219]	84 [2134]	45 [1143]	1 3/8 [35] (3)	5/8 [16] (3)

Top view diagram showing air flow directions: SUPPLY AIR and RETURN AIR. Dimensions include: 2 1/2 [64], W, C, W+5.

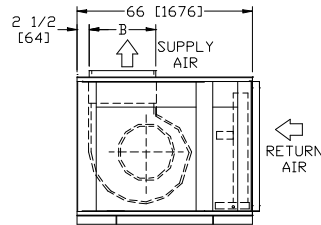
NOTES.: 1.) ALL DIMENSIONS ARE IN INCHES [MM].
2.) UNITS SHOWN ARE RIGHT HAND PIPING CONNECTION.

4.0 OPERATION

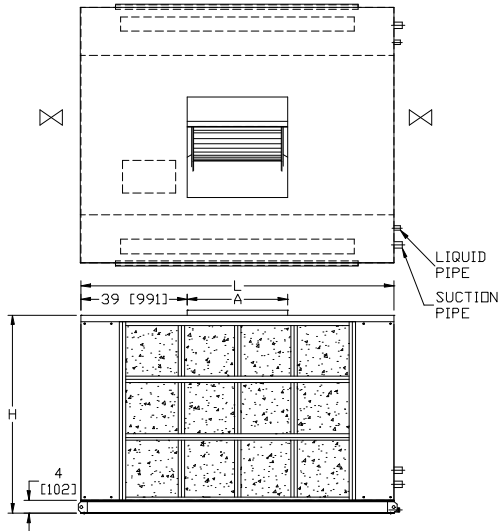
EB 480D, 510D, 570D, 640D, 700D, 760D



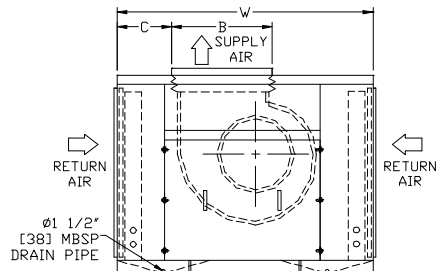
MODEL	A	B	H	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
EB 480D	25[635]	25[635]	68[1727]	1 3/8[35] (3)	5/8[16] (3)
EB 510D	25[635]	25[635]	68[1727]	1 3/8[35] (2) 1 5/8[41] (1)	5/8[16] (3)
EB 570D	25[635]	25[635]	68[1727]	1 5/8[41] (3)	5/8[16] (3)
EB 640D	28[711]	28[711]	78[1981]	1 5/8[41] (2)	7/8[22] (2)
EB 700D	28[711]	28[711]	78[1981]	1 5/8[41] (1) 2 1/8[54] (1)	7/8[22] (2)
EB 760D	28[711]	28[711]	78[1981]	2 1/8[54] (2)	7/8[22] (2)



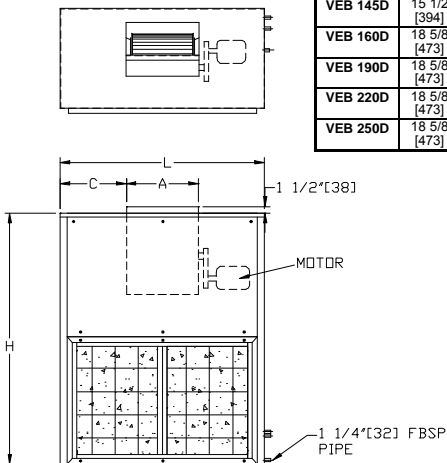
EB 800D, 890D, 960D, 1020D, 1140D, 1340D, 1520D



