Johnson Controls	LIMITED WARRANTY ENGINEERED SYSTEMS EQUIPMENT	
SERVICE POLICY	Supersedes: 50.05-NM2 (903)	Form 50.05-NM2 (1008)

POLICY STATEMENT

Johnson Controls, Inc. (JCI) warrants all new Engineered Systems Equipment and materials, or installation or start-up services performed by JCI in connection therewith, against defects in workmanship and material for a period of eighteen (18) months from date of shipment or twelve (12) months from date of start-up, whichever occurs first. This warranty does not extend to products used for rental chiller duty. Subject to the exclusions listed below, JCI, at its option, will repair or replace, FOB point of shipment, such JCI products or components as it finds defective.

Except for reciprocating replacement compressors, which JCI warrants for a period of twelve (12) months from date of shipment, JCI reconditioned or replacement materials, or installation or start-up services performed by JCI in connection therewith, warrants against defects in workmanship and material for a period of ninety (90) days from date of shipment. Subject to the exclusions listed below, JCI, at its option, will repair or replace, FOB point of shipment, such JCI products or components as it finds defective.

Exclusions:

Unless specifically agreed to in the contract documents, this warranty does not include the following costs and expenses:

1. Labor to remove or reinstall any equipment, materials, or components.
2. Shipping, handling, or transportation charges.
3. Cost of refrigerant.

No warranty repairs or replacements will be made until payment for all equipment, materials, or components has been received by JCI.

ALL WARRANTIES ARE VOID IF:

1. Equipment is used with refrigerants, oil, or antifreeze agents other than those authorized by JCI.
2. Equipment is used with any material or any equipment such as evaporators, tubing, other low side equipment, or refrigerant controls not approved by JCI.
3. Equipment has been damaged by freezing because it is not properly protected during cold weather, or damaged by fire or any other conditions not" ordinarily encountered.
4. Equipment is not installed, operated, maintained and serviced in accordance with instructions issued by JCI.
5. Equipment is damaged due to dirt, air, moisture, or other foreign matter entering the refrigerant system.
6. Equipment is not properly stored, protected, or inspected by the customer during the period from date of shipment to date of initial start-up.
7. Equipment is damaged due to acts of god, abuse, neglect, sabotage, or acts of terrorists.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, EXPRESS OR IMPLIED IN LAW OR IN FACT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE WARRANTIES CONTAINED HEREIN SET FORTH BUYER'S SOLE AND EXCLUSIVE REMEDY IN THE EVENT OF A DEFECT IN WORKMANSHIP OR MATERIALS. IN NO EVENT SHALL JCI'S LIABILITY FOR DIRECT OR COMPENSATORY DAMAGES EXCEED THE PAYMENTS RECEIVED BY JCI FROM BUYER FOR THE MATERIALS OR EQUIPMENT INVOLVED. NOR SHALL JCI BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. THESE LIMITATIONS ON LIABILITY AND DAMAGES SHALL APPLY UNDER ALL THEORIES OF LIABILITY OR CAUSES OF ACTION, INCLUDING, BUT NOT LIMITED TO, CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY. THE ABOVE LIMITATIONS SHALL INURE TO THE BENEFIT OF JCI'S SUPPLIERS AND SUBCONTRACTORS.

Johnson Controls

P.O. Box 423, Milwaukee, WI 53203
www.johnsoncontrols.com

Printed in USA 50.05-NM2 (1008)
New Replaces: 50.05-NM2 (903)

YORK®	CUSTOM AIR HANDLERS	
INSTALLATION & START-UP	Replaces 100.31-NOM1 (205)	Form 100.31-NOM1 (208)

LD13282

Users and Installers of this equipment should be aware of all recommended safety procedures and information such as AMCA Publication 410-90 - Safety Practices.

For Product Warranty Support and Parts call 814-479-4005.

IMPORTANT!
READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Consider for IAQ compliance per ASHRAE STANDARD 62-2001

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

NOTE is used to highlight additional information which may be helpful to you.

CHANGEABILITY OF THIS DOCUMENT

In complying with YORK's policy for continuous product improvement, the information contained in this docu-ment is subject to change without notice. While YORK makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest YORK Service office.

It is the responsibility of operating/service personnel to verify the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

External wiring, unless specified as an optional connection in the manufacturer's product line, is NOT to be connected inside the micro panel cabinet. Devices such as relays, switches, transducers and controls may NOT be installed inside the micro panel. NO external wiring is allowed to be run through the micro panel. All wiring must be in accordance with YORK's published specifications and must be performed ONLY by qualified YORK personnel. YORK will not be responsible for damages/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this will void the manufacturer's warranty and cause serious damage to property or injury to persons.

For Product Warranty Support and Parts call 814-479-4005

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SECTION 1 – INTRODUCTION

This manual provides the information necessary to safely install and startup York Custom equipment. Due to the custom nature of York Custom products there may be areas beyond the scope of this manual. If there are any questions about a special application lacking coverage, please contact your local York International Sales Representative or the York International factory.

SAFETY

The customer is responsible for providing qualified and trained personnel to install and operate the equipment. Consult all local building, occupational safety, electrical, gas, and other codes applicable to the installation.

A variety of optional safety features are available from the manufacturer; it is the responsibility of the owner to determine if the unit is equipped with all of the safety devices required for the particular application.

Safety considerations include:

1. The accessibility of the equipment to non-service personnel.
2. The provision of electrical lockout switches.
3. Maintenance procedures.
4. Automatic control sequences.

Users and installers of this equipment should be aware of all recommended safety procedures and information such as AMCA publication 410-90-Safety Practices.

Never open an access door while air handling unit is in operation.

A fan, even though locked out electrically, can rotate in a seemingly insignificant air flow. During maintenance the impeller should be secured to restrict rotation, making sure that the restrictive device is removed before putting the fan back into service.

Equipment wired to automatic control devices may start without warning, resulting in personal injury or property damage. In many instances, a unit will have multiple electrical and compressed-air connection points. To prevent unforeseen startup, prior to beginning work on an air-handler always lockout all power supplies.

Always replace any protective covers removed for servicing.

