Form No: FE2995-CS3

DUNHAM-BUSH

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DB

INSTALLATION, OPERATION & MAINTENANCE MANUAL

MODULAR CENTRAL STATION AIR-HANDLING UNITS

CS3 Series

TABLE OF CONTENTS

NOMENCLATURE

Each unit nameplate will carry the unit model designation.

The following gives a sample nomenclature of Dunham-Bush air-handlers

AHD FS 100 H L

AHD= Air Handler Double Skinned

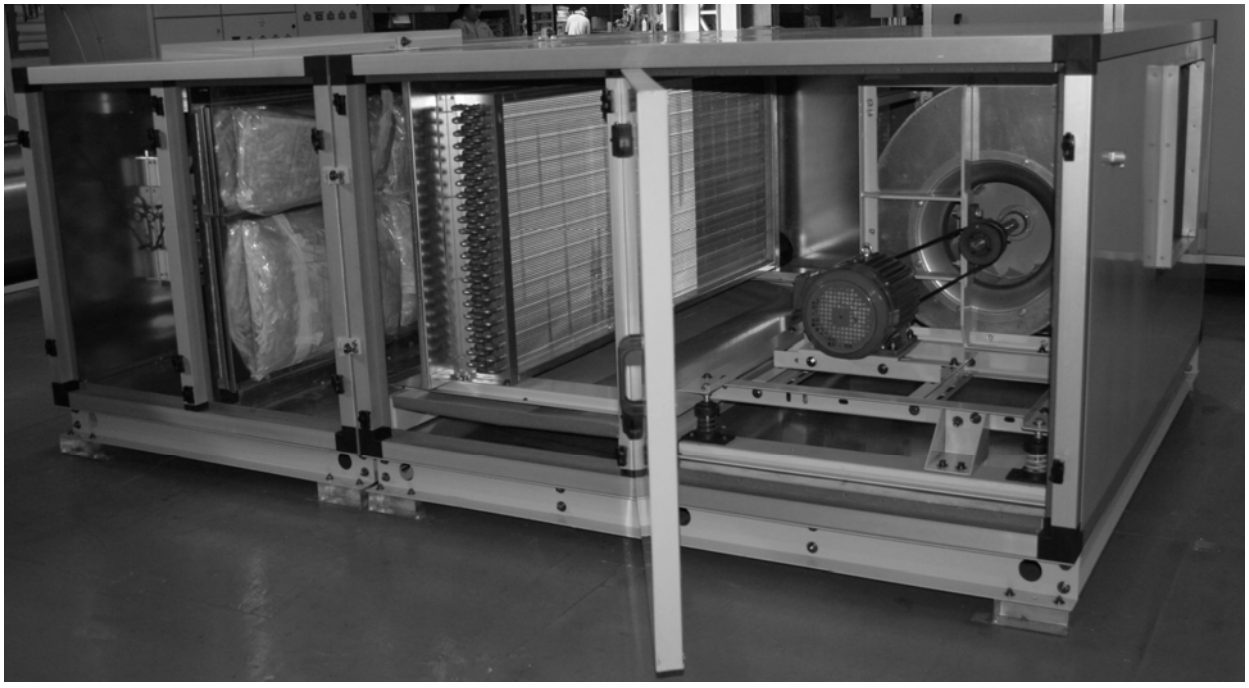
FS= Forward Curved Wheel
AF= Air Foil Wheel
BF= Backward Curved

Unit Size = Nominal CFM / 100

L= Low Pressure Unit Up To 3.5" TSP
M= Medium Pressure Unit Over 3.5" TSP

H= Horizontal
V= Vertical
M= Multi Zone

MODULAR DESIGN



INTRODUCTION

RECEIVING

All units leaving Dunham-Bush factory have been thoroughly checked to ensure the shipment of quality products. We guarantee that all air-handlers are properly packaged.

Cautions: Dunham-Bush Industries Sdn Bhd will not be responsible for any damages or loss parts in shipment or at the job site. Report any shipping damage to nearest Dunham-Bush office immediately.

Carefully inspect all shipments immediately after delivery. When damage is evident, note this fact on the carrier's freight bill and request that the carrier send a representative to inspect the damage. This may be done by telephone or in person, but should always be confirmed in writing.

The shipment should be unpacked in the presence of the agent so that the extent of damage or loss can be determined. The carrier's agent will make an inspection report and a copy will be given to the consignee for forwarding to the carrier with a formal claim. Do not report missing items until you have thoroughly checked the units because bolts, belts or other small item's might be packed inside the units.

STORAGE

If equipment is stored out-of-doors, special care should be taken to protect against moisture, corrosion and dust. Wheels should be covered to prevent unintended location by wind. Equipment, when stored under such conditions, must be periodically inspected to stop trouble from developing.

LONG-TERM STORAGE

If storing unit before installation, observe the following precautions,

1. The storage site should be level, rigid, and free of debris. If the site is in a heavy rain area, set the unit off of the ground.
2. Do not store the unit in a heavy traffic area or on a vibrating surface. Vibration can damage stationary bearings.
3. Monthly move the coverall, enter the fan section through the access door, and slowly rotate the fan and motor by hand. This operation prevents bearing corrosion by redistributing the bearing grease.
4. On no occasion should anything be stacked on top of the units. The elapsed time for the warranty prevails even though the units are in storage.

INTRODUCTION

HANDLING AND RIGGING

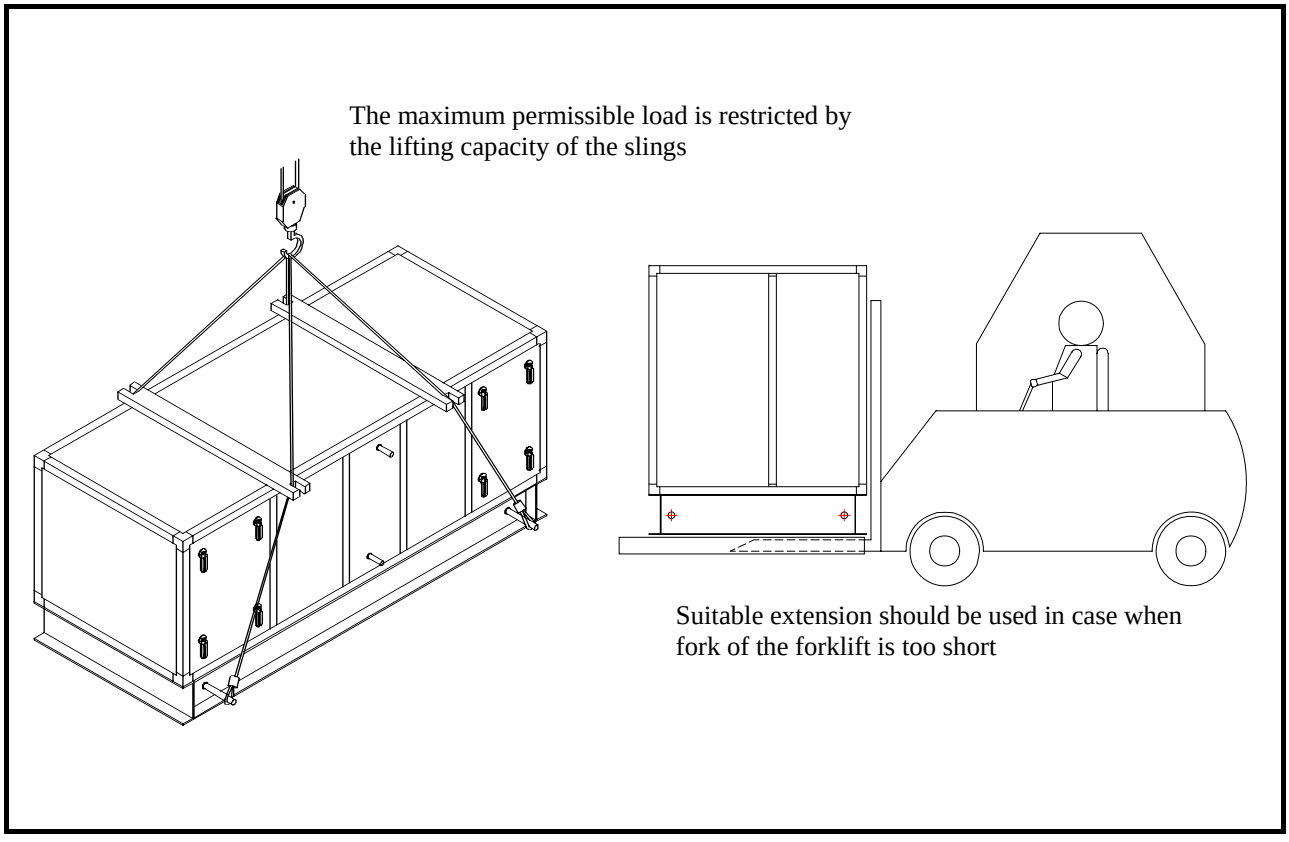
Proper handling and rigging procedure should be exercised to prevent damages. Some units are completely assembled and should be handled carefully to avoid dropping or jarring. Others are shipped in a few sections or completely knock-down. Care is required in handling the individual parts. Fan wheels, casings, coils that are furnished with extra protective coatings must be handled with extreme care, as an injury to the coating can result in a break of continuity and this will destroy permanently the value of the protective covering for the metal. Any such rupture of coating, due to mishandling, is not covered by the guarantee.

Air handling units are shipped on strong plastic package or crate with sections bolted as determined by lorries or trailer size limitations. When lifting with slings, use spreader bars across the top of the units to avoid damaging panel or framework. Caution must be exercised to avoid damages to any sections. Check the weight of the units before rigging. Try to place the rigging cable such that the weight is evenly distributed.

Lifting cables should not be attached to the extremities of the accessory sections without intermediate support at the basic units. The feet on the accessory section are provided for isolator mounting and not designed for rigging connections and must not be abused.

All fan outlets are covered with cardboard. Remove it just prior to when the duct is connected to the unit.

Figure 1: Typical Rigging



INSTALLATION

GENERAL

If your inspection indicates that the unit is ready for installation, move it to the desired location. Evaluate the job site by considering the following points:

(l.) Is the floor or foundation level enough to support the weight of the unit (the minimum foundation shall be 4 times the rotating mass of the fan and drives or about double of the units weight). Refer to table 1 to 5 for weight and dimensions.

(2.) Is there sufficient space for making piping, drainings and wiring connections, and this space accessible.

(3.) Is there adequate space for servicing the unit, and for removing or opening the access doors. A minimum clearance equal to the width of the units must be provided on one side of the unit for removing the coil, shaft and wheel.

(4.) How ductwork is to be done and is there enough space for ducting.

In extreme cases when it is necessary to completely isolate any vibration from the air-conditioner which can adversely affect any other nearby equipment, it is recommended that either one of the following methods be followed:

(1.) Provide a separate floating plinth.

(2.) Place the unit on a minimum 2.5" thick cork sheet.

(3.) Support the complete unit on spring isolators. Request factory to provide correct spring isolators and mounting brackets at base units.

For stringent quiet and vibration-free application, a good acoustical and vibration engineering practice has to be applied.

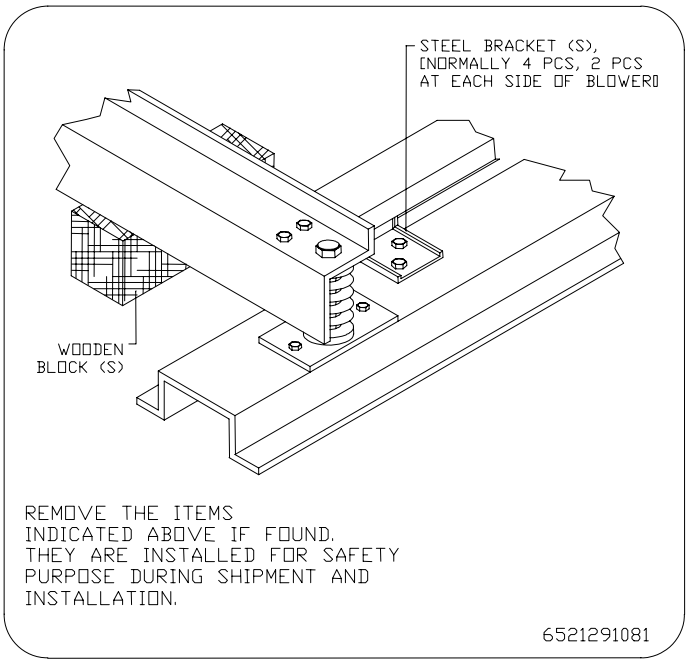
Ideally, a heavy concrete slab should be used for floor mounted units, and main support beams for ceiling hung units. Long floor or ceiling spans should be avoided.

INSTALLATION

Fan System

The fan section needs to be checked carefully before the unit is turned on. After removing all transportation protections (only in case when spring shock absorbers are installed) one should check if there are any objects near the fan, which could be sucked into the impeller after it is turned on. See Figure 2.

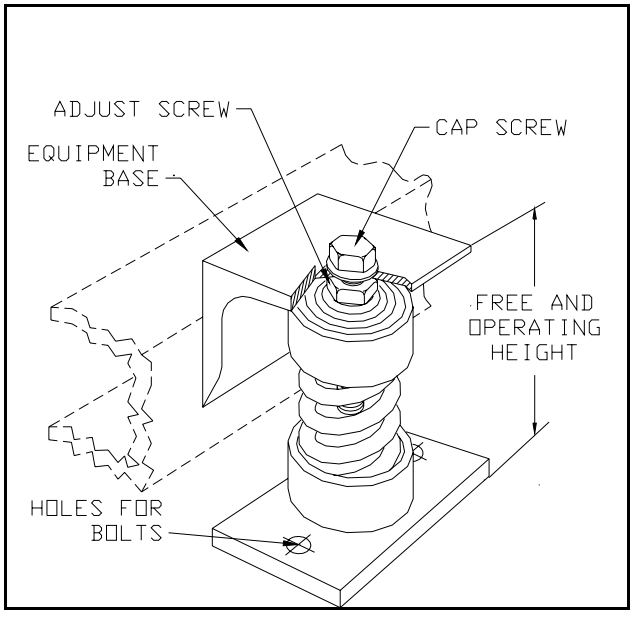
Figure 2



LEVELING FAN DECK ASSEMBLY

After installation, check the fan deck to ensure that it is level with the foundation. The level may be corrected by loosening the cap screw (see Figure 3). To raise the level, turn the adjusting screw anti-clockwise; to lower, turn the screw clockwise. When the correct level is achieved, firmly tighten the cap screw.

Figure 3: Spring Floor Mount



CLEARANCE

Clearance must be provided for

(a.) Supply and return ductwork
(b.) Chilled water piping connection
(c.) Electrical power and control wiring
(d.) Trapped condensate drain connection
(e.) Routine services like filter and lubrication
(f.) Coil removal

Curb mounted and weather-proof units can be provided upon request.

GENERAL PIPING PARAMETERS - HOT WATER COILS

The following precautions should be noted with regard to the piping layout for hot water coils:

(1.) All coils should be connected to provide adequate venting and drainage.

(2.) Thermometers are recommended to provide temperature readings when coils are balanced.

(3.) a. Plug cocks are used to manually adjust the water flow for a set pressure drop through the coil.