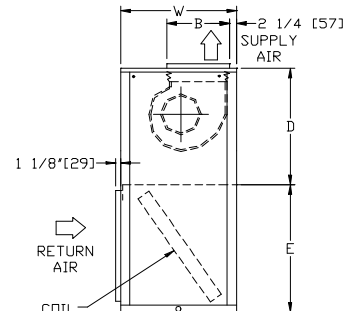
MODEL	A	B	C	H	L	W	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
EB 800D	31 1/2 [800]	31 1/2 [800]	17 [432]	62 [1575]	98 [2489]	80 [2032]	1 3/8[35] (1) 1 5/8[41] (1)	7/8[22](2) 5/8[16](1)
EB 890D	31 1/2 [800]	31 1/2 [800]	17 [432]	62 [1575]	98 [2489]	80 [2032]	1 5/8[41] (2) 2 1/8[54] (1)	5/8[16](1) 7/8[22](2)
EB 960D	31 1/2 [800]	31 1/2 [800]	17 [432]	62 [1575]	98 [2489]	80 [2032]	1 5/8[41] (3)	7/8[22](3)
EB 1020D	35 1/2 [902]	35 1/2 [902]	14 [356]	62 [1575]	98 [2489]	80 [2032]	1 5/8[41] (2) 2 1/8[54] (1)	7/8[22](3)
EB 1140D	35 1/2 [902]	35 1/2 [902]	14 [356]	62 [1575]	98 [2489]	80 [2032]	2 1/8[54] (3)	7/8[22](3)
EB 1340D	40 [1016]	40 [1016]	14 [356]	70 [1778]	118 [2997]	86 [2184]	1 5/8[41] (3) 2 1/8[54] (1)	7/8[22](4)
EB 1520D	40 [1016]	40 [1016]	14 [356]	70 [1778]	118 [2997]	86 [2184]	2 1/8[54] (4)	7/8[22](4)