WARRANTY

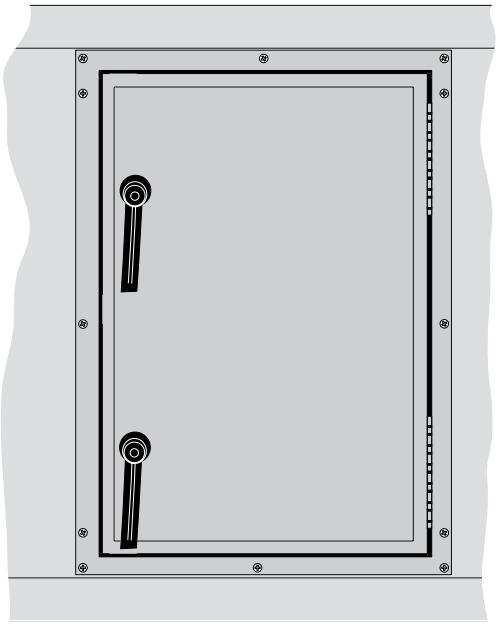
For Warranty Support With York Custom Air-handlers contact Product Service at 814-479-4005.

CAUTION

Always replace bolt or lock on access door latch for doors that provide access to moving parts. This mechanical protection from moving parts is required by UL 1995 (See Fig. 1).

CAUTION

A number of additional safety issues are discussed throughout the manual. <u>Please read the complete manual prior to installing, operating, or servicing the equipment.</u>



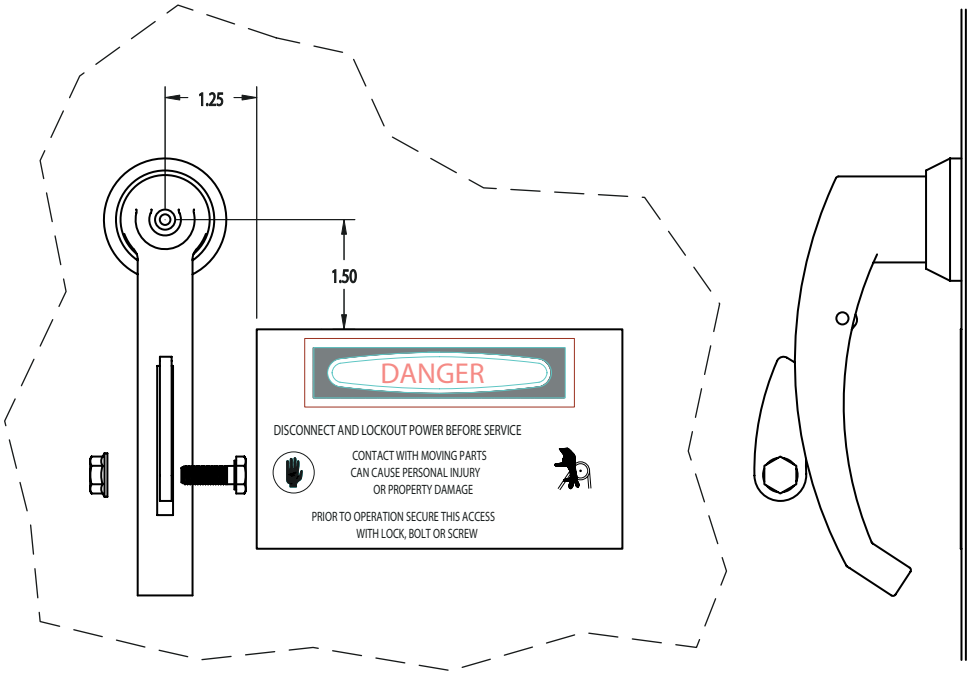


FIG. 1 – ACCESS DOOR LATCH

SECTION 2 – INSTALLATION

RECEIVING & INSPECTION

York Custom units are inspected and tested prior to shipment, ensuring a high quality product. Upon receipt of the unit(s), inspect for any damage that may have occurred during shipment.

Upon delivery, compare items on the bill of lading with the items on the shipment to verify all parts have been received.

Any shortage, breakage or damage noticed at time of delivery should be indicated on the carrier's freight bill and signed by the driver or carrier's representative. Damage, noticed after delivery, should be reported to the carrier at once. Request their inspection of the shipment and fill out a concealed damage inspection report.

Located on the inside of fan section access door is a handwritten list of field install items shipped with the unit. Items typically shipped loose include:

FAN SECTION
Accu-Shield Roof Coating *(see Fig. 10) (optional)*
Thermal Break Gasketing *(see Fig. 13)*
Split Re-Assembly Hardware (Nuts, bolts, polyurethane caulking) Filter Clips (Usually Shipped Separately)
Extra Fan Belts (If Ordered)
Installation and Start-Up Manual
Lifting Lugs*
Filters & Filter Clips (Typically Shipped Separately)
FILTER SECTION
HEPA Filter Latches ship loose and/or attached to HEPA filter frames

* Lifting Lugs are attached to unit base when shipping section is ordered with "fully wrap" shipping cover.

Shortage of field installed items must be reported within ten (10) days after receipt of order.

CLEARANCE REQUIREMENTS

Particular attention should be paid to the location and clearances between the air-handling unit and adjacent objects.

The national electrical code (NEC or CEC) requires a minimum of at least 36 inches of service space between the face of any electrical enclosure and any wall or obstruction.

Sufficient clearance needs to be provided to open doors and install piping and ducting. There must be no obstructions to prevent airflow through the hoods or louvers. Allow a distance equal to the horizontal width of the louver between the louver and any wall facing the louver.

Allow sufficient space around the unit for removing the access panels and various parts of the unit such as the belt guard. A minimum clearance equal to the width of the unit should be provided on one side of the unit for removing coils, fan shaft, and fan wheel.

STORAGE

Short term storage is considered six (6) months or less from date of shipment. Storage maintenance during this time period is usually limited to the following:

1. Store units in dry, indoor protected area on a firm flat surface to prevent unit distortion.
2. Protect units from excessive vibration and accidental impact.
3. Do not store other equipment on top of or inside unit.
4. When unit is stored outdoors, prior to installation within building, special care should be taken to cover and protect the unit from dust, rain, snow and rodents. The units should be protected from constant exposure to rain and snow.
5. Outdoor storage period shall not exceed 1 week unless the outdoor storage guidelines are followed.

Outdoor Storage

Whenever possible, unit should be stored indoors or under cover. If unit must be stored more than 1 week outdoors, York International recommends the following guidelines:

1. Cover all floor openings and secure all doors.
2. Tarp unit to protect unit from dust, rain, snow and rodents. (Tarp over the roof and down the side to the base channel and secure.)
3. Store on level surface. If unit must be raised off ground, supports under base channel and base channel cross supports at maximum interval of 5 feet.
4. Fan wheels should be rotated by hand 90° every month. Lightly lubricate bearings every two (2) months.