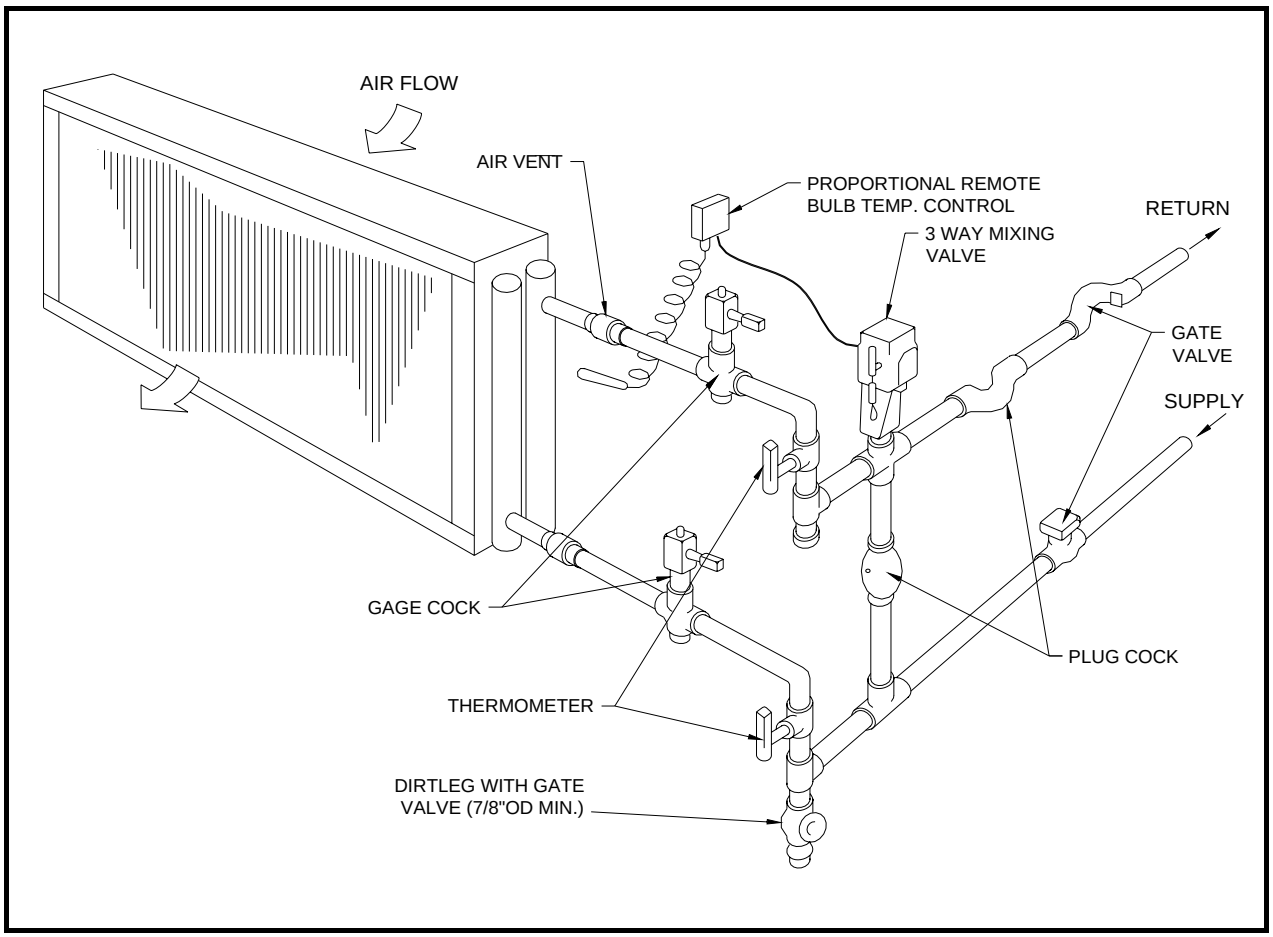
b. The pressure drop is determined by connecting pressure gauges to the gauge cocks

(4.) The leaving air temperature from the coil (in this piping layout) is maintained by automatically proportioning the amount of water flowing through the coil or through the by-pass. The water flow is regulated by a motorised 3 way mixing valve, controlled through a proportional remote bulb temperature controller.

(5.) A gate valve and hose connection provided in the supply line dirt leg should be supplied when floor drains are remote in relation to the coil location.

(6.) Water piping and coil section should be supported independently.

Figure 4: Hot Water Coil Piping Layout



INSTALLATION

GENERAL PIPING PARAMETERS -STEAM COILS (MEDIUM OR HIGH PRESSURE SYSTEM)

The following precautions should be noted with regard to the piping layout for steam coils:

(1.) Return piping from coil to trap should be of at least the same size as the coil outlet connection.

(2.) Steam piping and coil section should be supported independently.

(3.) The sizing of control valves should be based on the steam load and not on the coil supply connection size.

(4.) Thermostatic traps should be used for venting only.

(5.) A strainer should be provided on the steam supply side of the control valve.

(6.) Locate traps at least 12 inches below the coil return connection.

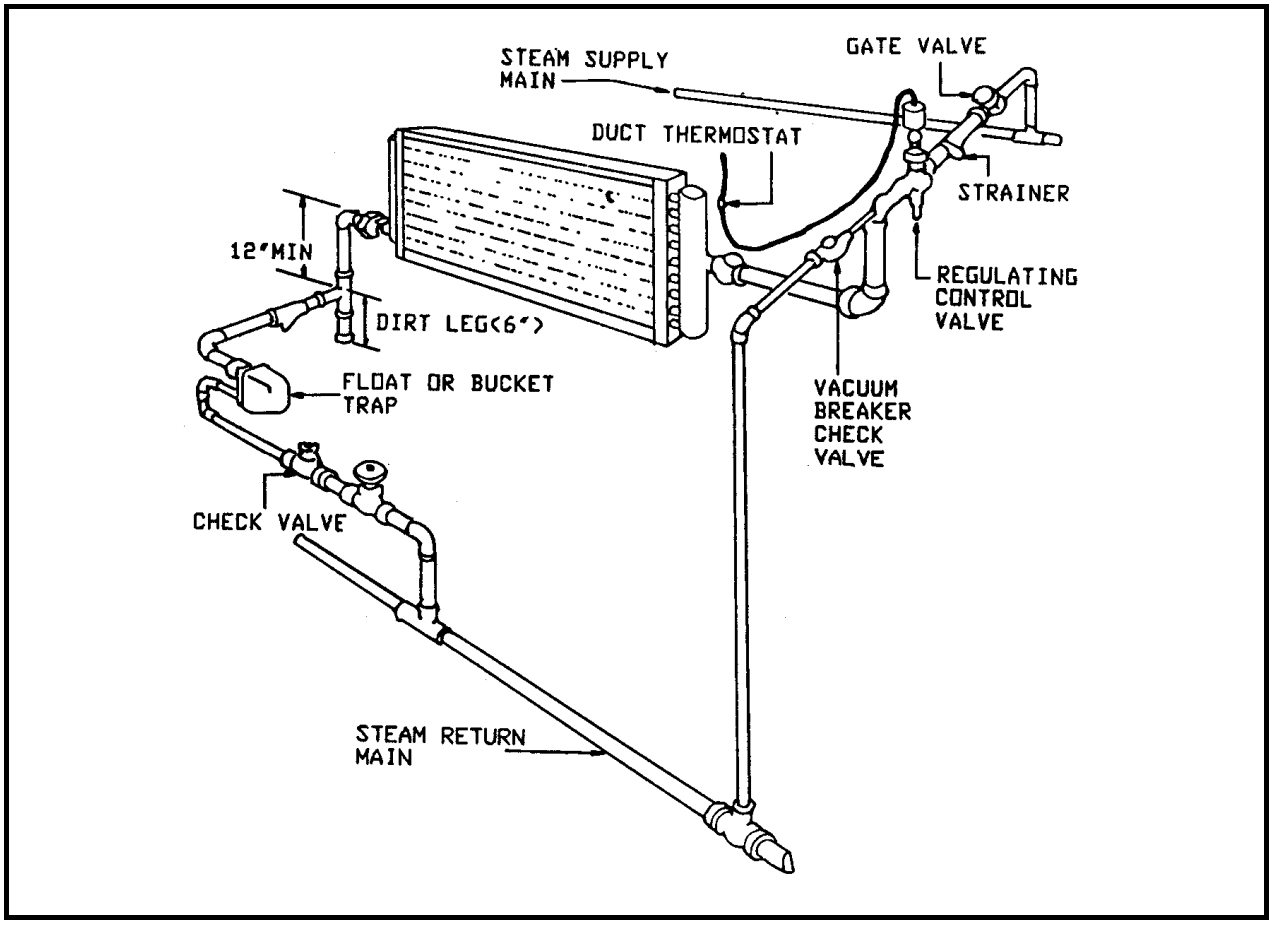
(7.) Where handling outside air below 35°F the following precautions must be followed:

a. Proper draining is mandatory to avoid damage by freezing.

b. Do not use overhead returns from coils.

c. An immersion thermostat should be used to protect the coil. The device controls the outdoor air damper and fan motor when the steam supply fails or condensate temperature drops below a pre-set level. Thermostat is located in the return line before the dirt leg.

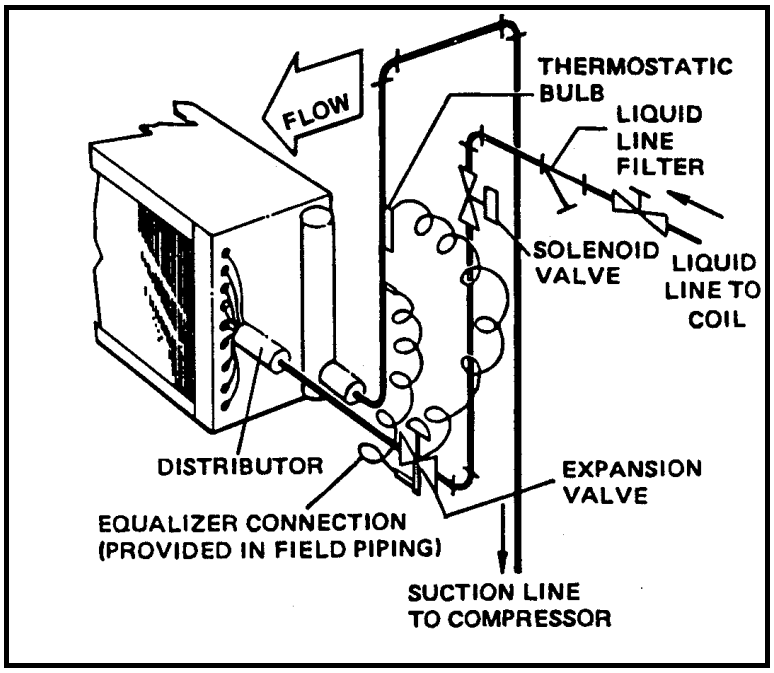
Figure 5: Steam Coil Piping Layout



GENERAL PIPING PARAMETERS- DIRECT EXPANSION COILS

Each coil must be installed with the suction header on the entering air face of the coil and with the suction connection at the lower end. The orientation of the refrigerant distributor is not critical but the distributor tubes must not be kinked or bent in a non-uniform configuration. Refer to, Figure 6.
An individual expansion device must be provided for each coil or each section of coil which contains a header suction connection. If the air flow through two or more coils is in parallel, as in a stacked coil bank, the suction piping must be installed in such a way that liquid from one coil suction header cannot reach another coil suction header. The bulb for the control valve must be attached to the header of the coil or section of coil fed by that valve and not to a common header. When two or more coils are connected to a common suction line, never place the bulb on the common line.

Figure 6: DX Coil Piping Arrangement



Thermostatic expansion valves are to be equipped with external equalizer tubes that are field connected to the suction line. The valve should be sized in accordance with the manufacturers recommendations, allowing approximately 35 psi pressure drop through the coil and distributor at full load. Do not oversize the valve. Follow the valve manufacturer's instructions on the location of the thermostatic bulb. Proper expansion valve operation is necessary in order to realize the rated coil capacity.

When a DX type coil is operated with a suction temperature below 32°F, a build up of frost will occur on the finned surface. It is, therefore, not recommended to operate DX coils for air conditioning purposes at below freezing suction temperatures. If the full load operating point for the coil is selected at a "safe" temperature, a system analysis is required to check for the lowest probable suction temperature at light load conditions. Suction pressure controlled hot gas bypass valves are available from various control manufacturers to maintain an adequate minimum suction temperature.

INSTALLATION

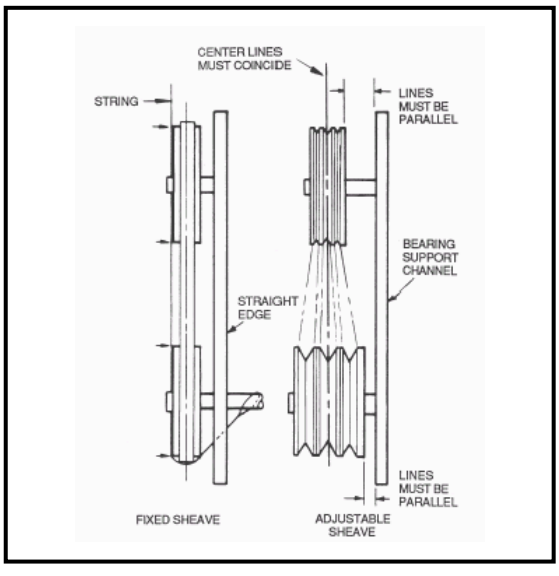
SHEAVES ALIGNMENT

Factory-supplied drives are pre-aligned and tensioned. However, it is recommended that you check the belt tension and alignment before starting the unit. Always check the drive alignment after adjusting belt tension. To install sheaves on the fan or motor shaft, remove any rust-preventive coating on the shaft. Make sure the shaft is clean and free of burrs. Add grease or lubricant to bore of sheave before installing. Mount sheave on the shaft. To prevent bearing damage do not use excessive force. Place sheaves for minimum overhang. Each factory-assembled fan, shaft and drive sheave assembly is precision aligned and balanced. If excessive unit vibration occurs after field replacement of sheaves, the unit should be rebalanced. To change the drive ratio, reselect and replace the motor sheave, not the fan sheave.

Make sure that fan shafts and motor shafts are parallel and level. The most common causes of misalignment are nonparallel shafts and improperly located sheaves. Where shafts are not parallel, belts on one side are drawn tighter and pull more than their share of the load. As a result, these belts wear out faster, requiring the entire set to be replaced before it has given maximum service. If misalignment is in the sheave, belts enter and leave the grooves at an angle, causing excessive belt and sheave wear.

1. Shaft alignment can be checked by measuring the distance between the shafts at 3 or more locations. If the distances are equal, then the shafts are parallel.
2. Sheave alignment:
    - Fixed sheaves: To check the location of the fixed sheaves on the shaft, a straightedge or a piece of string can be used. If the sheaves are properly aligned, the string will touch them at the points indicated by the arrows in Figure 5.
    - Adjustable sheaves: To check the location of adjustable sheave on shaft, make sure that the centerlines of both sheaves are in line and parallel with the bearing support channel. See Figure 5. Adjustable pitch drives are installed on the motor shaft.
3. Rotate each sheave a half revolution to determine whether the sheave is wobby or the drive shaft is bent. Correct any misalignment.
4. With sheaves aligned, tighten cap screws evenly and progressively.
5. With taper-lock bushed hubs, be sure the bushing bolts are tightened evenly to prevent side-to-side pulley wobble. Check by rotating sheaves and rechecking sheave alignment. When substituting field-supplied sheaves for factory-supplied sheaves, consider that fan shaft sheaves has been factory balanced with fan and shaft as an assembly. For this reason, substitution of motor sheave is preferable for final speed adjustment.

FIGURE 7: Sheave alignment



INSTALLATION

BELT TENSION INSPECTION GUIDE

When installing or replacing belts, always use a complete set of new belts. Mixing old and new belts will result in the premature wear or breakage of the newer belts.

Correct tensioning of V-belts drive is carried out as follows,

1. Fit the belts into the grooves and increase the centre distance until the belts are snug. (Note: Never lever belts over sheaves)
2. Tighten belts and equalize belt slack so that it is on the same side of belt for all belts. Failure to do so may result in uneven belt stretching.
3. As shown in Figure 8, measure the span length (mm) of the drive. Determine the deflection at the centre of the span according to the table below.

Belt Span (mm)	Deflection (mm)
250-300 310-360 370-420	4 5 6
430-480 490-540 550-600	7 8 9
610-660 670-720 730-780	10 11 12
790-840 850-900 910-960	13 14 15
970-1020 1030-1080 1090-1140	16 17 18

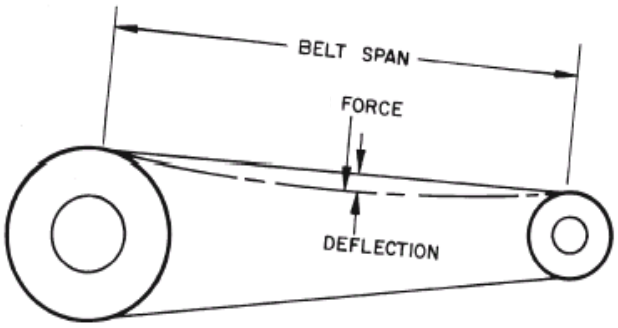


FIGURE 8

4. From table below, find the appropriate deflection force according to belt type. The deflection force for any V-belt should be within the minimum and maximum force shown in the table. When the tension drops to the minimum value, readjust to the maximum value.