VEB 108D, 125D, 145D, 160D, 190D, 220D, 250D



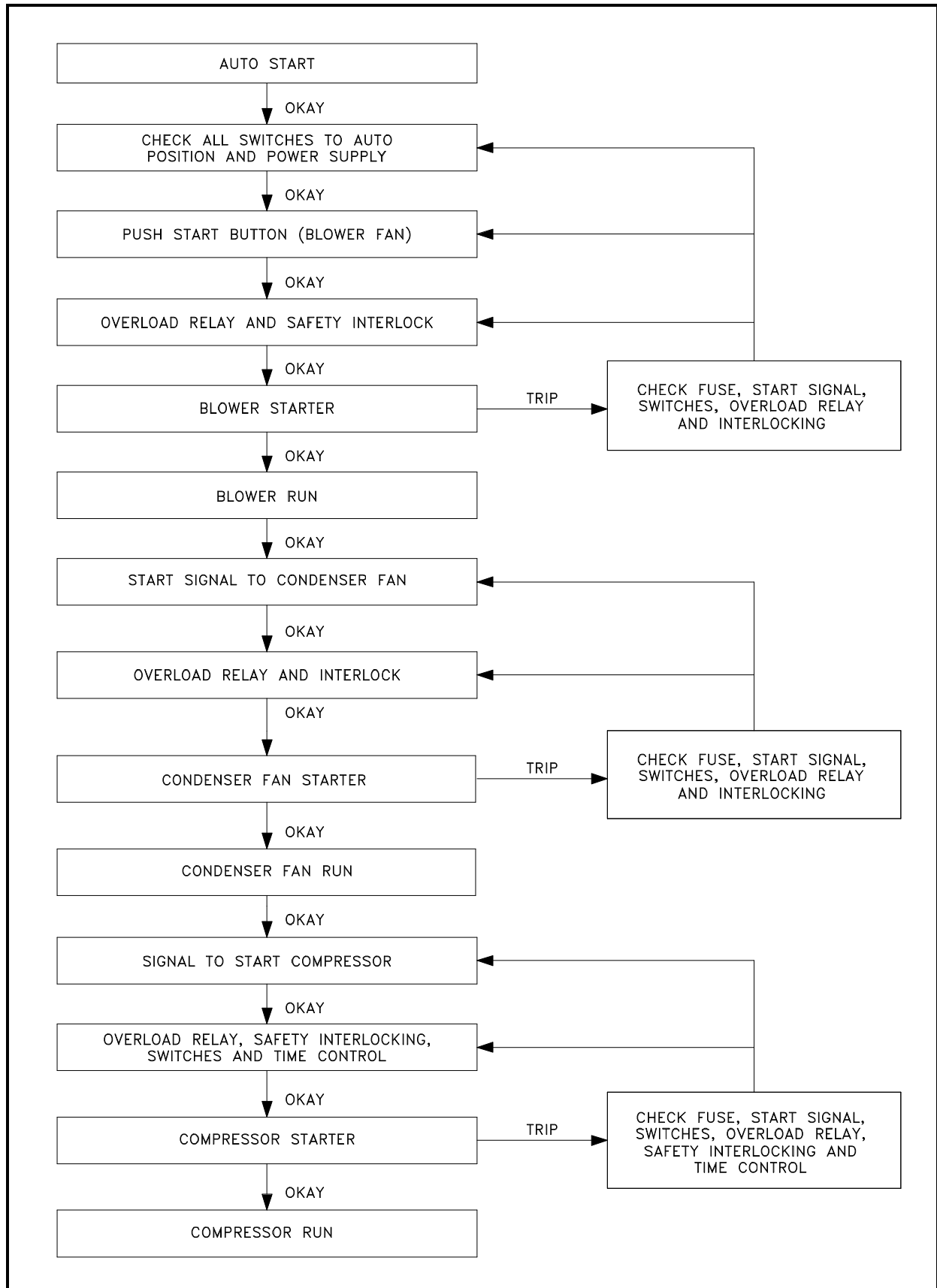
Model	A	B	C	D	E	H	L	W	SUCTION SIZE ø (QTY)	LIQUID SIZE ø (QTY)
VEB 108D	15 1/2 [394]	13 1/2 [343]	15 [381]	25 3/4 [654]	25 3/4 [654]	53 3/4 [1365]	52 [1321]	25 [635]	1 1/8[29] (1)	1/2[13] (1)
VEB 125D	15 1/2 [394]	13 1/2 [343]	17 1/4 [438]	25 3/4 [654]	25 3/4 [654]	54 1/2 [1384]	52 [1321]	25 [635]	1 3/8[35] (1)	1/2[13] (1)
VEB 145D	15 1/2 [394]	13 1/2 [343]	17 1/4 [438]	25 3/4 [654]	25 3/4 [654]	54 1/2 [1384]	52 [1321]	25 [635]	1 3/8[35] (1)	5/8[16] (1)
VEB 160D	18 5/8 [473]	16 [406]	15 [381]	28 3/4 [730]	28 3/4 [730]	57 1/2 [1461]	58 1/2 [1486]	28 [711]	1 3/8[35] (1)	5/8[16] (1)
VEB 190D	18 5/8 [473]	16 [406]	15 [381]	28 3/4 [730]	28 3/4 [730]	57 1/2 [1461]	58 1/2 [1486]	28 [711]	1 5/8[41] (1)	5/8[16] (1)
VEB 220D	18 5/8 [473]	16 [406]	31 7/16 [799]	28 3/4 [730]	30 [762]	58 3/4 [1492]	81 1/2 [2070]	28 [711]	1 1/8[29] (2)	1/2[13](2)
VEB 250D	18 5/8 [473]	16 [406]	31 7/16 [799]	28 3/4 [730]	30 [762]	58 3/4 [1492]	81 1/2 [2070]	28 [711]	1 3/8[35] (2)	1/2[13](2)



NOTES.: 1.) ALL DIMENSIONS ARE IN INCHES [MM].
2.) UNITS SHOWN ARE RIGHT HAND PIPING CONNECTION.