5. A 200-watt light bulb needs to burn continually in each section to prevent water condensation inside unit.
6. Inspect and ventilate each section every 2 weeks to prevent them from getting musty and to ensure that unexpected problems are addressed immediately. Special care may be required for electrical or electronic components.

Long-term Storage

Long-term storage is considered to be any period beyond six (6) months from date of shipment. If long-term storage is anticipated, contact York sales representative at time of order entry for the proper instructions and requirements for long-term storage. *Refer to Form 50.20-NM3 on page 47.*

Lifting & Handling

The unit will ship (as specified on unit submittal) either assembled, as a subassembly (collection of parts), or as individual sections.

To prepare for safely lifting the air-handling unit, estimate the approximate center of gravity. Internal placement of components may cause the weight to be unevenly distributed, with more weight in the coil and fan areas.

Removable lifting lugs are provided to raise the unit. (Lifting lugs are typically shipped in fan section and must be installed before lifting. *Lifting lugs are attached to unit base when shipping section is ordered with "fully wrap" shipping cover.) Spreader bars are required to prevent damage to the cabinet and protruding components during a lift. Use all lifting lugs provided. Adjust the tension in each line for proper load distribution, *(See Figs. 2 and 3 for recommended lifting).*

WARNING:

UNIT SECTIONS ARE BOLTED TOGETHER FOR SHIPPING PURPOSES. SECTIONS MUST BE SEPARATED AND SEALED PRIOR TO FINAL INSTALLATION AND OPERATION.

BOLTED LOOSELY / SHIPPED IN ONE PIECE

Split units may be shipped "loosely" assembled to reduce freight costs. The split sections are fastened together using a minimum number of bolts for transit and can be removed off the truck to the ground. Disassembly is required before lifting to the roof. Each section must be lifted individually to the roof.

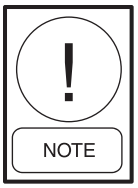
Remember - when lifting; use all lifting lugs to avoid damage and/or personal injury. Lifting lugs are shown in Fig. 4.

If there are no lifting lugs, a belt type sling should be used to raise the unit. Be cautious in avoiding protrusions such as electrical boxes, coil connections, and door handles.

Do not lift non-base units or subassemblies by attaching clevis, hooks, pins, bolts, etc. to casing, casing hardware, angles, tabs or flanges.

Lift the air-handling unit only in an upright position. Never lift or move a unit on its side or upside-down.

If you do not rig or lift the unit carefully, you could damage the unit, hurt yourself or others. Use Caution!



Outdoor Custom units have an optional roof coating applied where light foot traffic is permitted, but storage of materials typically found on construction sites are not permitted to be placed on roofs. Care must be taken not to damage the roof coating. If other than light foot traffic or storage of materials becomes necessary, plywood may be placed on the roof provided the weight applied does not exceed 50lbs. per sq. ft.