Deflection Force (Kg)								
Belt Type	**SPZ**		**SPA**		**SPB**		**SPC**	
Diam. Of smaller sheave (mm)	**Min.**	**Max**	**Min.**	**Max**	**Min.**	**Max**	**Min.**	**Max**
63-80	1.2	1.9	-	-	-	-	-	-
90-112	1.6	2.4	1.9	2.9	-	-	-	-
125-160	1.9	2.8	2.6	4.0	3.3	5.0	-	-
180-224	1.9	2.9	3.0	4.6	4.3	6.4	5.8	8.7
250-355	-	-	3.2	4.8	5.1	7.7	7.9	11.9
400-630	-	-	-	-	5.5	8.2	10.3	15.4

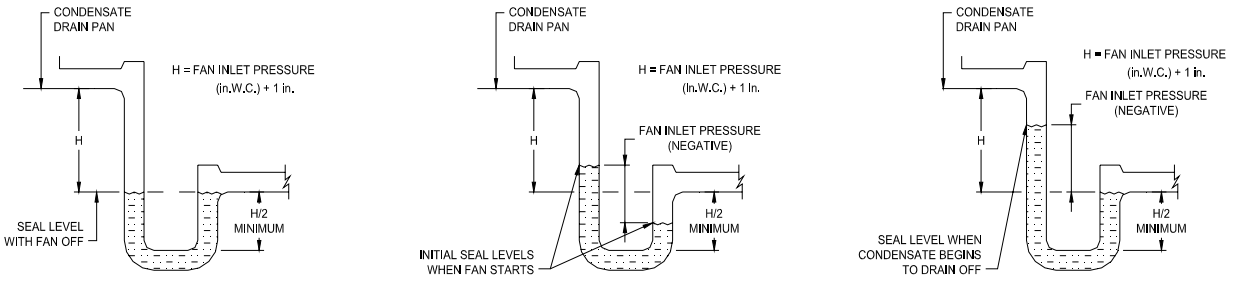
Note: A new drive should be tensioned to the higher value. After the drive has been running for 30 minutes, the tension should be checked and readjusted to higher value.

CONDENSATE DRAIN TRAPS

The condensate drain trap piping must be properly designed to insure the removal of condensate (See Figure 9).

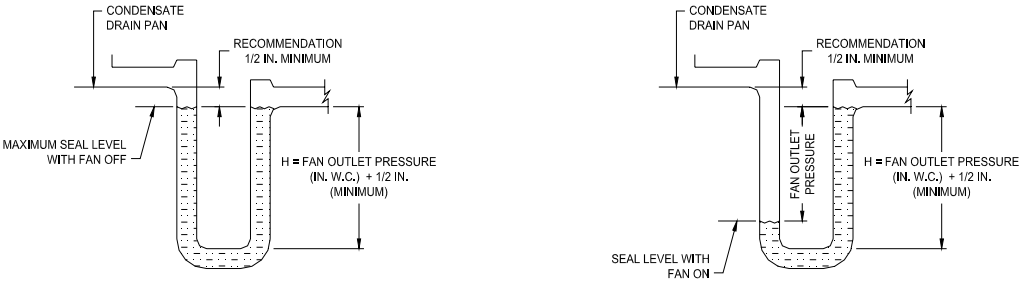
FIGURE 9: TYPICAL CONDENSATE PIPING

a.) Condensate Drain – Draw-through units



1. Fan Off
2. Fan Just Started
3. Condensate Beginning to Drain Away

b.) Condensate Drain – Blow-through units



1. Fan Off
2. Fan Running and Condensate Beginning to Drain Away

DUCT CONNECTIONS

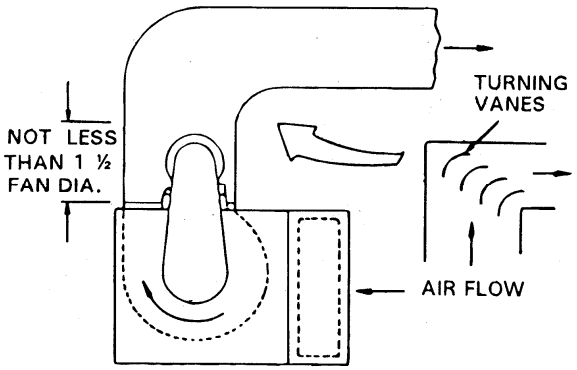
All intake and discharge air duct connections to the unit should be made with flexible material. The accessory flexible connectors may be used for this purpose. The flexible material should be installed so that it is sufficiently loose to prevent the transmission of vibration to the ductwork. Duct turns and transitions must be made carefully to hold the friction loss to a very minimum. Avoid short turns and duct elbows should contain splitters or turning vanes.

Ductwork which is connected to the fan discharge should run in a straight line at least 1½ fan diameters and should not be reduced in cross sectional area (See Figure 10). Figure 10 shows the recommended air discharge arrangement for an air duct turn made close to the unit. Notice that a duct should be in same direction as the fan rotation. Never deadhead the discharge into the flat side of a plenum.

The air duct should never be unprotected to the elements when outside air is drawn into a unit. A hood or louvered assembly should be provided to keep rain and snow out of the unit. Also an expanded metal screen should be provided to keep birds and other animals out. Open return air ducts and free discharge openings should be protected with an expanded metal screen.

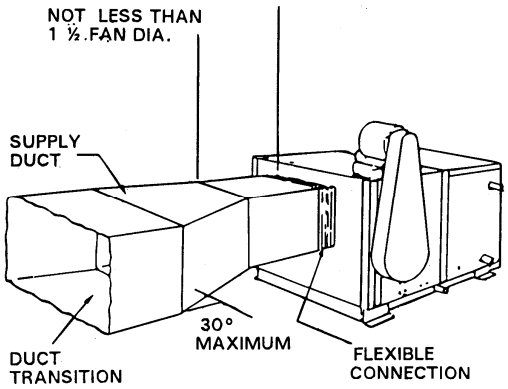
INSTALLATION

FIGURE 10: RECOMMENDED DISCHARGE DUCT ARRANGEMENT WHEN TURNS ARE REQUIRED



Note : Make Turns In The Same Direction As Fan Rotation.

FIGURE 11: DUCT CONNECTIONS



JUNCTION BOX CONDENSATE PREVENTION

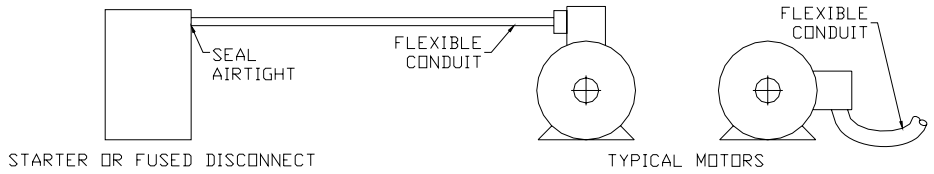
When air handlers are installed outdoors in a high humidity environment or indoors where the apparatus room is used as a fresh air plenum, precautions must be taken to prevent condensation forming inside the junction box of the internally mounted motor.

Standard installation practice is to mount the motor starter or fused disconnect box adjacent to the air handler and enclose the power wiring to the motor in flexible conduit.

The sheet metal housing of the disconnect switch or motor starter is not airtight. Thus, warm moist air can migrate through the flexible conduit to the junction box on the motor. With the motor located inside the unit, the motor temperature is that of the cool supply air; thus, condensate can form inside the junction box and, possibly, on the live terminal lugs.

To prevent the moist air from migrating through the conduit to the motor, seal the power wires inside the flexible conduit at the motor starter or fused disconnect (Figure 12) by using a nonconductive, non-hardening sealant.

FIGURE 12: SEALING POWER WIRES IN FLEXIBLE CONDUIT

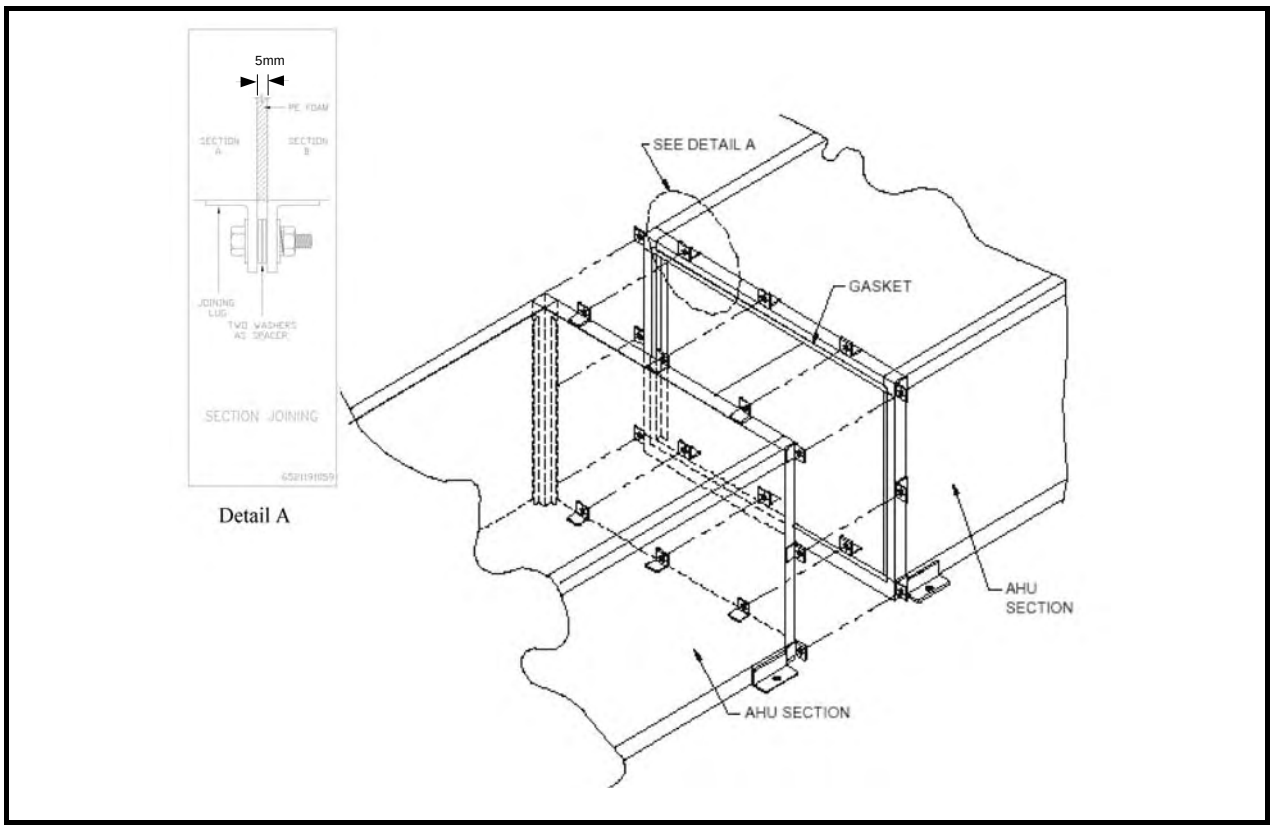


INSTALLATION

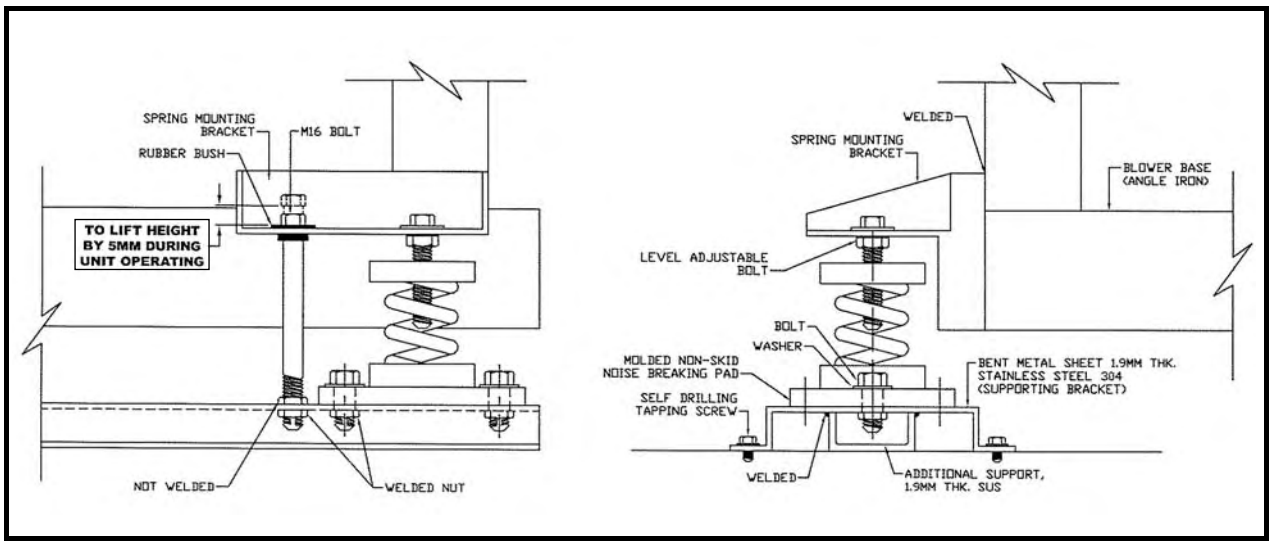
SECTION ASSEMBLY

Sections are connected together as shown in Figure 13. Rig and align sections so that sides andtops are flush and joining lug are aligned. Places of contact of framework profiles should becovered with gasket around perimeter of unit frame, which has been assembled onto the sectionframe. Fasten the bolts and nuts provided following the instruction, which can be found on sideof the section frame. In general, torque required to pull the joining lug shall be 35±3 lb-ft inorder to compress the gasket which creates the frame seal.

FIGURE 13



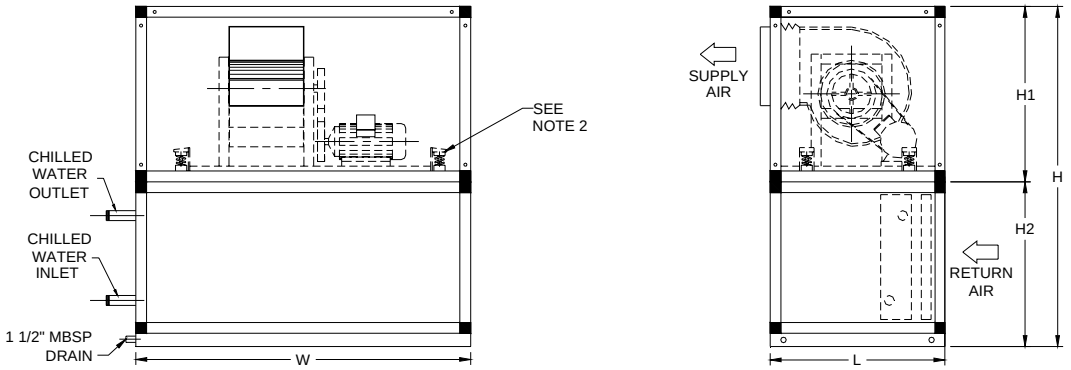
SHIPPING BRACKET



INSTALLATION

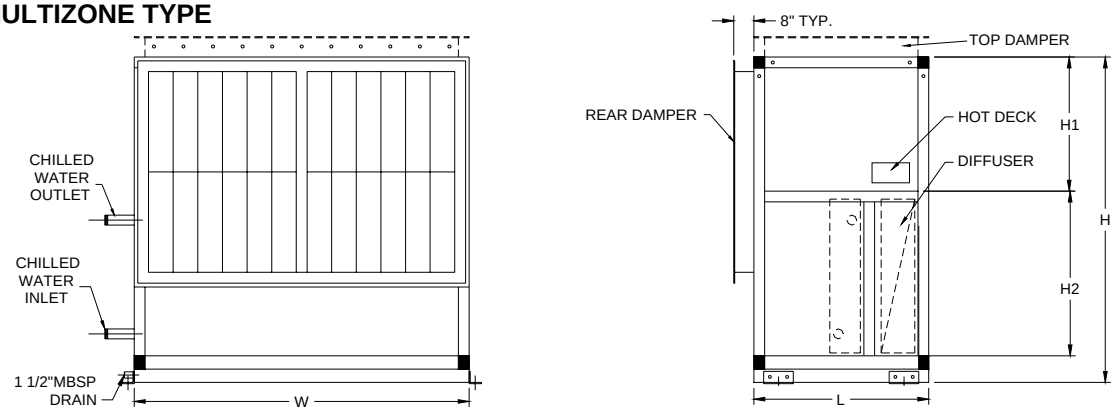
PHYSICAL DIMENSION

1.) VERTICAL TYPE



Model	1" Casing - inch [mm]					2" Casing - inch [mm]				
	H	W	H1	H2	L	H	W	H1	H2	L
12	60 5/8[1540]	33.1/16[840]	-	-	33 1/16[840]	61[1550]	33 7/16[850]	-	-	33 7/16[850]
22	68 1/2[1740]	48 13/16[1240]	-	-	33 1/16[840]	68 7/8[1750]	49 1/4[1250]	-	-	33 7/16[850]
32	76 3/8[1940]	48 13/16[1240]	-	-	33 1/16[840]	76 3/4[1950]	49 1/4[1250]	-	-	33 7/16[850]
40	84 1/4[2140]	56 11/16[1440]	-	-	33 1/16[840]	84 5/8[2150]	57 1/16[1450]	-	-	33 7/16[850]
48	84 1/4[2140]	64 9/16[1640]	-	-	40 15/16[1040]	84 5/8[2150]	65[1650]	-	-	41 3/8[1050]
64	85 7/8[2180]	80 5/16[2040]	40 15/16[1040]	44 7/8[1140]	40 15/16[1040]	86 5/8[2200]	80 3/4[2050]	41 3/8[1050]	45 1/4[1150]	41 3/8[1050]
80	101 1/2[2580]	80 5/16[2040]	48 13/16[1240]	52 3/4[1340]	48 13/16[1240]	102 3/8[2600]	80 3/4[2050]	49 1/4[1250]	53 1/8[1350]	49 1/4[1250]
100	109 7/16[2780]	80 5/16[2040]	48 13/16[1240]	60 5/8[1540]	48 13/16[1240]	110 1/4[2800]	80 3/4[2050]	49 1/4[1250]	61[1550]	49 1/4[1250]
120	117 5/16[2980]	80 5/16[2040]	48 13/16[1240]	68 1/2[1740]	48 13/16[1240]	118 1/8[3000]	80 3/4[2050]	49 1/4[1250]	68 7/8[1750]	49 1/4[1250]
150	133 1/16[3380]	80 5/16[2040]	56 11/16[1440]	76 3/8[1940]	56 11/16[1440]	133 7/8[3400]	80 3/4[2050]	57 1/8[1450]	76 3/4[1950]	57 1/16[1450]
180	NOT AVAILABLE					141 3/4[3600]	104 5/16[2650]	651650	76 3/4[1950]	65[1650]
210						148 7/16[3770]	112 3/16[2850]	65[1650]	83 3/4[2120]	65[1650]
240						148 7/16[3770]	120 1/16[3050]	65[1650]	83 3/4[2120]	65[1650]