4.0 OPERATION

4.10 TYPICAL OPERATING SEQUENCE



5.0 MAINTENANCE

5.1 MAINTENANCE

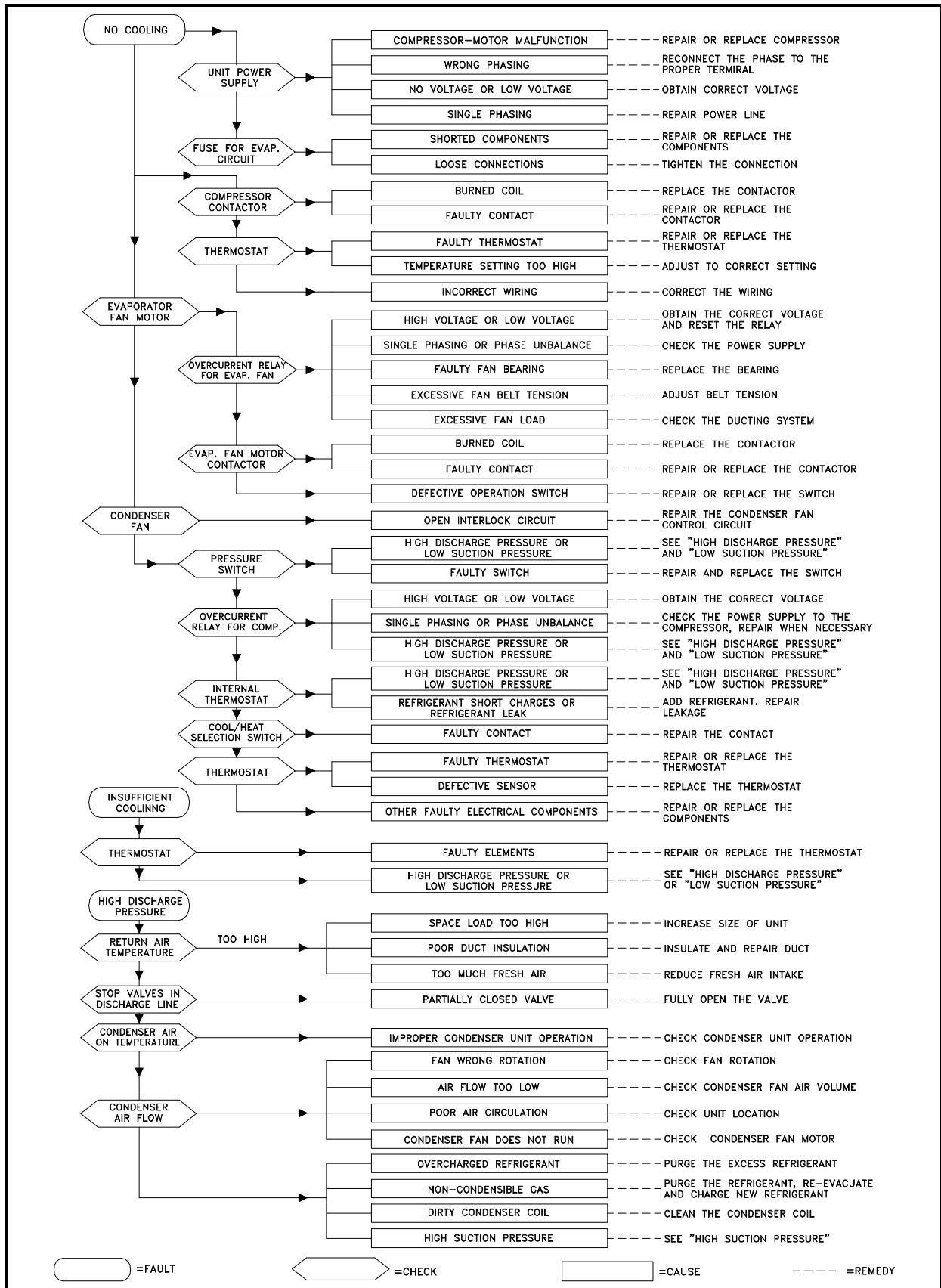
These units are designed to provide years of services with minimum maintenance. Nonetheless, it is a good practice to carry out

regular inspection and checking to ensure the unit's optimum performance and compliance with local rules and regulations.