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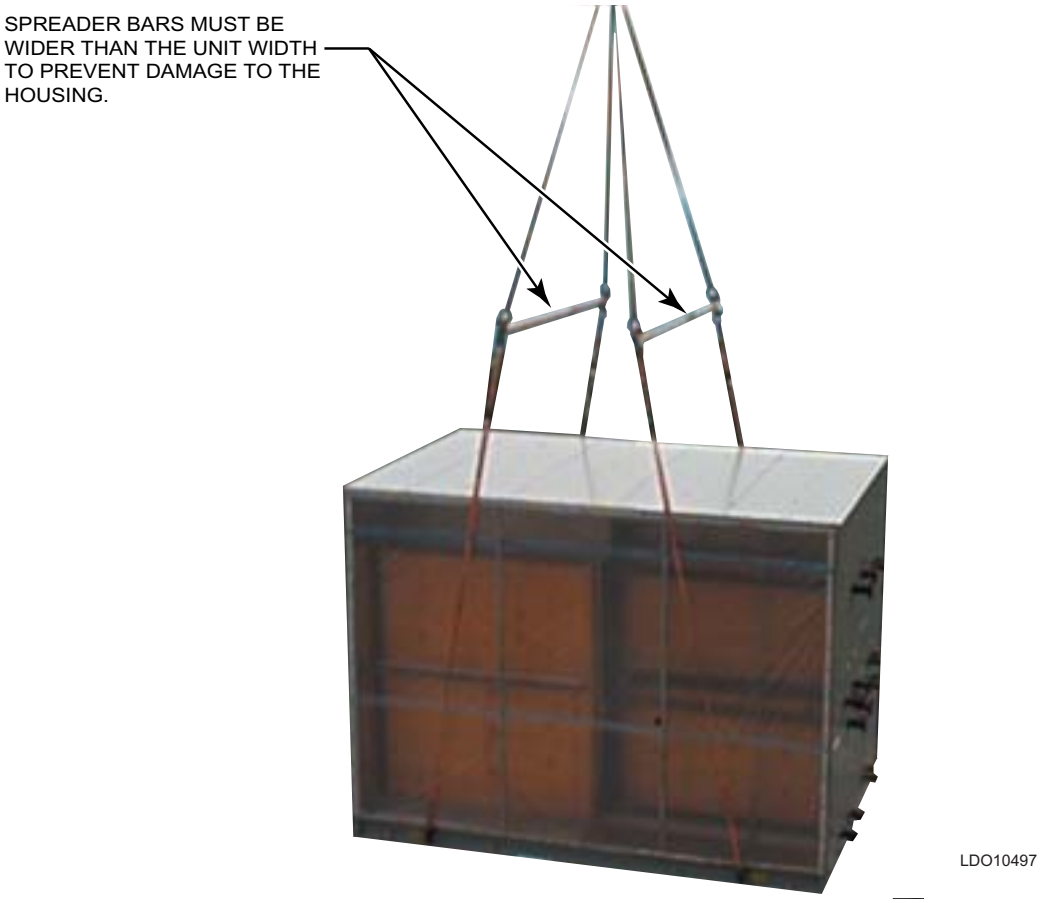
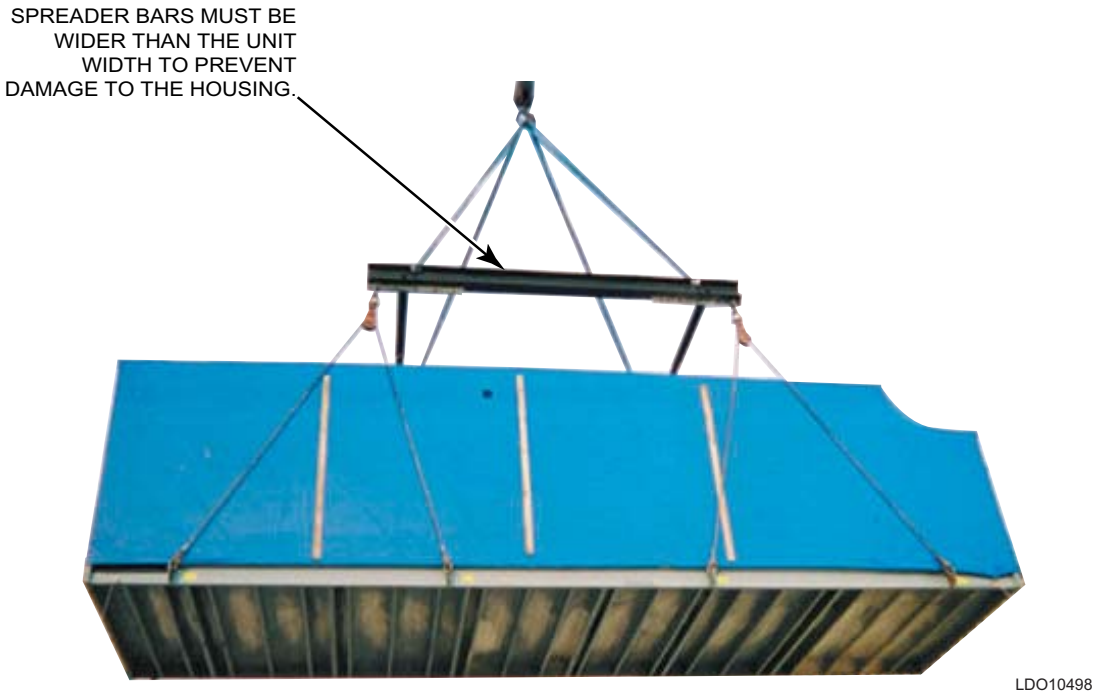
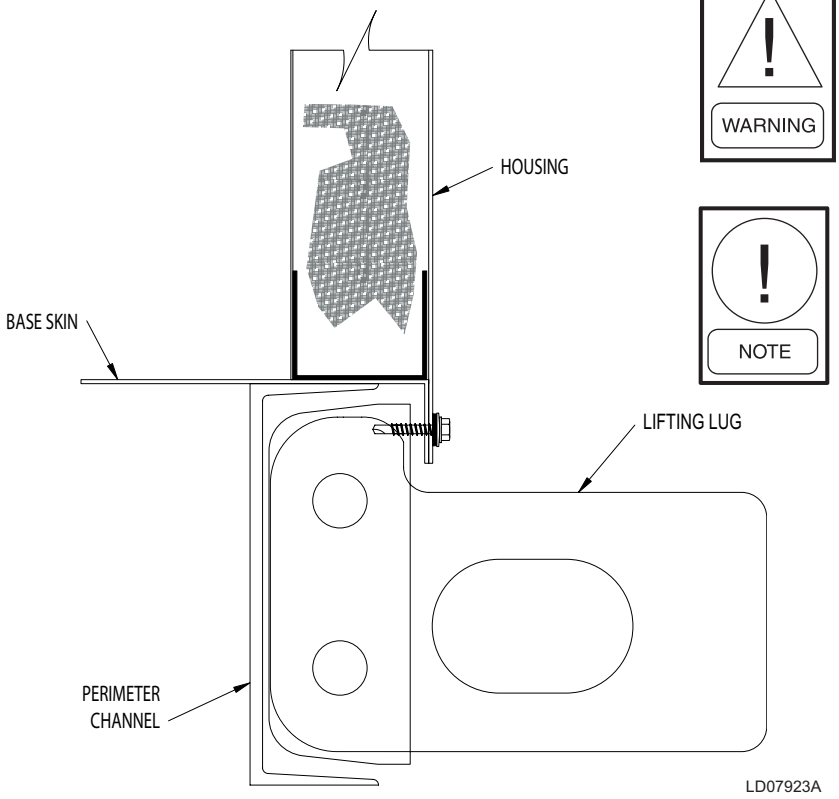


FIG. 2 – RECOMMENDED LIFTING WITH FOUR LIFTING POINTS



RIGGING INSTRUCTIONS
FOR LIFTING AIR HANDLERS WITH LIFTING LUGS, USE SPREADER BARS AND CABLES AS INDICATED. DO NOT USE A FORKLIFT. ALL LIFTING LUSGS MUST BE USED TO AVOID DAMAGE.

FIG. 3 – RECOMMENDED LIFTING WITH MULTIPLE POINTS



WARNING

Do not lift non-base units or subassembly by attaching clevis hooks, pins or bolts to casing, casing hardware, angles, tabs or flanges.

NOTE

Save bolts when removing lifting lugs. Bolts will be used for assembly of split units.

FIG. 4 – LIFTING LUGS

LOCATION CONSIDERATIONS

Housekeeping Pad

The floor and foundation on which the units are to be located should be rigid and level (shim if required).

Shims should be placed at intervals no longer than 5 feet apart. On units longer than 8 feet wide, foundation shall support not only perimeter base channel, but also “interval cross supports.” Consult factory if housekeeping pad is not continuous.

The structure should be capable of supporting the weight of the unit, including the fan motor and the water or refrigerant within the coils, plus the load imposed by the rotating centrifugal fans.

Secure the unit to the housekeeping pad. The installer is responsible to secure the unit to the housekeeping pad in accordance with applicable building and earthquake codes.

Ceiling Suspended Units

Ceiling suspended units are designed to be supported from the welded base *(see Fig. 5)*. Four or more suspension points are required to support the unit. On ceiling suspended units with splits, suspension rod is required on only 1 side of split (once split base is bolted together.) (Number of support points depends on unit length and weight and is shown on submittal.)

NOTE

The casing is not intended to support the unit.

The installer is responsible to make the hanging installation in accordance with applicable building and earthquake codes.