2.) MULTIZONE TYPE



Model	1" Casing - inch [mm]					2" Casing - inch [mm]				
	H	W	H1	H2	L	H	W	H1	H2	L
22	52 3/4[1340]	48 13/16[1240]	-	-	40 15/16[1040]	53 1/8[1350]	49 1/4[1250]	-	-	41 3/8[1050]
32	60 5/8[1540]	48 13/16[1240]	-	-	40 15/16[1040]	61[1550]	49 1/4[1250]	-	-	41 3/8[1050]
40	60 5/8[1540]	56 11/16[1440]	-	-	40 15/16[1040]	61[1550]	57 1/16[1450]	-	-	41 3/8[1050]
48	60 5/8[1540]	64 9/16[1640]	-	-	40 15/16[1040]	61[1550]	65[1650]	-	-	41 3/8[1050]
64	60 5/8[1540]	80 5/16[2040]	-	-	40 15/16[1040]	61[1550]	80 11/16[2050]	-	-	41 3/8[1050]
80	78[1980]	80 5/16[2040]	25 3/16[640]	52 3/4[1340]	48 13/16[1240]	78 3/4[2000]	80 11/16[2050]	25 9/16[650]	53 1/2[1350]	49 3/4[1250]
100	85 7/8[2180]	80 5/16[2040]	25 3/16[640]	60 5/8[1540]	48 13/16[1240]	86 5/8[2200]	80 11/16[2050]	25 9/16[650]	61[1550]	49 3/4[1250]
120	93 11/16[2380]	80 5/16[2040]	25 3/16[640]	68 1/2[1740]	56 11/16[1440]	94 1/2[2400]	80 11/16[2050]	25 9/16[650]	68 7/8[1750]	57 1/16[1450]
150	101 9/16[2580]	80 5/16[2040]	25 3/16[640]	76 3/8[1940]	56 11/16[1440]	102 3/8[2600]	80 11/16[2050]	25 9/16[650]	76 3/4[1950]	57 1/16[1450]
180	NOT AVAILABLE					102 3/8[2600]	104 5/16[2650]	25 9/16[650]	76 3/4[1950]	57 1/16[1450]
210						109 1/16[2770]	112 3/16[2850]	25 9/16[650]	83 7/16[2120]	65[1650]
240						109 1/16[2770]	120 1/16[3050]	25 9/16[650]	83 7/16[2120]	65[1650]

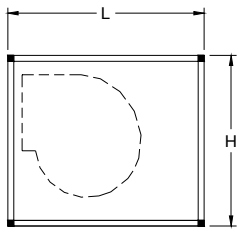
Notes: 1. Height (H) includes the unit base.
2. Spring type isolators are for standard fan of model AF64 onwards and FS80 onwards only. The rest are rubber isolator mounting.
3. L/H motor and R/H piping shown.

INSTALLATION

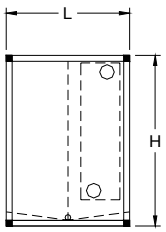
PHYSICAL DIMENSION

3.) DIMENSIONS FOR ACCESSORY SECTIONS

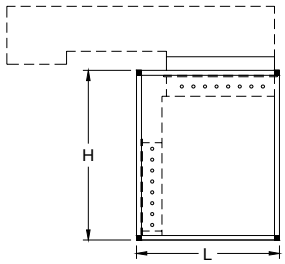
FAN MODULE



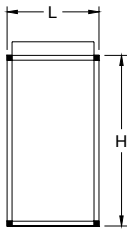
COIL MODULE



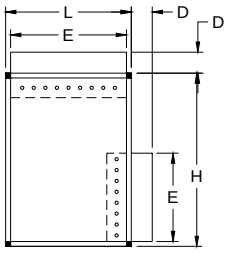
EXTERNAL FACE AND BYPASS MODULE



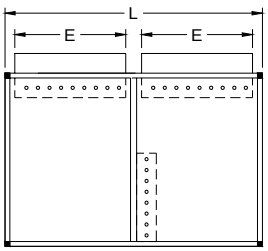
DISCHARGE PLENUM MODULE



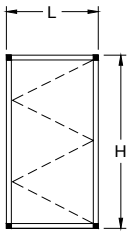
MIXING BOX MODULE



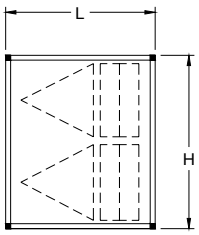
ECONOMIZER MODULE



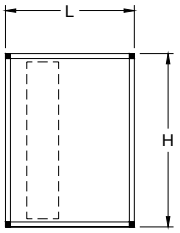
ANGLE FILTER MODULE



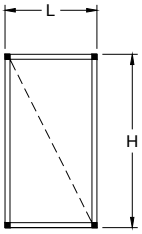
FLAT & BAG FILTER MODULE



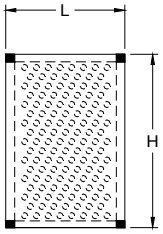
HEPA FILTER MODULE



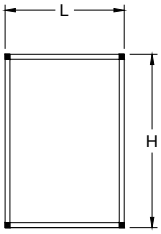
DIFFUSER MODULE



SILENCER MODULE



ACCESS MODULE



Model	Unit Height (H)	Unit Width (W)	Fan	Coil (Long)	Coil (Short)	External Face & Bypass	Mixing Box	Econo-mizer	Flat & Bag / Angle Filter	Hepa Filter	Diffuser	Silencer	Access	Discharge Plenum	Damper / Discharge Plenum Opening Size	
															Width (E)	Length (L)
	Module		Module Length (M)												Inch [mm]	
12	4	4	4	4	3	2	2	4	3	5	2	5	3	2	8 3/4[210]	15 3/4[400]
22	4	6	4	4	3	2	2	4	3	5	2	5	3	2	8 3/4 [210]	27 9/16[700]
32	5	6	4	4	3	3	3	6	3	5	2	5	3	3	12 3/16[310]	27 9/16[700]
40	5	7	4	4	3	3	3	6	3	5	2	5	3	3	12 3/16[310]	35 7/16[900]
48	5	8	5	4	3	3	3	6	3	5	2	5	3	3	12 3/16[310]	43 5/16[1100]
64	5	10	5	4	3	3	3	6	3	5	2	5	3	3	12 3/16[310]	55 1/8[1400]
80	6	10	6	4	3	3	3	6	3	5	3	5	3	3	16 1/8[410]	55 1/8[1400]
100	7	10	6	4	3	4	4	8	3	5	3	5	3	4	20[510]	55 1/8[1400]
120	8	10	6	4	3	4	4	8	3	5	4	5	3	4	20[510]	63[1600]
150	9	10	7	4	3	4	4	8	3	5	4	5	3	4	24[610]	63[1600]
180	9	13	8	4	3	5	5	10	3	5	4	5	3	5	24[710]	63[1600]
210	10	14	8	4	3	5	5	10	3	5	5	5	3	5	24[710]	70 7/8[1800]
240	10	15	8	4	3	5	5	10	3	5	5	5	3	5	24[710]	78 3/4[2000]
270	10	17	8	4	3	5	5	10	3	5	5	5	3	5	31 7/8[810]	78 3/4[2000]
320	11	18	9	4	3	6	6	6 + 6	3	5	5	5	3	6	35 13/16[910]	78 3/4[2000]
420	11	20	10	4	3	7	7	7 + 7	3	5	5	5	3	7	43 11/16[1110]	90 9/16[2300]
520	11	21	10	6	5	8	8	8 + 8	3	5	5	5	3	8	51 9/16[1310]	90 9/16[2300]

Notes: 1.) To calculate actual unit height, **1 Module = 7 7/8" [200mm]**
- 1" Casing, Unit base for model 12 to 180 = 4" [100mm]
  Unit base for model 210 to 240 = 3 1/2" [90mm]
- eg. For Model 12 , Unit Height (H) = (4 x 7 7/8"[200mm]) + 1 1/2"[40mm] + 4"[100mm] = 37"[940mm] (includes unit base)
  For Model 210, Unit Height (H) = (10 x 7 7/8"[200mm]) + 1 1/2"[40mm] + 3 1/2"[90mm] = 83 3/4"[2130mm] (includes unit base)
- 2" Casing, Unit base for model 12 to 180 = 4" [100mm]
  Unit base for model 210 to 240 = 2 3/4" [70mm]
- eg. For Model 12, Unit Height (H) = (4 x 7 7/8"[200mm]) + 2"[50mm] + 4"[100mm] = 37 1/2"[950mm] (includes unit base)
  For Model 210, Unit Height (H) = (10 x 7 7/8"[200mm]) + 2"[50mm] + 2 3/4"[70mm] = 83 1/2" [2120mm] (includes unit base)

2.) To calculate actual unit width and length, **1 Module = 7 7/8" [200mm]**
- 1" Casing, For all Models, Unit Width (W) = (4 x 7 7/8"[200mm]) + 1 1/2"[40mm] = 33"[840mm]
- 2" Casing, For all Models, Unit Width (W) = (4 x 7 7/8"[200mm]) + 2"[50mm] = 33 1/2"[850mm]

3.) Maximum shipping length, if, Unit Width <= 10M, Lmax = 15M
Unit Width > 10M, Lmax = 10M

INSTALLATION

UNIT SHIPPING WEIGHTS (KG)

Sections

Model	Fan Section (Horizontal without Fan)	Coil Section (Short without Coil)	Coil Section (Long without Coil)	Diffuser Section	External Face & Bypass Section (with Dampers, without Duct)	Flat & Bag Filter Section (without Media)	Hepa Filter Section (without Media)	Angle Filter Section (without Media)	Mixing Box Section (with Dampers)	Economizer Section (with Dampers)	Access Section	Silencer Section (with Splitters)	Vertical (without Fan & Coil)	Multizone (without Coil)
12	76	64	79	35	49	46	68	46	49	65	46	70	132	-
22	93	80	99	44	63	57	84	57	63	82	57	88	175	149
32	102	84	104	46	86	60	91	60	86	123	60	95	184	158
40	110	92	113	52	97	67	98	67	97	136	67	102	211	172
48	144	100	124	57	108	72	106	72	108	147	72	111	265	191
64	174	127	154	73	138	94	135	94	138	187	94	142	324	231
80	215	131	160	98	153	98	142	98	153	200	98	150	401	290
100	228	134	165	101	188	101	148	101	188	258	101	158	413	301
120	243	138	170	130	205	105	154	105	205	278	105	166	427	342
150	285	143	175	135	221	110	161	110	221	296	110	174	509	354
180	375	172	209	159	298	131	190	131	298	403	131	207	(740)	(468)
210	457	230	276	244	376	181	252	181	376	503	182	265	(858)	(654)
240	476	242	287	255	396	191	263	191	396	523	191	285	(893)	(682)
270	523	267	316	287	437	210	289	210	437	566	211	313	-	-
320	609	283	336	304	519	224	307	224	519	789	225	336	-	-
420	711	305	361	325	619	241	327	241	619	957	241	360	-	-
520	748	430	487	335	693	249	337	249	693	1087	249	371	-	-

Notes: 1.) Add 10% for 2" Casing
2.) Weight in ( ) of Model 180, 210 and 240 are for 2" Casing.

Accessories

Model	Fan (Forward Curved, Class 1)	Fan (Forward Curved, Class 2)	Fan (Airfoil Curved, Class 1)	Fan (Airfoil Curved, Class 2)	Pre Filter (2", Flat)	Pre Filter (2", Angle)	Secondary Filter (4")	Secondary Filter (15" Bag)	Secondary Filter (22" Bag)	Secondary Filter (12" Catridge)	Hepa Filter	Eliminator	Internal Face & Bypass Dampers
12	11	-	16	22	2.1	2.4	0.7	1.8	2.0	6.0	17	7	6
22	13	-	23	29	3.5	4.1	1.2	3.4	3.8	10.0	25	10	9
32	21	-	29	39	4.1	7.0	1.4	3.6	4.0	12.0	25	13	12
40	27	-	36	48	4.7	8.2	1.5	4.6	5.2	14.4	33	15	14
48	27	-	50	62	6.2	10.5	2.0	5.4	6.0	18.0	33	18	16
64	32	-	58	79	7.1	12.3	2.3	6.9	7.8	21.6	50	22	23
80	50	-	78	103	10.3	14.1	3.5	10.8	12.0	32.1	76	26	28
100	63	73	101	137	12.3	18.5	4.1	10.8	12.0	36.0	99	31	33
120	90	97	101	137	14.1	21.2	4.5	13.8	15.6	43.2	99	34	39
150	115	132	140	187	18.5	24.6	6.1	16.2	18.0	54.0	125	39	42
180	115	132	183	238	24.6	32.8	8.2	21.6	24.0	72.0	167	49	51
210	132	168	183	238	25.8	37.6	8.4	23.6	26.4	76.8	198	69	60
240	132	168	244	295	30.5	44.6	10.1	28.1	31.4	89.6	198	77	66
270	165	230	244	295	32.3	47.0	10.6	29.5	33.0	96.0	248	85	72
320	288	329	353	378	38.5	51.3	12.5	38.4	43.2	118.5	274	100	90
420	-	-	439	470	46.3	61.3	15.5	41.7	46.2	136.5	297	112	99
520	-	-	534	575	49.2	70.0	16.3	43.2	48.0	144.0	323	116	102

Coil

Model	Type A Coil (@12 FPI)					Type 5 Coil (@12 FPI)				
	3 Rows	4 Rows	5 Rows	6 Rows	8 Rows	3 Rows	4 Rows	5 Rows	6 Rows	8 Rows
12	18	20	24	26	31	20	25	29	33	41
22	28	32	38	43	53	35	42	50	58	74
32	33	39	47	53	66	43	53	63	73	94
40	40	47	57	64	81	52	65	77	90	115
48	46	55	66	75	95	60	75	90	105	136
64	55	67	81	93	118	77	97	116	136	175
80	65	80	97	110	142	92	116	140	164	211
100	75	92	112	129	166	110	138	167	196	253
120	90	110	135	156	202	130	165	200	234	304
150	107	133	163	189	245	167	212	257	302	392
180	139	170	207	238	306	192	245	298	351	457
210	170	191	252	311	341	232	278	328	415	551
240	180	220	270	328	401	255	324	393	462	601
270	203	250	307	355	459	295	377	458	540	702
320	233	288	354	408	529	338	432	526	620	809
420	270	335	412	478	620	394	505	615	726	949
520	310	387	477	555	723	462	594	726	858	1122

Notes: For other fin series: "8FPI x 0.85", "10FPI x 0.92", "14FPI x 1.08".