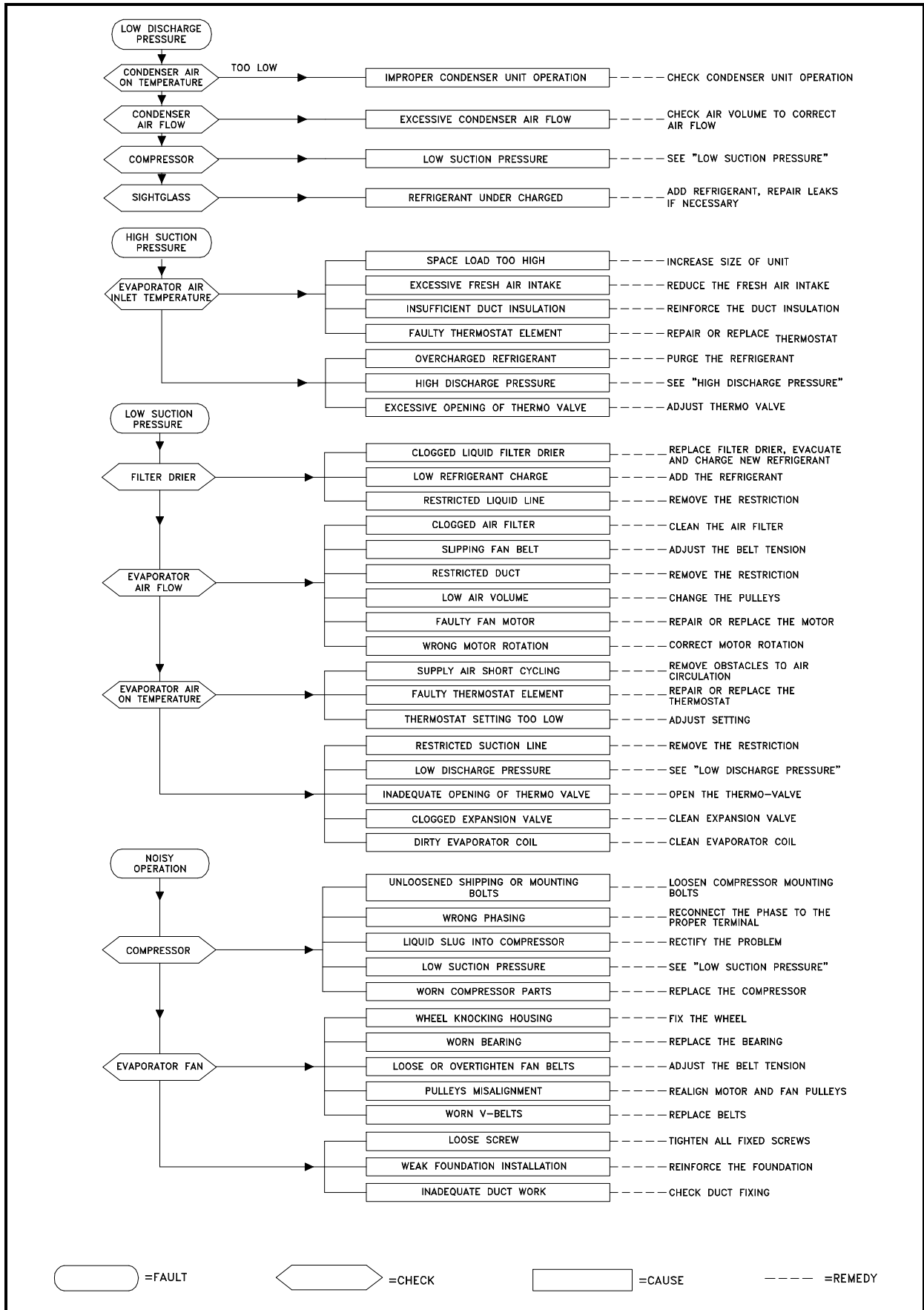
ITEM	MAINTENANCE PROCEDURE	RECOMMENDED SCHEDULE
Air Filters	<ol style="list-style-type: none"> 1. Washable type. 2. Clean with a vacuum cleaner or tapped lightly and then wash in luke warm water (below 104°F [40°C]). 3. Make sure the filter is dry. 	Once a month or depending upon the condition of the circulated air.
Belt	<ol style="list-style-type: none"> 1. Check the tension and alignment. 2. Move the motor if the belt is loose. 	Once every six months.
Pulley	<ol style="list-style-type: none"> 1. Make sure the set screws are properly tightened and there is no crack on the pulley. 	Once every six months.
Blower	<ol style="list-style-type: none"> 1. Turn the blower manually. It should run smoothly and there is no excessive bearing noise. 	Once every six months.
Bearing and Shaft	<ol style="list-style-type: none"> 1. Check for evidence of wear. 	Once a year.
Bolts, Screws and Nuts.	<ol style="list-style-type: none"> 1. Tighten any loose components. 	Once a year.
Coil	<ol style="list-style-type: none"> 1. Check and remove clogged item between fins. 	Once a year.
Paint	<ol style="list-style-type: none"> 1. Check any evidence of corrosion. 	Once a year.
Compressor	<ol style="list-style-type: none"> 1. Check if there is any leakage. 	Every six months.
Electrical	<ol style="list-style-type: none"> 1. Check voltage, current and wiring. 2. Check connections. 	Every two months.
Drain Pan and Pipe	<ol style="list-style-type: none"> 1. Pour some water into the drain pan and let the water run through. If the pipe is clogged, remove the dirt. 	Every six months.