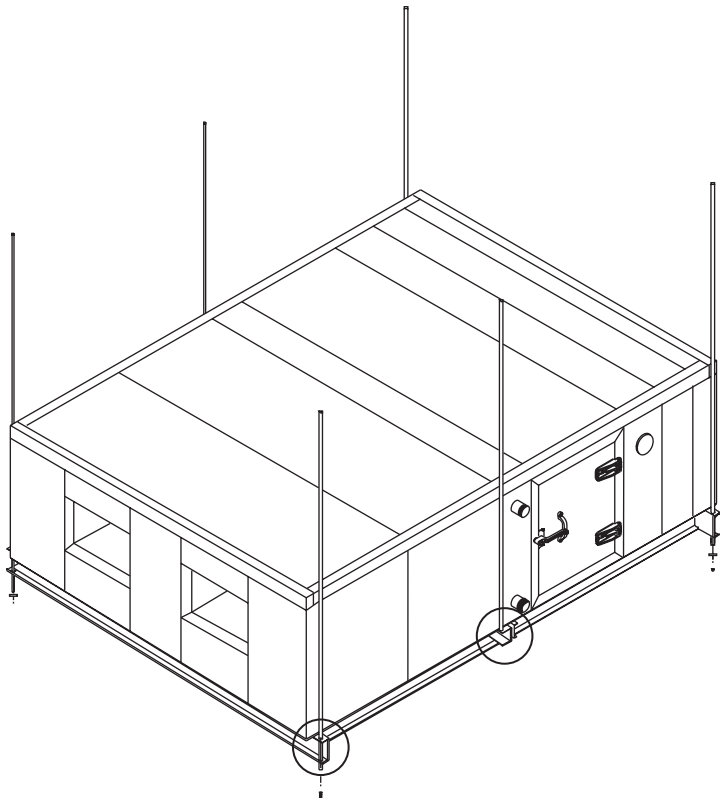


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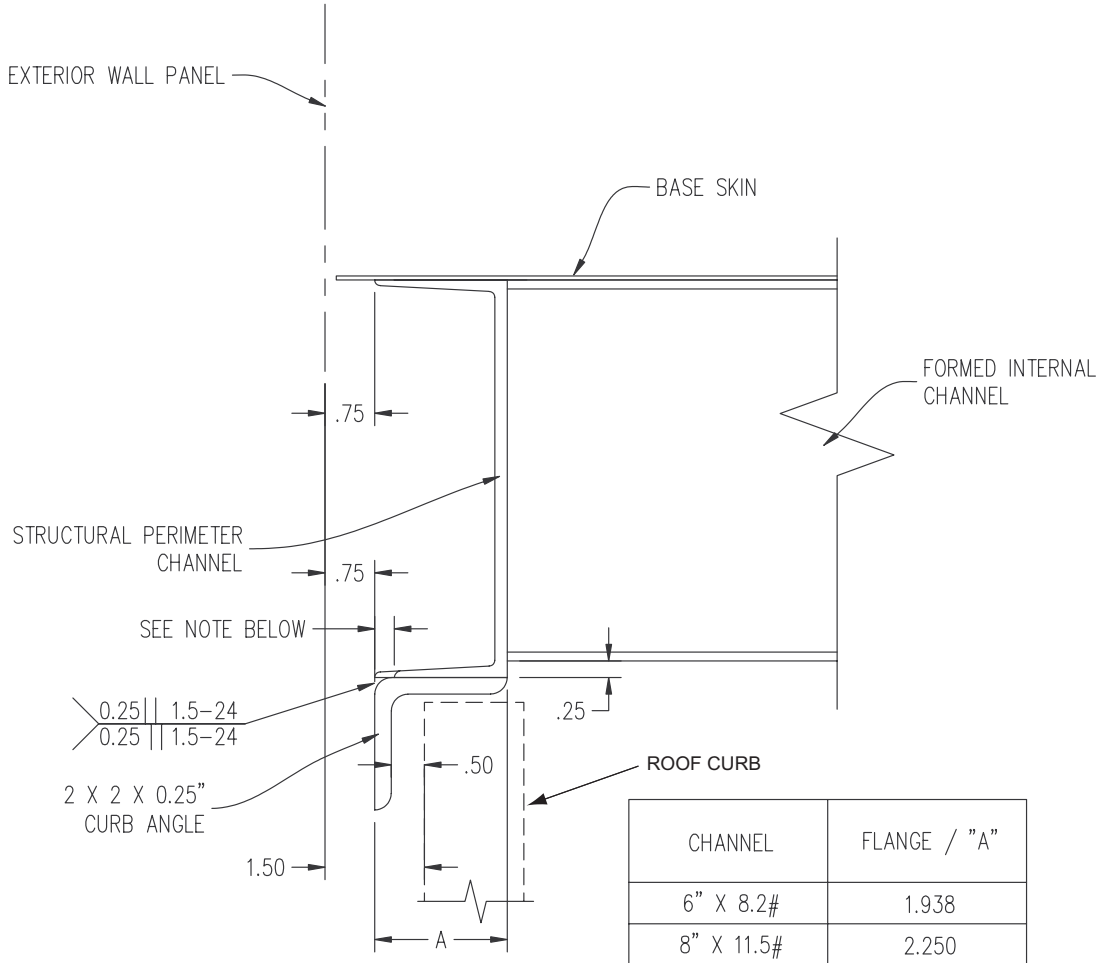
FIG. 5 – CEILING SUSPENDED UNIT

Roof Curb Assembly (Optional)

1. When supplied by YORK, roof curbs ship either fully welded or in pieces. If bolted curb construction, bolt together.
2. Curb must be level (shim if required). Shims should be placed at intervals no larger than 5 feet apart. On large units with splits, remember to shim at the split's mid-span *(see Fig. 7)*.
3. The installer is responsible to secure roof curb to the building structural support in accordance with local building and earthquake codes.
4. Seal all roof curb joints and seams with suitable sealer/polyurethane caulk to prevent water leakage.

Roof Curb Installation

1. Check that the curb is level and secured to the roof.
2. Check that there is adequate height between the base of the unit and the roof to allow for drain trapping.
3. Install 1/8" thick neoprene gasket, on the top of the curb to provide a seal between the unit and the roof curb. If units must be slid into place, a polyurethane sealant may be used in lieu of the gasket.
4. Lift the unit in place.
5. The installer is responsible to secure installation in accordance with the local building and earthquake codes.



CHANNEL	FLANGE / "A"
6" X 8.2#	1.938
8" X 11.5#	2.250
10" X 15.3#	2.625
12" X 20.7#	3.000

NOTE:
FLANGE WIDTH CAN VARY. LOCATE OUTSIDE EDGE OF CURB ANGLE USING "A" DIMENSION FROM THE BACK SIDE OF THE PERIMETER CHANNEL.