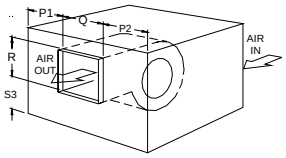
Motor

Motor HP & Drive	Weight, kg
1	18
1.5	21
2	26
3	35
4	40
5	47
5.5	47
7.5	69
10	85
15	127
20	145
25	189
30	226
40	306
50	360
60	386
75	523
100	605

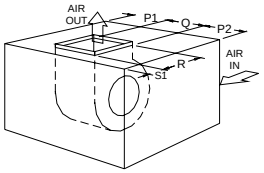
INSTALLATION

DISCHARGE ARRANGEMENTS

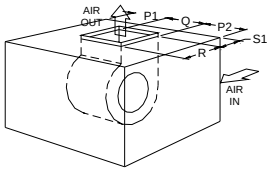
A.) FAN SECTION ONLY



Horizontal Front

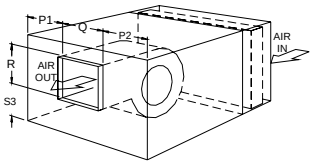


Top Inverted

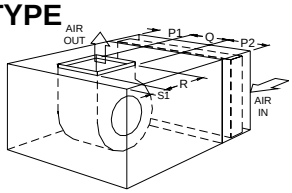


Top

B.) SINGLE ZONE HORIZONTAL TYPE



Horizontal Front



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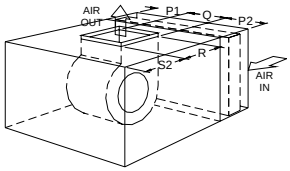
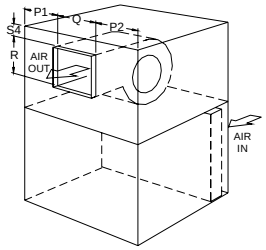
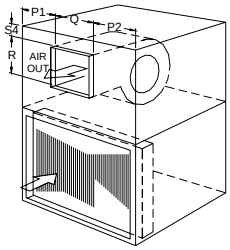


Top

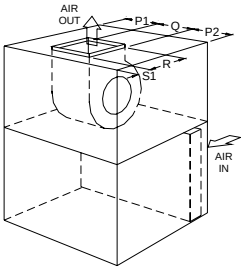
C.) SINGLE ZONE VERTICAL TYPE



Horizontal Front



Horizontal Rear



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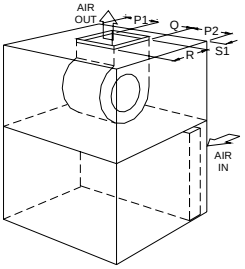


Top

1" Casing

Model	Forward Curved Blower									Backward Inclined Airfoil Blower								
	P1	P2	Q	R	S1	S2	S3	S4	Max. Motor Frame Size	P1	P2	Q	R	S1	S2	S3	S4	Max. Motor Frame Size
12	170	435	235	265	110	465	385	90	D90L	145	435	260	260	110	470	360	120	D100L
22	430	545	265	290	110	440	415	235	D100L	370	545	325	325	110	405	385	230	D112
32	385	545	310	345	110	385	440	155	D100L	335	545	360	360	110	370	405	175	D112
40	420	645	375	405	110	325	465	270	D112M	390	645	405	405	110	325	420	315	D112M
48	520	745	375	405	110	525	465	270	D132S	440	745	455	455	110	475	450	235	D132M
64	665	905	470	405	110	525	465	270	D132M	625	905	510	510	155	375	500	110	D132M
80	575	905	560	480	175	585	565	295	D160M	565	905	570	570	175	495	565	205	D160M
100	565	905	570	570	175	495	565	205	D160M	495	905	640	640	155	445	570	130	D160M
120	495	905	640	640	155	445	570	130	D180M	495	905	640	640	155	445	570	130	D180M
150	420	905	715	715	175	550	605	220	D180M	420	905	715	715	175	550	605	220	D180M
180	760	1165	715	715	175	750	605	–	D180L	720	1120	800	800	145	695	655	–	D180L
210	920	1120	800	800	145	695	645	–	D180L	920	1120	800	800	145	695	645	–	D180L
240	1120	1120	800	800	145	695	645	–	D200L	1070	1070	900	900	145	595	640	–	D180L
270	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
320	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
420	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
520	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

2" Casing

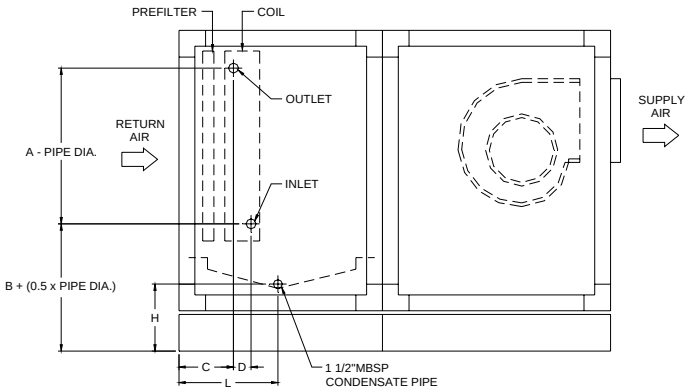
Model	Forward Curved Blower									Backward Inclined Airfoil Blower								
	P1	P2	Q	R	S1	S2	S3	S4	Max. Motor Frame Size	P1	P2	Q	R	S1	S2	S3	S4	Max. Motor Frame Size
12	175	440	235	265	115	470	410	75	D90L	150	440	260	260	115	475	385	105	D100L
22	435	550	265	290	115	445	440	220	D100L	375	550	325	325	115	410	410	215	D112
32	390	550	310	345	115	390	465	140	D100L	340	550	360	360	115	375	430	160	D112
40	425	650	375	405	115	330	490	255	D112M	395	650	405	405	115	330	445	300	D112M
48	525	750	375	405	115	530	490	255	D132S	445	750	455	455	115	480	475	220	D132M
64	670	910	470	405	115	530	490	255	D132M	630	910	510	510	160	380	520	95	D132M
80	580	910	560	480	180	590	590	280	D160M	570	910	570	570	180	500	575	205	D160M
100	570	910	570	570	180	500	575	205	D160M	500	910	640	640	160	450	595	115	D160M
120	500	910	640	640	160	450	595	115	D180M	500	910	640	640	160	450	595	115	D180M
150	425	910	715	715	180	555	630	205	D180M	425	910	715	715	180	555	630	205	D180M
180	765	1170	715	715	180	755	630	405	D180L	725	1125	800	800	150	700	680	270	D180L
210	925	1125	800	800	150	700	650	270	D180L	925	1125	800	800	150	700	650	270	D180L
240	1125	1125	800	800	150	700	650	270	D200L	1075	1075	900	900	150	600	655	125	D180L
270	1275	1275	900	900	150	600	695	–	D200L	1275	1275	900	900	150	600	695	–	D200L
320	1250	1250	1150	1150	250	450	670	–	D200L	1250	1250	1150	1150	250	450	670	–	D200L
420	–	–	–	–	–	–	–	–	–	1450	1450	1150	1150	250	650	770	–	D250SC
520	–	–	–	–	–	–	–	–	–	1450	1450	1350	1350	95	650	770	–	D250MC

Notes: 1.) P2 is motor location. P1 & P2 can be inter charged to switch motor location.
2.) For other type of discharge arrangement, consult factory for dimensional details.

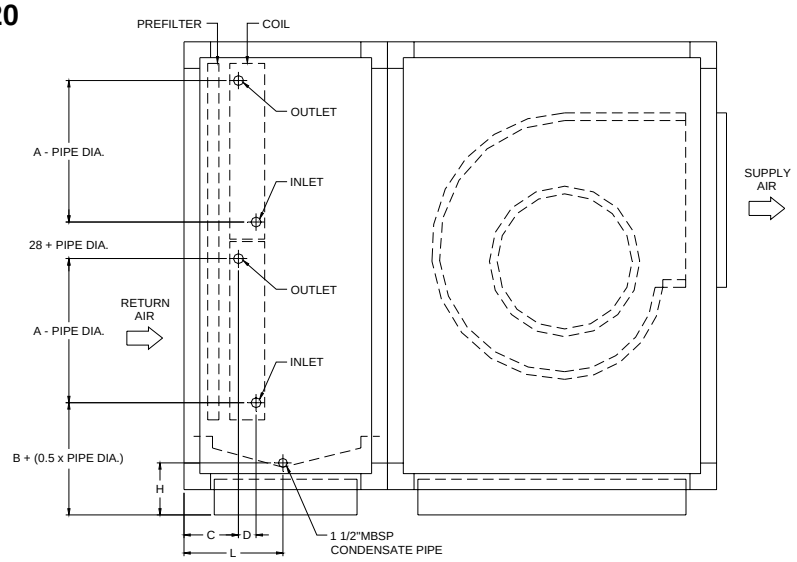
INSTALLATION

WATER INLET AND OUTLET LOCATIONS

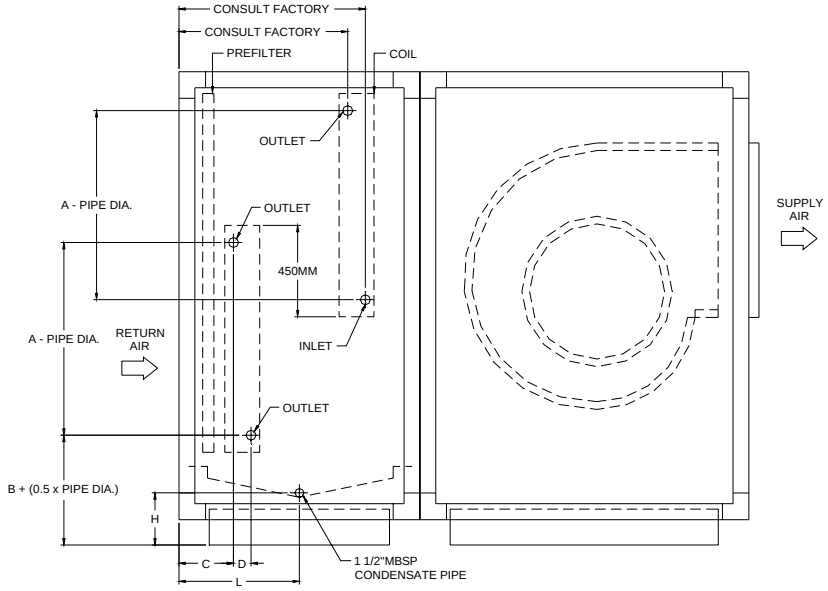
MODEL 12 TO 180



MODEL 210 TO 420



MODEL 520 (STAGGERED COILS)



INSTALLATION

1" Casing (Horizontal and Vertical Type)

Model		12	22	32	40	48	64	80	100	120	150	180	210	240
A		530	530	721	721	721	721	911	1165	1356	1546	1546	848	848
B		276	276	276	276	276	276	276	276	276	276	276	266	266
H		190	190	190	190	190	190	190	190	190	190	190	180	180
L	Short Coil	325												
	Long Coil	425												
1 Row	C	169												
	D	38												
2 Row	C	191												
	D	44												
3 Row	C	211												
	D	56												
4 Row	C	198												
	D	83												
5 Row	C	206												
	D	116												
6 Row	C	195												
	D	138												
8 Row	C	194												
	D	192												

2" Casing (Horizontal and Vertical Type)

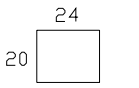
Model		12	22	32	40	48	64	80	100	120	150	180	210	240	270	320	420	520
A		530	530	721	721	721	721	911	1165	1356	1546	1546	848	848	848	975	975	1165
B		296	296	296	296	296	296	296	296	296	296	296	266	266	266	266	266	266
H		210	210	210	210	210	210	210	210	210	210	210	180	180	180	180	180	180
L	Short Coil	325																525
	Long Coil	425																625
1 Row	C	179																
	D	38																
2 Row	C	201																
	D	44																
3 Row	C	221																
	D	56																
4 Row	C	208																
	D	83																
5 Row	C	216																
	D	116																
6 Row	C	205																
	D	138																
8 Row	C	204																
	D	192																

Note: 1) All dimensions are in mm, tolerances +/- 50mm.
2) Locations shown are for reference only. For certified pipe location, please consult factory.
3) Applicable to standard coil size only.

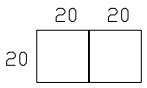
INSTALLATION

FILTER ARRANGEMENTS

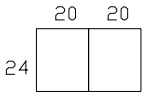
1.) FLAT FILTER (2” OR 4”), BAG/CARTRIDGE FILTER



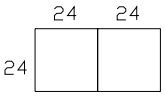
SIZE 12
20 x 24 (1)



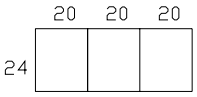
SIZE 22
20 x 20 (2)



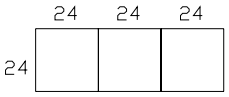
SIZE 32
20 x 24 (2)



SIZE 40
24 x 24 (2)



SIZE 48
20 x 24 (3)



SIZE 64
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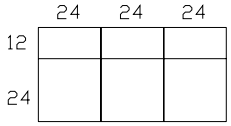
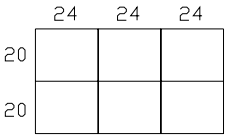
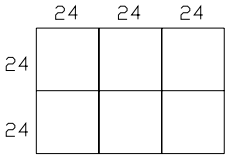


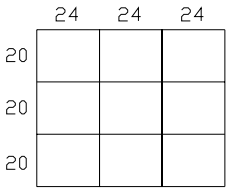
SIZE 80
12 x 24 (3), 24 x 24 (3)



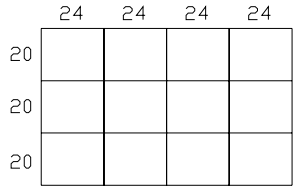
SIZE 100
20 x 24 (6)



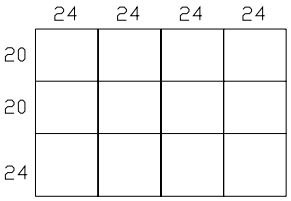
SIZE 120
24 x 24 (6)



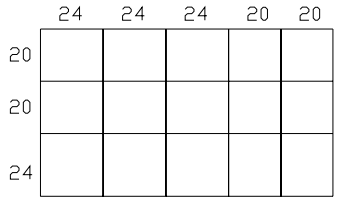
SIZE 150
20 x 24 (9)



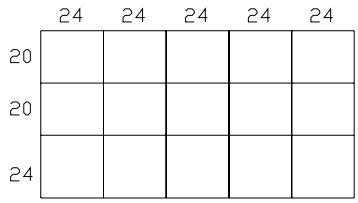
SIZE 180
20 x 24 (12)



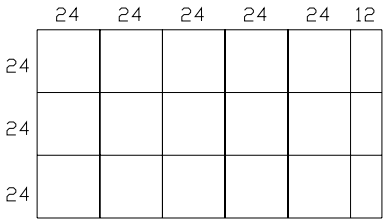
SIZE 210
20 x 24 (8), 24 x 24 (4)



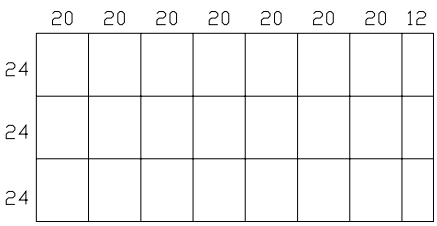
SIZE 240
20 x 20 (4), 20 x 24 (8), 24 x 24 (3)



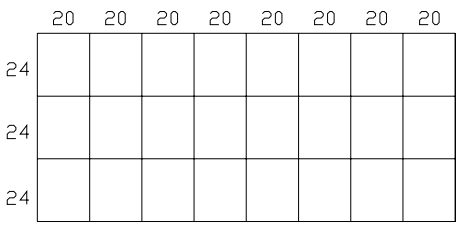
SIZE 270
20 x 24 (10), 24 x 24 (5)



SIZE 320
12 x 24 (3), 24 x 24 (15)