5.0 MAINTENANCE

5.2 TROUBLE SHOOTING CHART



5.0 MAINTENANCE



5.0 MAINTENANCE

5.3 SAMPLE LOG SHEET

SHEET NO.

DUNHAM-BUSH AIR COOLED SPLIT UNIT

UNIT MODEL NO. UNIT NO. VOLTS: Hz

UNIT SERIAL NO.

START UP : DATE TIME.....

DATE									
TIME									
COMP. NO.									
SUCTION PRESSURE	1.								
	2.								
	3.								
	4.								
SUCTION TEMPERATURE	1.								
	2.								
	3.								
	4.								
DISCHARGE PRESSURE	1.								
	2.								
	3.								
	4.								
DISCHARGE TEMPERATURE	1.								
	2.								
	3.								
	4.								
DISCHARGE SUPERHEAT (DISC. TEMP.-SAT. DISCH.)	1.								
	2.								
	3.								
	4.								
SUCTION SUPERHEAT (SAT. SUCT .- SUC. TEMP)	1.								
	2.								
	3.								
	4.								
RETURN AIR TEMPERATURE – DB/WB									
SUPPLY AIR TEMPERATURE – DB/WB									
AIR VOLUME									
AMBIENT AIR TEMPERATURE									
OFF CONDENSER AIR TEMPERATURE									
COMPRESSOR AMPS	1.								
	2.								
	3.								
	4.								
CONDENSER FAN AMPS									
EVAPORATOR FAN AMPS									
VOLTS									

This log sheet is provided as a recommendation of the readings that should be taken on a periodic basis. The actual readings taken and the frequency will depend upon the units application, hours of use, etc. This type of information can prove very useful in preventing and/ or solving problems that might occur during the life of the unit.