LD010495

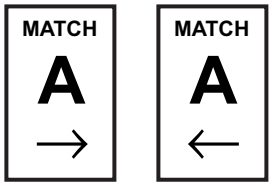
FIG. 6 – ROOF CURB DETAIL

SPLIT UNIT REASSEMBLY

General

Units which are shipped in sections, must be installed on a proper foundation and carefully assembled to provide the required unit performance.

- York Custom units are assembled in one piece in our factory, and then, split prior to shipping.
- York Custom units must be level for reassembly.
- All bolts, nuts, washers, split covers and polyurethane caulking (if required) can be found in supply fan section.
- All splits are labeled with letters (A-A, B-B, for example) to indicate which sections are to match up for reassembly.



REMOVABLE LIFTING LUGS

If your unit is wider than any split section's airway length, you will be provided with removable lifting lugs along the width of unit. Once the splits have been placed as close as possible to each other, remove the inner lifting lugs. A hand-actuated winch, or come-along, can be used to bring the unit sections closer together for final bolting. Attach hand winch or come-along to base "tie down tubes" to bring unit together.

ELECTRICAL WIRING/PIPING

It is the installer's responsibility to reconnect all internal and external electrical or piping splits. All wires are colored and/or numbered to designate which wires should be joined at each split. Before turning on power, check all electrical circuits for continuity!

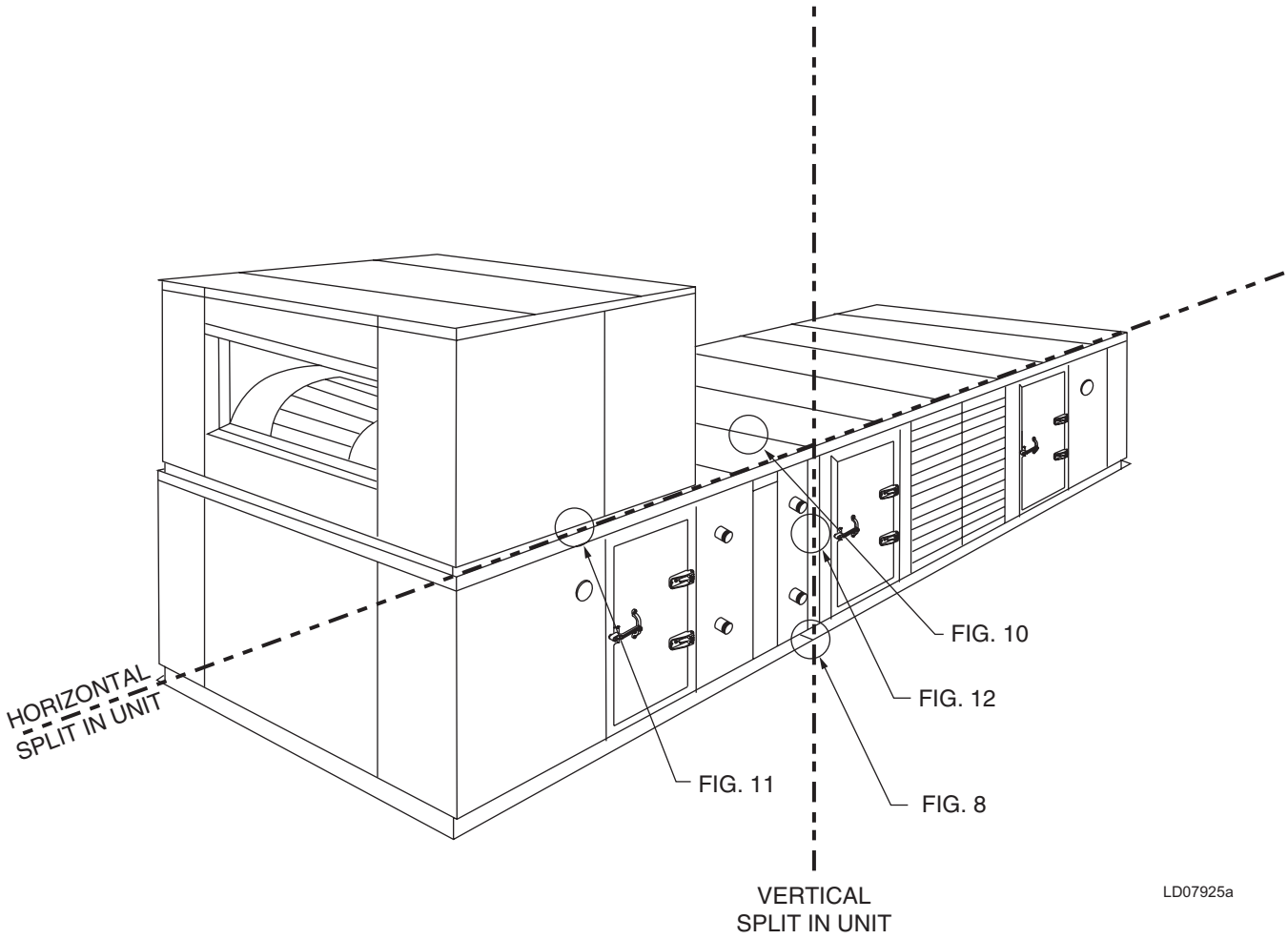


FIG. 7 – TYPICAL CABINET SPLIT

REASSEMBLY PROCEDURE FOR VERTICAL SPLIT UNIT

1. Position sections on level surface.
2. Apply polyurethane caulk where shown on both sides of split and bolt base together.
3. Attach hand winch to base "hold down tubes" and pull split section together. Bolt base per Fig. 8.
4. Split seams that have internal access to both sides of split will be reattached with bolts and nuts. Split seams with internal access to only one side of split will have cage nuts on the blind side and bolts installed from accessible side. All bolt holes require a bolt.
5. If bolt holes do not align, it may be due to racking during transit to job site. Use jack to lift one side until holes on the wall of the opposite side align. Bolt this wall together and then remove jack from opposite side. As the unit settles, the out-of-square racking caused during transit should realign. Continue assembly with bolting other side, base, floor and roof, making use of a drift pin to align the holes. Bar clamps may be needed to align the roofs together. If bar clamps are needed use wood for protection in between the bar clamp and unit.
6. Check to see if all bolts are secured properly, and apply polyurethane caulk to all exterior seams per Fig. 8.
7. Drive screw or bolt floor flange together.
8. CHECK all splits to see if polyurethane caulk was applied and split was bolted properly.
9. CHECK all splits to see if all electrical and piping connections are complete and correct.

NOTE

10. Temporary roof supports and diagonal (shipping) supports should not be removed until the split sections are completely reassembled.