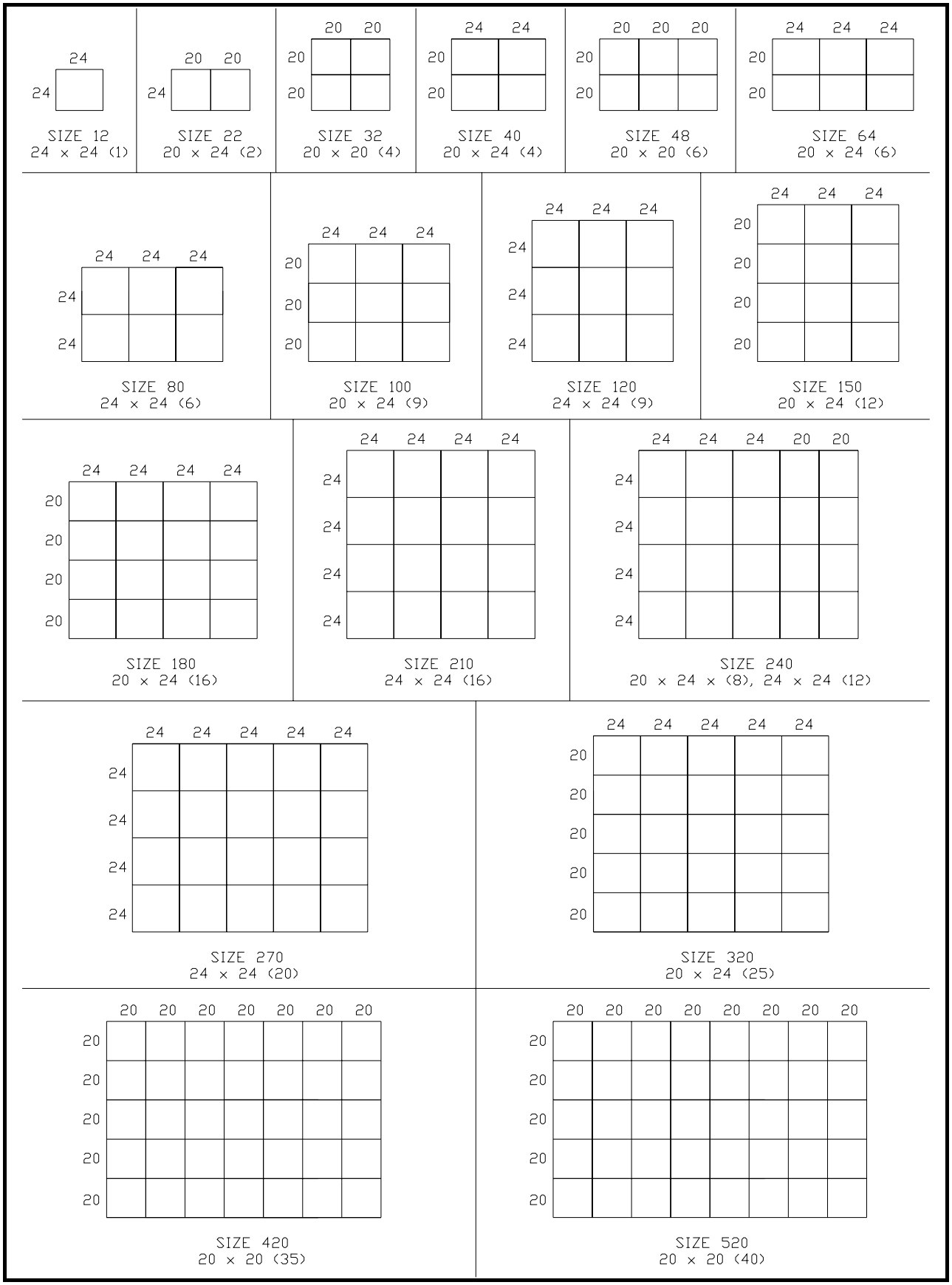
SIZE 420
12 x 24 (3), 20 x 24 (21)



SIZE 520
20 x 24 (24)

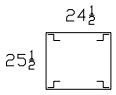
INSTALLATION

2.) ANGLE FILTER, FULL PANEL HEIGHT

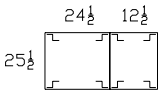


INSTALLATION

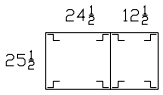
3.) HEPA FILTER



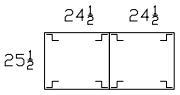
SIZE 12
24 x 24 (1)



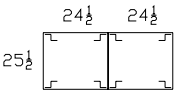
SIZE 22
12 x 24 (1), 24 x 24 (1)



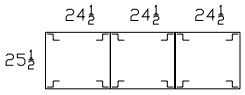
SIZE 32
12 x 24 (1), 24 x 24 (1)



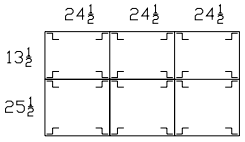
SIZE 40
24 x 24 (2)



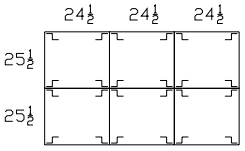
SIZE 48
24 x 24 (2)



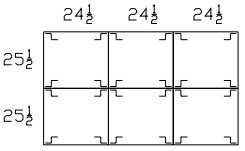
SIZE 64
24 x 24 (3)



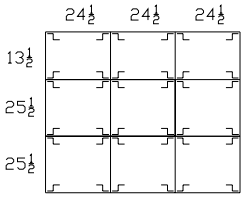
SIZE 80
12 x 24 (3), 24 x 24 (3)



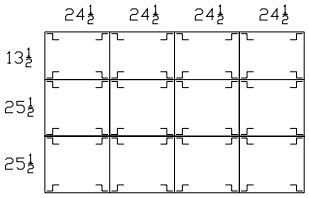
SIZE 100
24 x 24 (6)



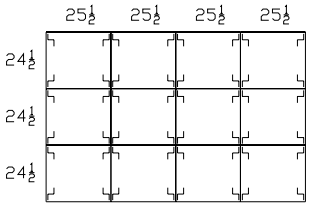
SIZE 120
24 x 24 (6)



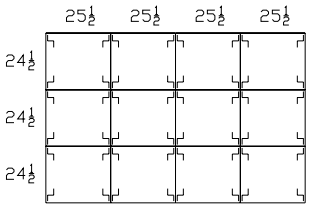
SIZE 150
12 x 24 (3), 24 x 24 (6)



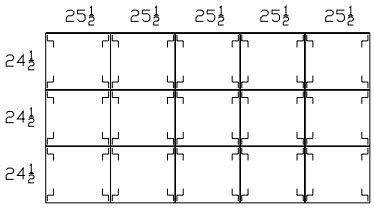
SIZE 180
12 x 24 (4), 24 x 24 (8)



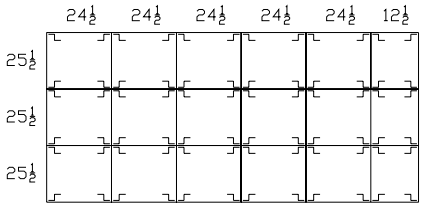
SIZE 210
24 x 24 (12)



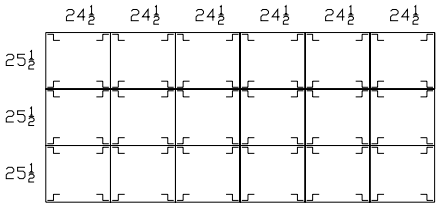
SIZE 240
24 x 24 (12)



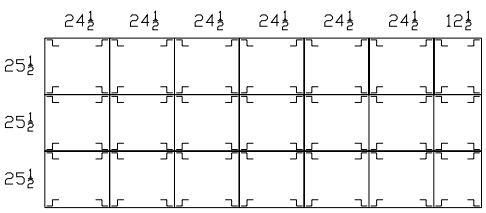
SIZE 270
24 x 24 (15)



SIZE 320
12 x 24 (3), 24 x 24 (15)



SIZE 420
24 x 24 (18)



SIZE 520
12 x 24 (3), 24 x 24 (18)

COMPONENTS ARRANGEMENT

BLOWER ARRANGEMENT

It is important to study the site layout and select the type of blower discharge pattern to suit the ductwork direction which will minimise noise and vibration. The selected blower discharge pattern should be specified in the purchase order (or order form) to the factory. Avoid field conversion of blower discharge pattern. If field conversion of the blower discharge pattern is required, contact factory or nearest Dunham-Bush representative and the field conversion should only carried out under the supervision of a factory authorised personnel.

Quick Service Access

Access panels are easily removable by screwed type panel lock. Hinged access is also available.

Air Tight Screwed Compression Latch

Filter

Various options of filter type, filter media and filter efficiency are available to meet the different air quality requirement.

Coils

Chilled water and DX cooling coils are manufactured from copper tubes with aluminum fins, copper fins, hydrophilic coated fins or other custom made coils. Heating can be hot water coil or electric heaters.

Three ways pitch drain pan design discharges condensate quickly and prevent microbial growth. Condensate pans of 304 stainless steel material is also available as an option.

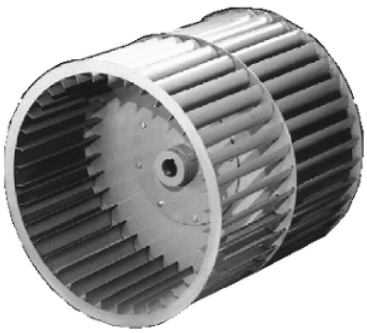
COMPONENTS ARRANGEMENT

FANS

Forward, Backward Inclined and Backward Airfoils Centrifugal fans which are AMCA certified are available. You can select class I, II or III fans to meet your required air flow, static pressure, performance and sound power.

Blower shall be coupled with pulley and motors.

Forward Curved Fan Wheel (FS)

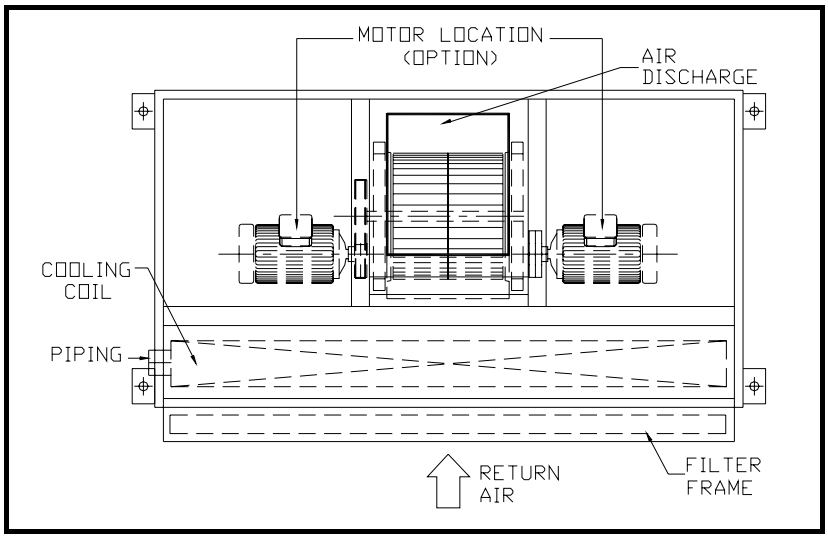


Airfoil Fan Wheel (AF)

MOTOR LOCATION

There are two possibility of arrangements: on the left or right of the blower section. Unless otherwise specified to factory, the motor location provided is at the opposite side to the chilled water and drain piping connection (access panel will be done to facilitate service).

FIGURE 13: PLAN VIEW OF DISCHARGE



OPTIONAL

A wide choice of accessory sections – diffuser sections, mixing box sections, face and bypass damper sections, humidifier sections, reheating sections and heat recovery sections are available to meet the required air conditions application needs.

For outdoor installation, applications in corrosive or hazardous atmosphere, other material options are available in Dunham-Bush.

Special motor voltages and dual speed motors can be supplied.

Frequency inverter drive for V.A.V. applications to meet the varying loads can also be offered as an option.

UNIT FEATURES AND ACCESSORIES

UNIT ASSEMBLY PLANNING

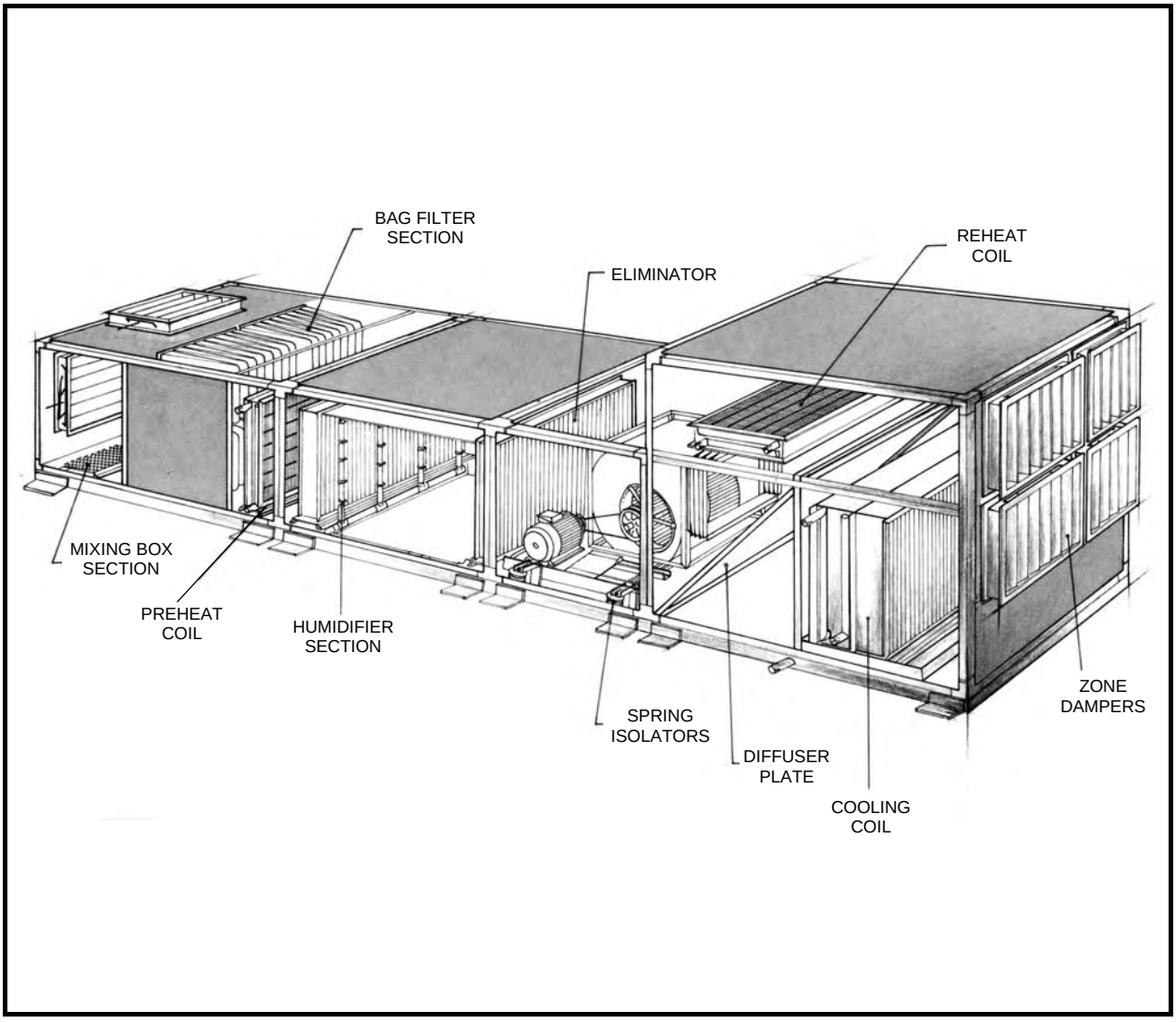
The Dunham-Bush modular central station air-handling units are available for draw-through application.

Draw through air-handling units are available for low, medium or high pressure single zone applications in horizontal or vertical arrangement, for ceiling or floor mounting.

Blow-through air handlers are available for multi-zone and single zone applications in horizontal arrangements for low, medium and high pressure applications.

TYPICAL ARRANGEMENT

FIGURE 14: MULTI-ZONE AIR-HANDING UNIT



FAN BEARINGS

Fan bearings are of the self-aligning ball bearings and selected for minimum 100,000 operating hours.