5.0 MAINTENANCE

5.4 DUNHAM-BUSH STARTUP REPORT

AIR COOLED CONDENSING UNITS & PACKAGED UNITS

SITE INFORMATION

Job Name _____ Installing Contractor _____
Address _____
Unit No. _____ Unit Location _____ Area Served _____

NAMEPLATE DATA

Unit Details

	<u>Model</u>	<u>Serial No.</u>	<u>Factory Order</u>
Indoor or Packaged Unit	_____	_____	_____
Outdoor Unit (<i>Remote Condenser</i>)	_____	_____	_____

Blower Motor

Model _____ Serial No. _____ Manufacturer _____
Volt _____ Phase _____ Hz _____ FLA _____ LRA _____
RPM _____ kW/HP _____ Type _____

Compressors

	<u>Compressor 1</u>	<u>Compressor 2</u>	<u>Compressor 3</u>
Model	_____	_____	_____
Serial No.	_____	_____	_____
V / Ph / Hz	_____ / _____ / _____	_____ / _____ / _____	_____ / _____ / _____
FLA / LRA	_____ / _____	_____ / _____	_____ / _____

Condenser Fans (Air Cooled & Remote Condenser)

	<u>Model</u>	<u>Serial No.</u>	<u>General</u>
1)	_____	_____	Volt _____
2)	_____	_____	Phase _____
3)	_____	_____	Hz _____
4)	_____	_____	FLA _____
5)	_____	_____	LRA _____
6)	_____	_____	HP/kW _____

BLOWER & COIL

Blower Section

Blower Model _____ Size _____ Fan Belt Model _____
Blower Pulley Model _____ Size _____ Fan Belt Size _____
Motor Pulley Model _____ Size _____ Quantity _____

Coil Section

Coil Material Aluminium Copper Hydrophilic
Coil Arrangement FPI _____ Length _____ Height _____ # Rows _____
Filter Type _____ Filter Size 1) _____ X _____ # Filters _____
2) _____ X _____ # Filters _____
3) _____ X _____ # Filters _____

5.0 MAINTENANCE

ELECTRICAL

	<u>Contactors</u> <u>Model / Rating</u>	<u>Serial No.</u>	<u>Qty</u>	<u>Type of Starters</u>	
Blower Fan	_____	_____	_____	<input type="checkbox"/> DOL	<input type="checkbox"/> SD / AT
	_____	_____	_____		
Comp. 1	_____	_____	_____	<input type="checkbox"/> DOL	<input type="checkbox"/> SD / AT
	_____	_____	_____		
Comp. 2	_____	_____	_____	<input type="checkbox"/> DOL	<input type="checkbox"/> SD / AT
	_____	_____	_____		
Comp. 3	_____	_____	_____	<input type="checkbox"/> DOL	<input type="checkbox"/> SD / AT
	_____	_____	_____		
Cond. Fan 1	_____	_____			
Cond. Fan 2	_____	_____			
Cond. Fan 3	_____	_____			
Cond. Fan 4	_____	_____			
Cond. Fan 5	_____	_____			
Cond. Fan 6	_____	_____			

Winding Insulation Test

<u>Blower Motor</u>	<u>Compressor 1</u>	<u>Compressor 2</u>	<u>Compressor 3</u>
L1 _____ MΩ	L1 _____ MΩ	L1 _____ MΩ	L1 _____ MΩ
L2 _____ MΩ	L2 _____ MΩ	L2 _____ MΩ	L2 _____ MΩ
L3 _____ MΩ	L3 _____ MΩ	L3 _____ MΩ	L3 _____ MΩ

Note :

Type apostrophe ' ahead of serial number when serial number appears as ##.
 Example: Type '123457890 for 1234567890.
 The Startup Report must be duly completed and copied to Dunham-Bush.
 The Startup Report applies to various models. Fill in where applicable.
 This list may be incomplete. Please fill setpoint in miscellaneous section if undefined.

DISCLAIMER

Failing to submit your Startup Report and Logsheets within (2) weeks from the date of startup will invalidate factory warranty on the whole unit.
 Please submit your startup report to the following address for warranty registration.