NOTE

Outdoor Custom units that have an SQ for roof coating applied where light foot traffic is permitted, but storage of materials typically found on construction sites are not permitted to be placed on roofs. Care must be taken not to damage the roof coating. If other than light foot traffic or storage of materials becomes necessary, plywood may be placed on the roof provided the weight applied does not exceed 50lbs. per sq. ft.

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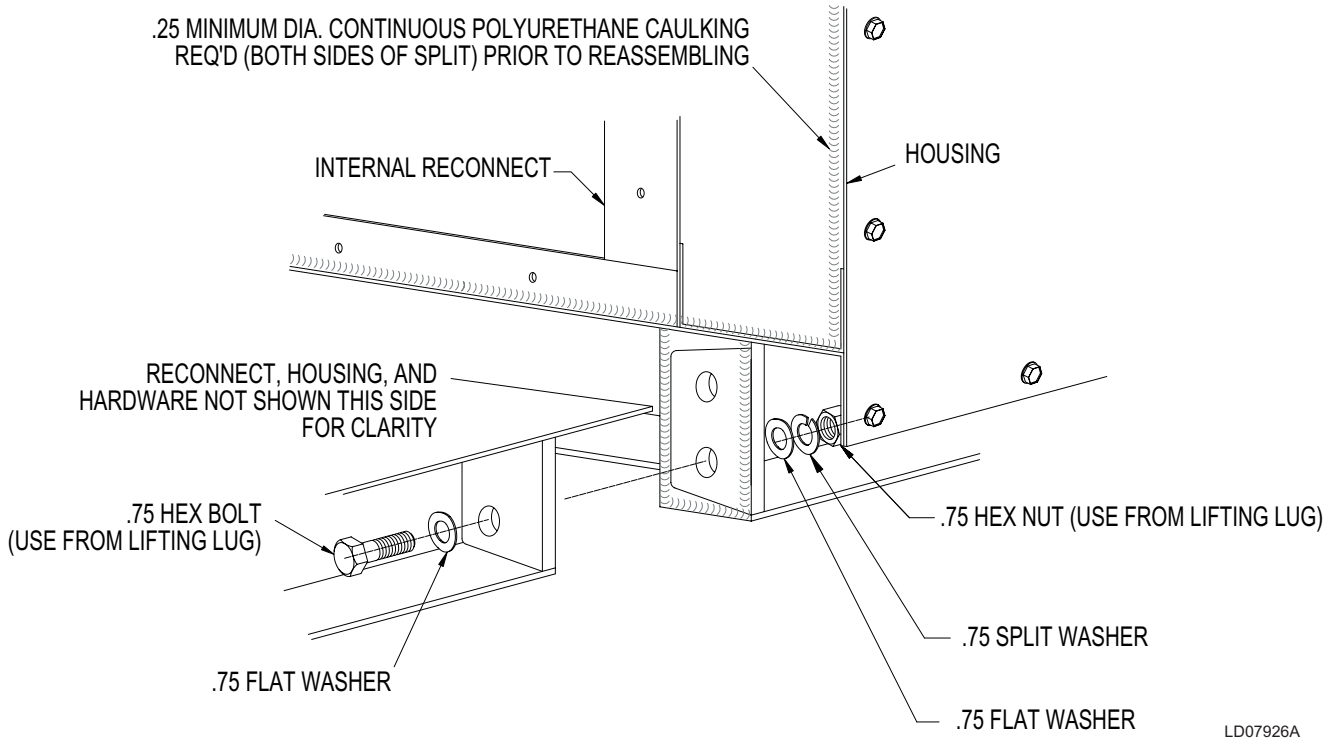