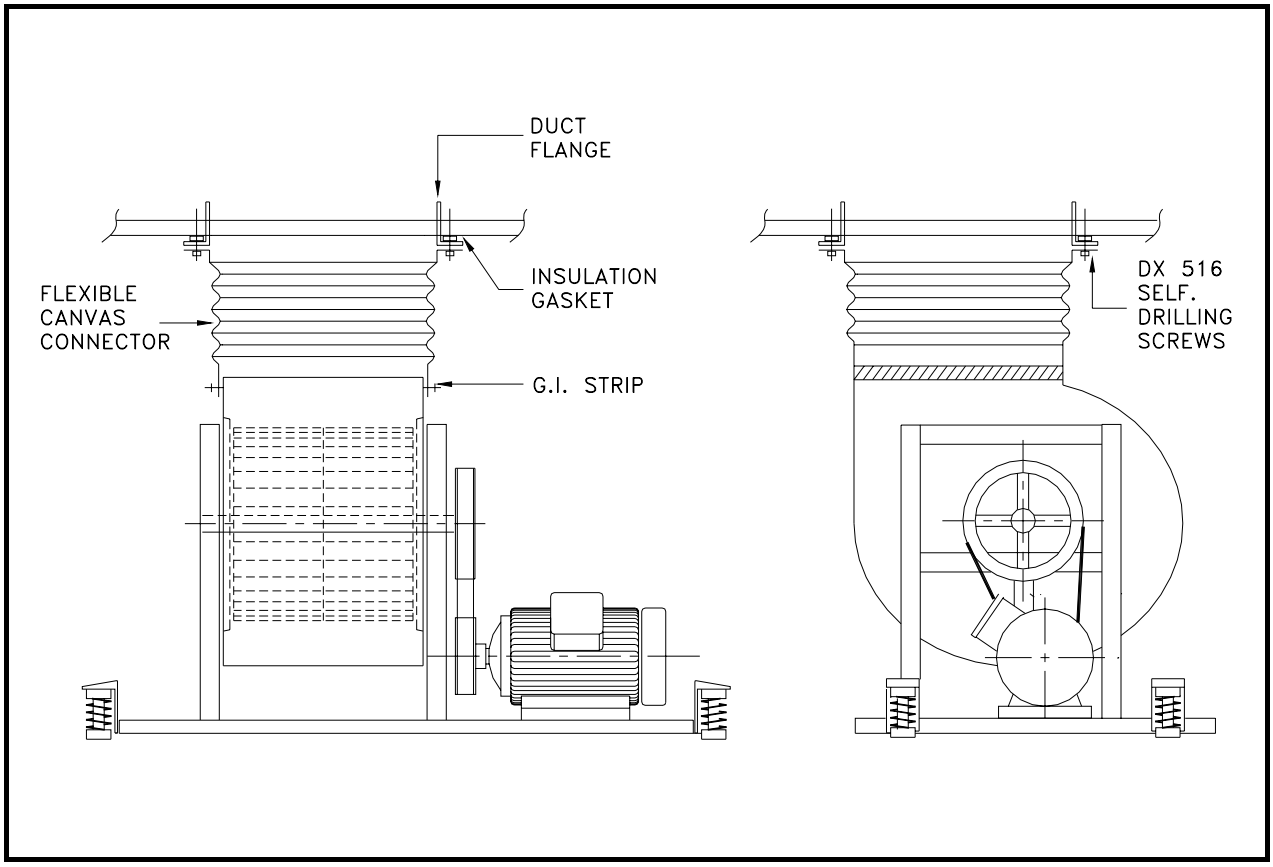
VIBRATION ISOLATION

Spring isolators are standard for unit with internally mounted motor to provide excellent vibration isolation. For unit with externally mounted motor and drive package, external spring isolators or neoprene Pads are provided to isolate complete air handling unit.

Fan and motor of standard unit are mounted on the same rigid, rugged steel frame.

Fan discharge is connected to unit discharge by internal flexible duct connectors to further reduce vibration of unit.

FIGURE 15: VIBRATION ISOLATION AND DISCHARGE CONNECTION



OPERATION

PRE-OPERATION CHECK

(1.) Is the blower pulley properly mounted onto shaft.
(2.) Is the motor rotation direction correct.
(3.) Is belt tension normal and belt size correct.
(4.) Are all bolts and nuts properly tightened.
(5.) Is the belt adjustment normal.
(6.) Is motorised damper functioning.
(7.) Is thermostat, fan selector switch functioning.
(8.) Is 3 or 4 way valve in proper condition.
(9.) Are the air filters in place.
(10.) Is fan wheel able to rotate free and clear when it is manually rotated.
(11.) Is fan and motor bearings properly lubricated.
(12.) Check that the fan and motor bearings do not run hot.
(13.) Is insulation properly done.

After the unit has been operated for quite sometime, do the following running check:

(1.) Is fan rpm and rotation correct.
(2.) Is motor running amps within the full load ampere.
(3.) Is motor and fan getting too hot.
(4.) Is there any air leakage from unit.
(5.) Is the unit panel and fan housing sweating.
(6.) Chilled water temperature inlet and outlet.
(7.) Inlet and outlet chilled water pressure.
(8.) Is unit vibrating excessively.
(9.) Is the on/off design coil temperature being achieved by the units.

Take necessary action to rectify any abnormal, operating conditions. Contact Dunham-Bush office for any uncertainties.

PRESSURE DROPS
CASING AND FILTERS ("WG)

SECTION	STANDARD COIL FACE VELOCITY (FPM)			
	300	400	500	600
BASIC UNIT (VERT.) NO. COIL	0.100	0.170	0.260	0.360
FACE AND BYPASS	0.020	0.040	0.060	0.100
MIXING BOX WITH FILTERS T.A.	0.059	0.090	0.125	0.163
MIXING BOX WITH CLEANABLE	0.030	0.053	0.073	0.088
FLAT FILTER (HI-VEL) CLEAN	0.028	0.055	0.087	0.114
V-TYPE FILTER (LO-VEL) T.A.	0.040	0.060	0.080	0.130
V-TYPE FILTER CLEAN	0.011	0.023	0.028	0.055
ELIMINATOR ASSEMBLY	0.024	0.039	0.057	0.077

AIR SIDE PRESSURE LOSS ("WG)

FACE VEL (FPM)	HOT WATER, STANDARD STEAM		NON- FREEZE STEAM			CHILLED WATER, DX	
	1 ROW(DRY)	2 ROW(DRY)	1 ROW(DRY)	2 ROW(DRY)	4 ROW(WET)	6 ROW(WET)	8 ROW(WET)
350	0.035	0.075	0.046	0.082	0.304	0.456	0.604
400	0.047	0.097	0.056	0.103	0.376	0.564	0.752
450	0.059	0.125	0.071	0.128	0.452	0.678	0.904
500	0.073	0.150	0.083	0.154	0.536	0.804	1.072
550	0.088	0.185	0.102	0.184	0.620	0.930	1.240
600	0.105	0.220	0.115	0.215	0.712	1.068	1.424
650	0.125	0.260	0.137	0.247	0.800	1.200	1.600
700	0.143	0.300	0.153	0.281	0.908	1.362	1.816

NOTE: 8 FINS/ INCH.

OPERATION

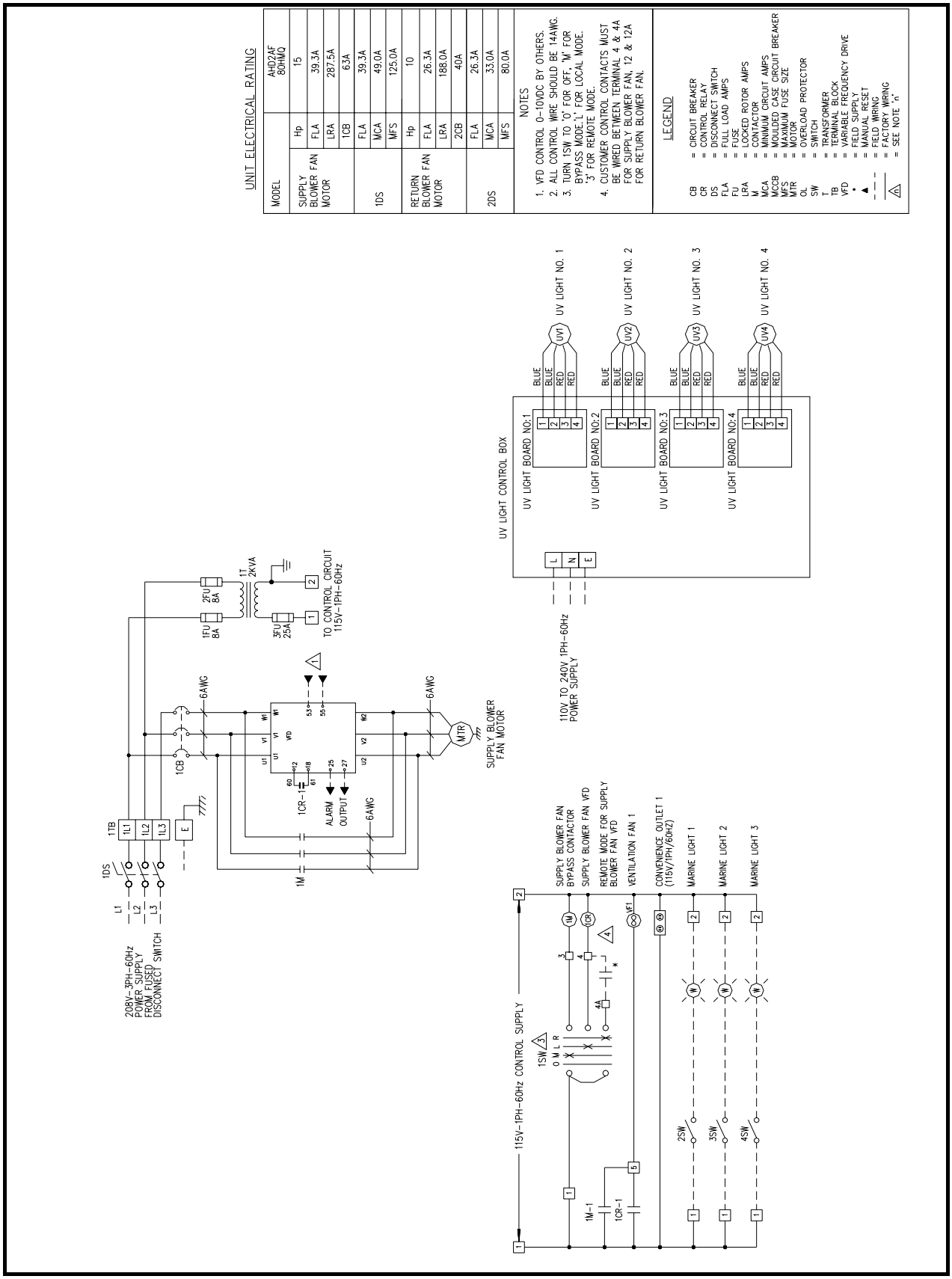
OPERATION LIMITATION

In order for the units to perform smoothly and be long lasting, the following operating limitation has to be strictly abided to:

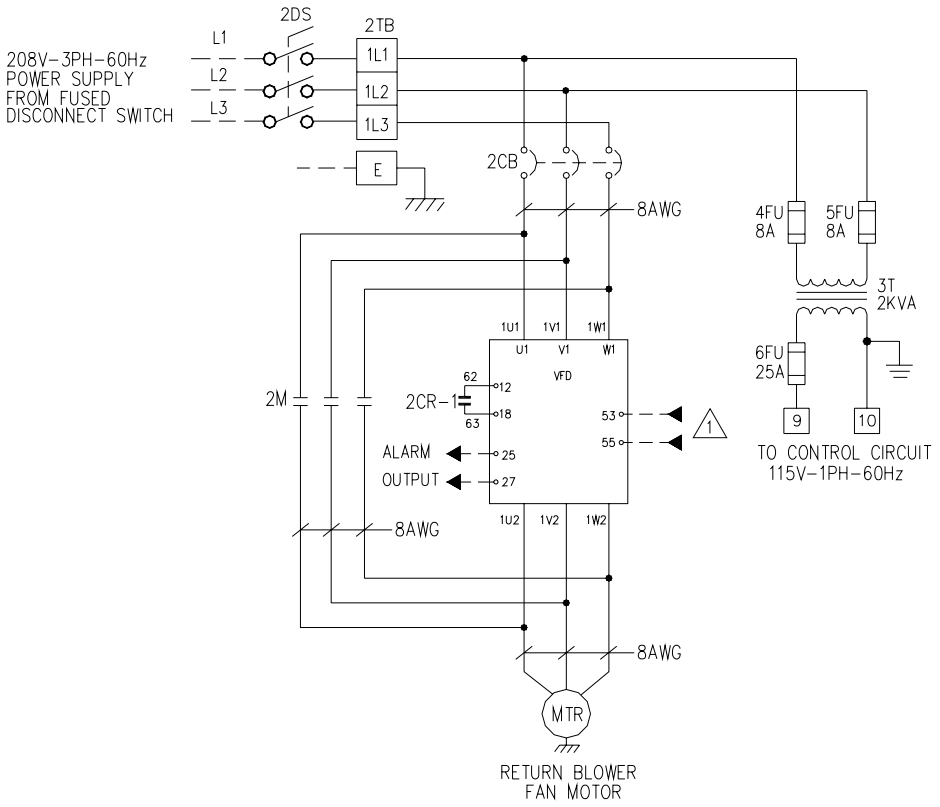
MODEL	MAX CFM	MAX MOTOR FRAME SIZE	
		FS	AF
12	1667	D90L	D100L
22	2667	D100L	D112M
32	3896	D100L	D112M
40	4813	D112M	D112M
48	5729	D132S	D132M
64	7563	D132M	D132M
80	9625	D160M	D160M
100	12375	D160M	D160L
120	14438	D180M	D160L
150	17000	D180M	D180M
180	22000	D180L	D180L
210	25458	D180L	D180L
240	28708	D200L	D180L
270	31958	D200L	D200L
320	40000	D200L	D200L
420	45000	-	D250SC
520	56250	-	D250MC

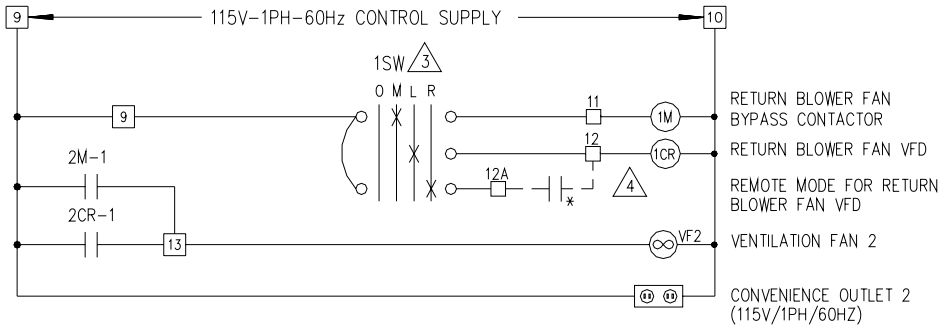
AHD2AF 80HMQ (CS3-AHU4) WIRING SCHEMATIC

1. SUPPLY AIR



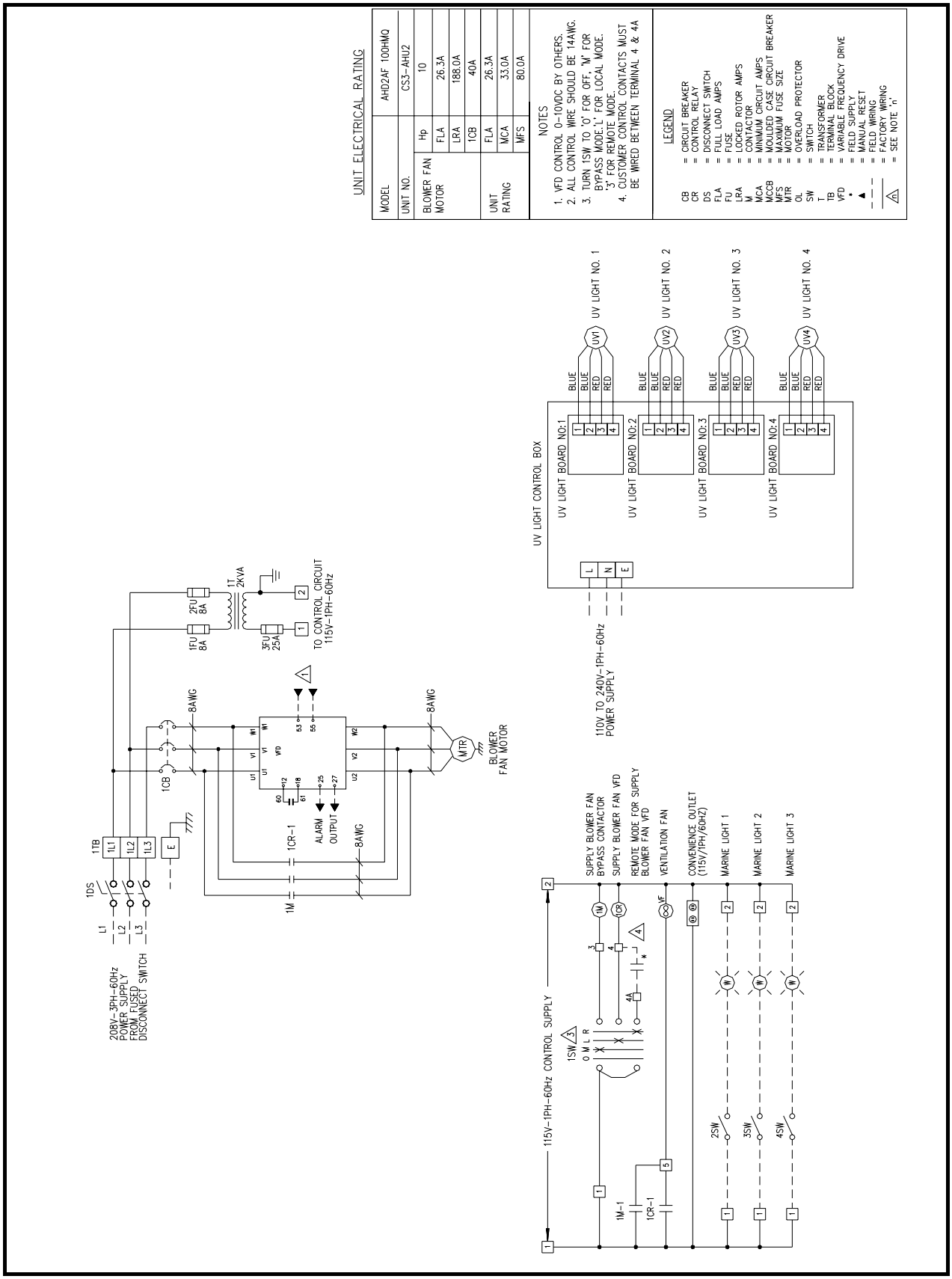
2. RETURN AIR


2DS
2TB
L1
L2
L3
208V-3PH-60Hz
POWER SUPPLY
FROM FUSED
DISCONNECT SWITCH
1L1
1L2
1L3
E
2CB
8AWG
4FU
8A
5FU
8A
3T
2KVA
6FU
25A
9
10
TO CONTROL CIRCUIT
115V-1PH-60Hz
1U1
1V1
1W1
U1
V1
W1
VFD
2M
2CR-1
62
63
12
18
53
55
1
ALARM
OUTPUT
25
27
1U2
1V2
1W2
8AWG
8AWG
MTR
RETURN BLOWER
FAN MOTOR