Attn : The Administrator (Global Service)

Dunham-Bush Holding Bhd

Lot 5755-6, Kidamai Industrial Park, Bukit Angkat, 43000 Kajang, Selangor Darul Ehsan, MALAYSIA
 Tel: (603) 8733 9898, Fax: (603) 8734 2178, 8734 6178
 E-mail: global@dunham-bush.com

5.0 MAINTENANCE

5.5 STARTUP CHECK LIST

- | | | |
|-------------------------------------------------------------------------------|------------------------------|-----------------------------|
| 1) Shipping, Transportation, Installation, Handling, or any other damages? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2) Short shipped components or accessories? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3) Unit installed in accordance with the technical specifications provided? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4) Steel brackets or wooden blocks against transportation damage removed? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5) Bower wheel mounted onto the shaft and setscrews tightened firmly? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 6) Blower shaft mounted onto the bearings and setscrews tightened firmly? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7) Blower pulley and motor pulley aligned and setscrews tightened firmly? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8) Bearings mounted firmly onto the framework or structure? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 9) Fan belt of the same size and type. Belt tension checked and acceptable? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 10) Motor bracket fastened firmly onto the rail without any loose motion? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 11) Motor and shaft bearings greased and lubricated? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 12) Rotating parts free to rotate whenever they are rotated manually? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 13) Drain pipe and "U" trap installed? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 14) Permanent return air filters or any other temporary filters installed? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 15) Any object or rubbish that would be sucked into the blower removed? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 16) Motor resistance above minimum resistance required for startup? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 17) Incoming power supply tested for correct phase sequence, voltage, etc? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 18) Setpoints verified and control sequence tested for functionality? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 19) Fan motor tested for correct rotation. Current drawn less than 1.1 x FLA? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 20) Compressor tested for correct rotation and functionality? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 21) Sign of vibration or abnormal noise? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 22) Sign of air leakage or condensation? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

5.0 MAINTENANCE

5.6 OPERATING PARAMETERS

Job Name _____ Unit Model _____ Date _____
 Job Location _____ Unit Serial No. _____ F/O _____

			Actual	Controller Setpoint	-
GENERAL	Room Temperature °C				-
	Evaporator	On Coil	(Dry Bulb) °C	-	-
			(Wet Bulb) °C	-	-
	Off Coil	(Dry Bulb) °C	-	-	
		(Wet Bulb) °C	-	-	

			System 1	System 2	System 3	
SYSTEM	Pressure	Suction Pressure	bar			
		Disch. Pressure	bar			
		Liquid Pressure	bar			
	Temp	Suction Temp	°C			
		Disch. Temperature	°C			
		Liquid Temperature	°C			
	SSH	Suction Superheat	°C			
		Disch. Superheat	°C			
		Subcooling	°C			
	Condenser	On Coil	(Dry Bulb) °C			
			(Wet Bulb) °C			
		Off Coil	(Dry Bulb) °C			
(Wet Bulb) °C						

			System 1		System 2		System 3		
ELECTRICAL	Amperage	Blower Fan	A		-		-		
		Compressors	A	System 1		System 2		System 3	
		Condenser Fans	A	1	2	3	4	5	6
	Voltage	L1~L2	V						
		L1~L3	V						
		L2~L3	V						

REMARKS

DETAILS OF STARTUP ENGINEER

CUSTOMER ACCEPTANCE OF STARTUP

 SIGNATURE

 SIGNATURE

 NAME/TITLE

 NAME/TITLE

 COMPANY

 COMPANY

 ADDRESS

 ADDRESS

 CONTACT NO.

 CONTACT NO.

MANUFACTURER RESERVES THE RIGHT TO CHANGE SPECIFICATION OR DESIGN AT ANY TIME WITHOUT PRIOR NOTICE.



Products that perform...By people who care



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