9
115V-1PH-60Hz CONTROL SUPPLY
10
1SW
3
O M L R
9
11
1M
RETURN BLOWER FAN
BYPASS CONTACTOR
12
1CR
RETURN BLOWER FAN VFD
2M-1
12A
4
REMOTE MODE FOR RETURN
BLOWER FAN VFD
2CR-1
13
VF2
VENTILATION FAN 2
CONVENIENCE OUTLET 2
(115V/1PH/60HZ)

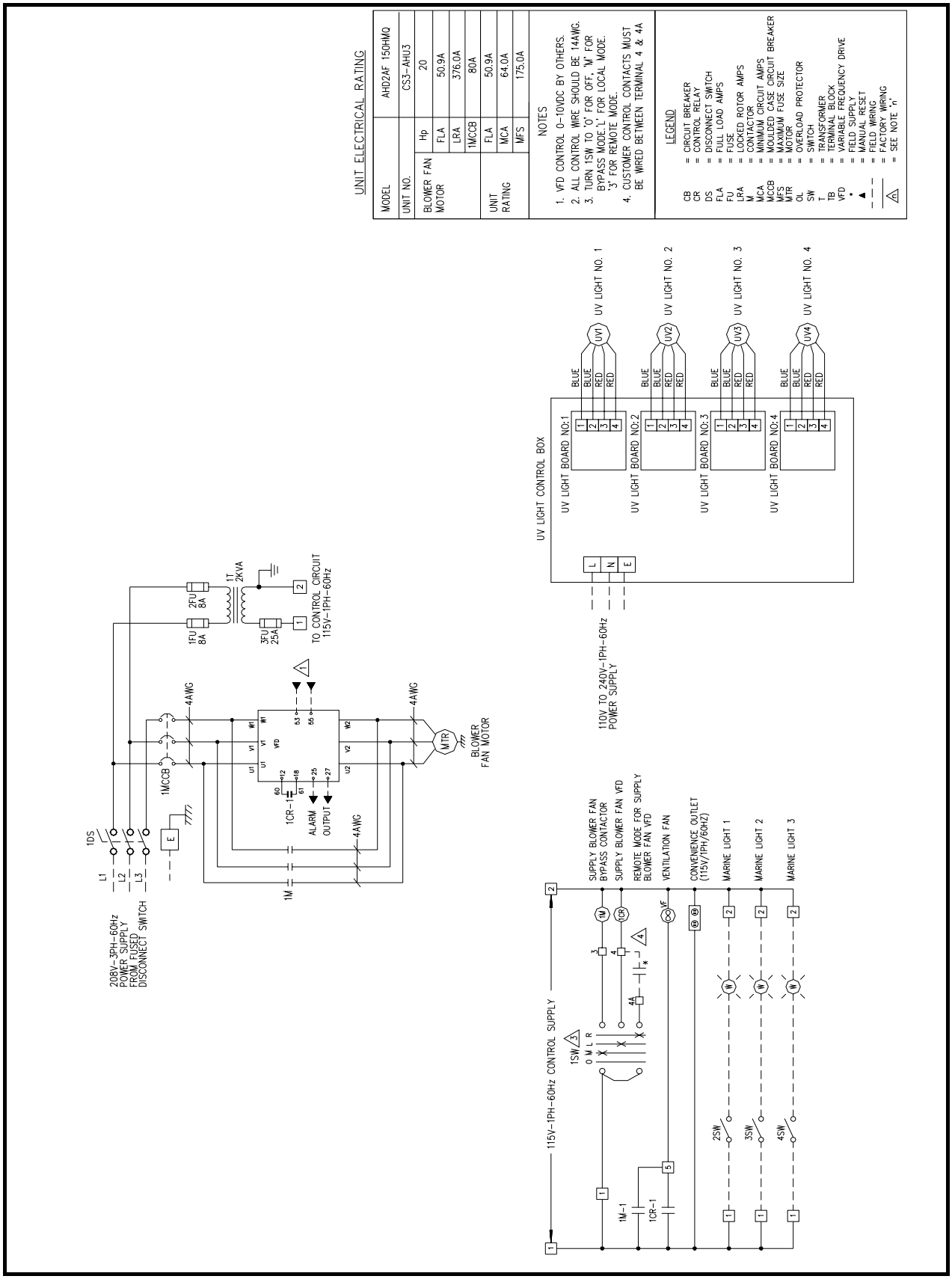
AHD2AF 100HMQ (CS3-AHU2) WIRING SCHEMATIC

SUPPLY AIR



AHD2AF 150HMQ (CS3-AHU3) WIRING SCHEMATIC

SUPPLY AIR



MAINTENANCE

An air handling unit, as with any mechanical equipment, requires periodic maintenance. The following is a recommended "check list" to be used as a guide in establishing a maintenance program.

PERIODIC INSPECTION

(1.) FAN BEARING

The fan bearing should be lubricated in accordance with manufacturer's recommendation:

a.) Fan equipped with deep grooved ball bearing inserted in rubber damper has sufficient high grade grease sealed in at the time of manufacture, there is no need for replenishment while in use at normal speed & normal condition.

b.) The pillow block housing has lubrication point can be lubricated when required refer to below table for greasing interval and grease amount accordance to factory recommendation:-

i) Relubrication Schedule

	Relubrication Schedule in Month *						
Bore (mm) RPM	**25 and below**	**From 26 to 35**	**From 36 to 45**	**From 46 to 55**	**From 56 to 65**	**From 66 to 75**	**From 76 to 85**
750	24	18	12	12	8	8	8
1000	18	12	12	8	8	6	6
1250	18	12	8	8	6	6	6
1500	12	8	8	6	6	4	4
1750	12	8	6	6	4	4	2
2000	12	8	6	4	4	2	2
2250	8	6	6	4	2	2	2
2500	8	6	4	4	2	2	2
2750	8	6	4	4	2	2	2
3000	6	4	4	4	2	2	2
3250	6	4	4	4	2	2	2
3500	6	4	4	2	2	2	2
3750	6	4	4	2	2	2	2
4000	6	4	4	2	2	2	1

Note: Suggested greasing interval is based on 12 hour per day operation. For continuous (24hour) operation, decrease greasing interval by 50%.

ii) Amount of recommended grease for ball bearing unit. (Recommended grease: Shell Alvania RL2, GOLD No. 3 or equivalent).

Bore Dia Code (Refer to the code casted on the bearing housing)	**Grease Amount (g)**
206	3.3
207	4.5
208	5.6
209	6.5
210	7.7
211	10.3
212	13.2
213	14.9
214	18.2
215	21.0
216	25.0
217	31.0
218	38.0

CAUTION: DO NOT exceed the initial greasing amount. Excessive and inadequate greasing may cause failure.
Note: The bearing should be relubricated while they are rotating and pumped in slowly until a slight bead forms around the seals.

MAINTENANCE

(2.) Check the belts for proper tension and alignment at least once every six months. Proper belt tension depends on the center distance between pulleys and type of belt used.

(3.) Check the pulleys and sheaves at least once every six months to make certain that set screws are properly tightened.

(4.) To insure proper air cleaning efficiency, filters must be properly maintained. Dirty filters will reduce the air volume handled by the unit which will result in reduced unit capacity. The length of time between the replacement of throwaway filters or cleaning of permanent type filters is dependent upon the condition of the circulated air. A six week cycle is normal, however, more frequent servicing may be required.

ANNUAL INSPECTION

(1.) If the unit is painted, check for evidence of corrosion or peeling. These areas should be properly cleaned and retouched.

(2.) Tighten the blower wheel set screws. Inspect the wheels and housings for evidence of corrosion and retouch if necessary.

(3.) Wash down the coil fin surfaces to eliminate dirt, lint or other foreign matter. If there is a particularly heavy accumulation of material, more frequent replacement or cleaning of filters is indicated.

(4.) Check the motor and fan shaft bearings for evidence of wear.

(5.) Check the drain pan and drain line to see that condensate is being properly drained and there are no restrictions in the line.

(6.) Replace all belts showing evidence of wear.

(7.) When cleanable type water coils are supplied, drain the water from the coils and remove several plugs from the return bends. Inspect the tubes carefully and if there is any evidence of scale formation, then remove all the plugs and clean the tubes. If chemicals are used for the cleaning operation it is recommended that a reputable water treatment firm be contacted for a recommendation of the proper cleaning agent to be used.

NOTE: It is recommended that all units be rebalanced to a minimum of "Quality Grade G6.3" if shaft or wheel is replaced.

TROUBLESHOOTING CHART

SYMPTOM	SOURCE	PROBABLE CAUSE
Noise	1. Impeller hitting inlet ring	♦ Impeller not center (check shaft clamp). ♦ Inlet ring damaged or not adjusted. ♦ Shaft loose in bearing (check locking collar). ♦ Impeller loose on shaft (check shaft clamp). ♦ Bearing loose in bearing support (check mounting bolts).
	2. Drive	♦ Sheave not tight on shaft (motor or fan). ♦ Belts hitting belt guard. ♦ Belts loose. Adjust after 48 hours operation. ♦ Belts too tight. ♦ Belts wrong cross section. ♦ Belts not "match" in length on multi-belt drive Variable pitch sleaves not adjusted so each. groove has same pitch diameter (multi-belt drives). ♦ Misaligned sheaves. ♦ Belts worn. ♦ Motor, motor base or fan not securely anchored. Belts oily or dirty.
	3. Bearing	♦ Defective bearing. ♦ Needs lubrication. ♦ Loose on bearing support. ♦ Loose on shaft (check locking collar). ♦ Misalignment (check alignment binding). ♦ Worn bearing ♦ Fretting corrosion between inner race and shaft.
	4. Impeller	♦ Loose on shaft (check shaft clamp). ♦ Defective impeller. Do not run fan. Contact manufacturer. ♦ Unbalance. ♦ Foreign material on fan blades.
	5. Housing	♦ Foreign material in housing. ♦ Inlet cones loose or not adjusted.
	6. Electrical	♦ Lead-in cantle not secure or is too rigid. ♦ AC hum in motor or relay. ♦ Starting relay chatter. ♦ Motor bearings. ♦ Single phasing a 3-phase motor.

TROUBLESHOOTING CHART

SYMPTOM	SOURCE	PROBABLE CAUSE
Noise	7. Shaft	♦ Bent. ♦ Undersized. May caused noise at impeller, bearings or sheave. ♦ Loose internal balance weights. ♦ Bearing alignment.
	8. High air velocity	♦ Ductwork too small. ♦ Fan running too fast. ♦ Fan section too small. ♦ Static pressure lower the expected. ♦ Registers and grilles too small. ♦ Insufficient face area of heating or cooling coil.
	9. Obstruction in high velocity air stream may cause rattle or pure tone whistle	♦ Dampers. ♦ Registers. ♦ Loose dampers or splitters. ♦ Grilles. ♦ Sharp elbows. ♦ Sudden expansion of duct work. ♦ Sudden contraction of ductwork. ♦ Turning vanes.
	10. Pulsation or surge	♦ Oversize ductwork. ♦ Parallel fan operation. ♦ Loose dampers or splitters. ♦ System instability. ♦ Ducts vibrate at same frequency as fan pulsations. ♦ Organ pipe action on long duct.
	11. High velocity through cracks holes or past obstructions	♦ Leaks in duct work. ♦ Registers or grilles.
	12. Rattles and/or rumbles	♦ Excessive duct velocities. ♦ Vibrating ductwork. ♦ Flex connector too tight or touching. ♦ Vibrating cabinet parts. ♦ Vibrating parts not isolated from building.

TROUBLESHOOTING CHART

SYMPTOM	SOURCE	PROBABLE CAUSE
CFM low	1. Fan	♦ Forward curve impeller installed backward. ♦ Fan running backward. ♦ Impeller not centered with inlet cones. ♦ Fan speed too slow.
	2. Duct system	♦ Actual system is more restrictive (more resistance to flow) than expected. ♦ Dampers closed. Splitter rod disconnected. ♦ Registers closed. ♦ Leaks in supply ducts. ♦ Open duct seams. ♦ Insulating duct liner loose. ♦ Fire dampers closed.
	3. Filters	♦ Dirty clogged (dirt, lint, snow, grass)
	4. Coils	♦ Dirty or clogged (construction trash)
	5. Recirculation	♦ Internal cabinet leaks in bulkhead separating fan outlet (pressure zone) from fan inlets (suction zone). ♦ Leaks around fan outlet at connection through cabinet bulkhead.
	6. Obstructed fan inlets	♦ Elbows, cabinet walls or other obstructions restrict air flow. ♦ Inlet obstructions cause restrictive systems but do not cause increased negative pressure readings near the fan inlet(s). ♦ Fan speed may be increased to counteract the effect of restricted fan inlet(s).(observe fan RPM limits).
	7. No straight duct at fan outlet	♦ Fans which are normally used in duct systems are tested with a length of straight duct at the fan outlet. If there is no straight duct at the fan outlet, decreased performance will result. If it is not practical to install a straight section of duct at the fan outlet the fan speed may be increased to overcome this pressure loss. Observe fan RPM limits.
	8. Obstructions in high velocity air stream	♦ Obstruction near fan outlet. ♦ Sharp elbows near fan outlet. ♦ Improperly designed or no turning vanes. ♦ Projections, dampers or other obstructions in part of system where air velocity is high.

TROUBLESHOOTING CHART

SYMPTOM	SOURCE	PROBABLE CAUSE
CFM high	1. System	♦ Oversized ductwork. ♦ Access door open. ♦ System not balanced. Resistance less than specified. ♦ Registers or grilles not installed. ♦ Dampers set to bypass coils. ♦ Filter(s) not in place.
	2. Fan	♦ Backward inclined impeller installed backward (HP will be high). ♦ Variable motor sheave not adjusted. ♦ Fan speed too fast.
Static Pressure Incorrect	1. System fan or interpretation of measurements	♦ General Discussion: ♦ The velocity pressure at any point of measurement is a function of the velocity of the air and its density. ♦ The static pressure at a point of measurement in the system is a function of system design (resistance to flow), air density and the amount of air flowing through the system. ♦ The static pressure measured in a "loose" or oversized system will be less than the static pressure in a "tight or undersized system for the same airflow rate. ♦ In most systems, pressure measurements are indicators of how the installation is operating. These measurements are the result of airflow and such are useful indicators in defining system characteristics.
	2. System	♦ System has less resistance to flow than expected. This is a common occurrence. Fan speed may be reduced to obtain desire flow rate. This will reduce HP, conserve energy, and save operating costs.

DUNHAM-BUSH

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