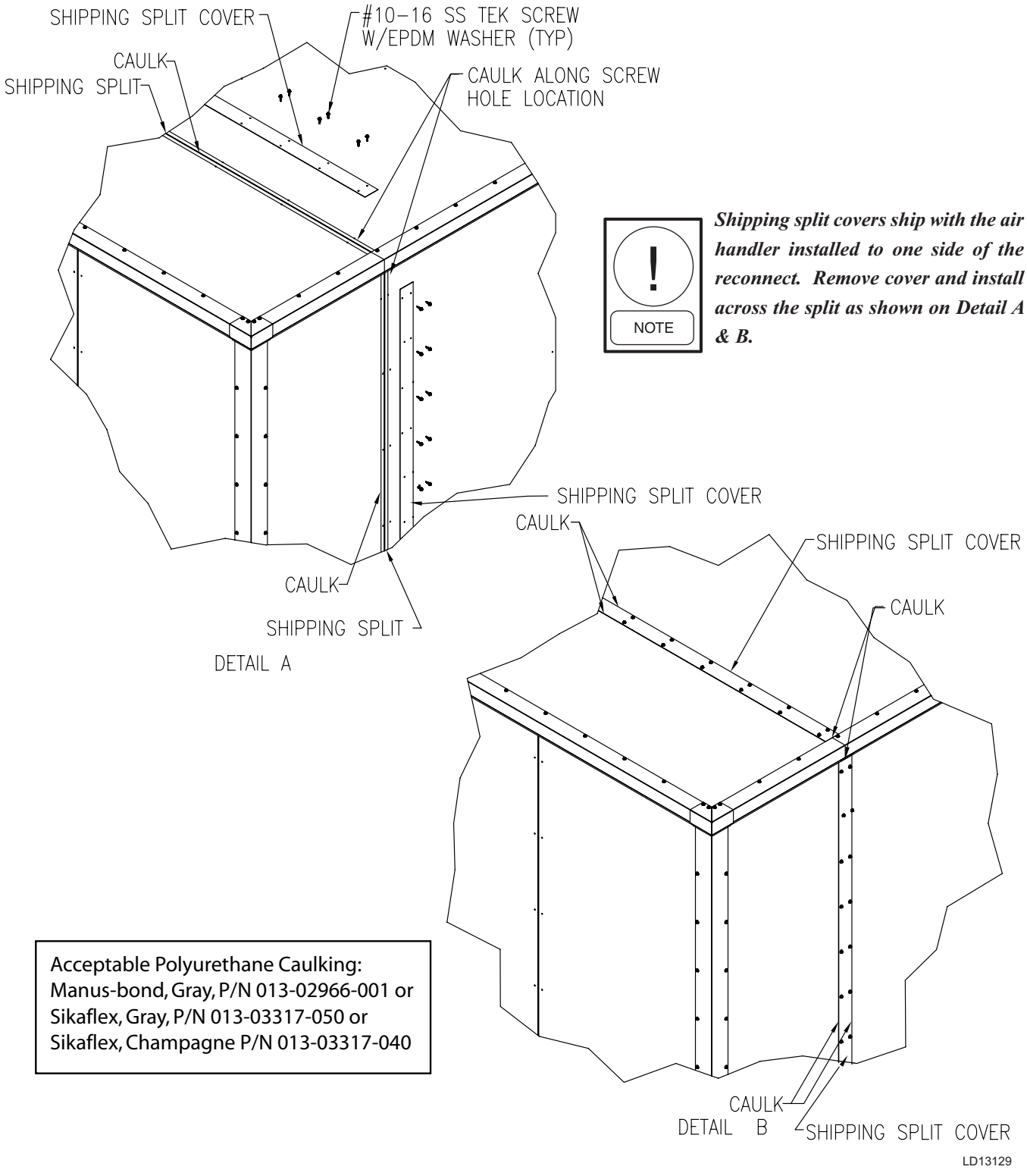
FIG. 8 – BASE ASSEMBLY ATTACHMENT

NOTE

Only use caulking shipped with unit.

CAUTION

Do not use silicone caulking on field reconnects or on shipping split covers.



NOTE

Shipping split covers ship with the air handler installed to one side of the reconnect. Remove cover and install across the split as shown on Detail A & B.

Acceptable Polyurethane Caulking:
Manus-bond, Gray, P/N 013-02966-001 or
Sikaflex, Gray, P/N 013-03317-050 or
Sikaflex, Champagne P/N 013-03317-040

FIG. 9 – SPLIT REASSEMBLY PROCEDURE FOR OUTDOOR UNITS ONLY

RECONNECTION INSTALLATION PROCEDURE:

1. Apply a generous amount of polyurethane caulking to the face of the housing and split plate as shown.

2. Pull sections together from the base split plate until they meet.

3. Clamp off bottom leg of reconnect until no gaps are visible.

4. Install reconnection hardware starting from the middle of the bottom angle working around to the middle of the top angle, making use of a drift pin to align the holes. Bar clamps may be needed to align the roofs together. If bar clamps are needed use wood for protection in between the bar clamp and unit.

5. Once unit sections have been joined, contractor to seal the exterior and interior reconnect seam with polyurethane caulk.

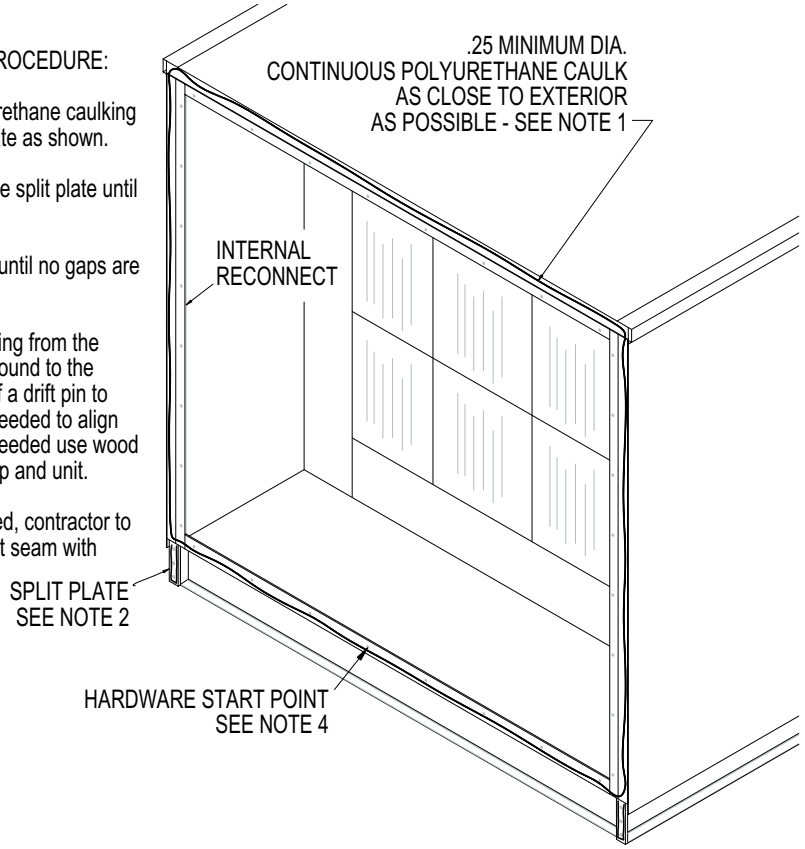
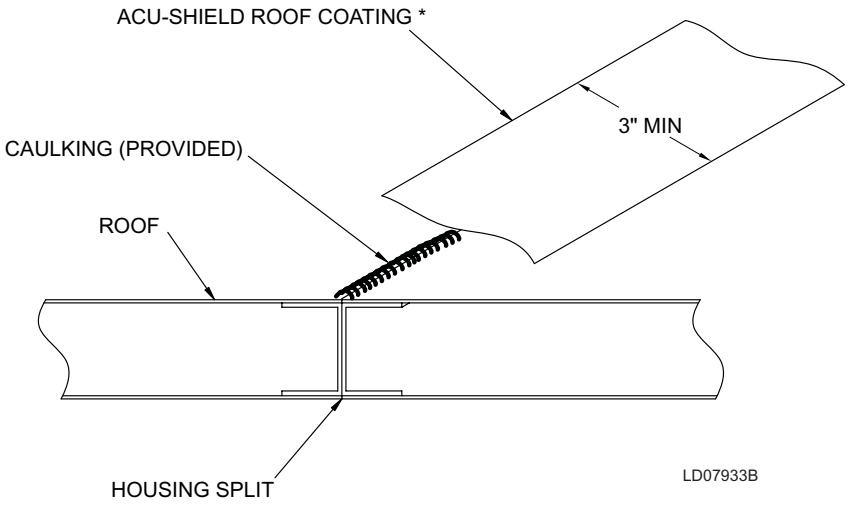


FIG. 9A – SPLIT REASSEMBLY PROCEDURE

OUTDOOR SPLIT ROOF SEALANT PROCEDURE

1. The mechanical joint between sections must be bolted and sealed with polyurethane caulking.
2. Acu-Shield Roof Coating can be applied after polyurethane caulking is dry and when surface temperature is between 45 and 108 degrees. Below 45 degrees, extra steps must be taken to keep the polyurethane caulking, acu-shield, and metal reconnect surfaces heated for proper application during installation. Contact Product Service for further direction.
3. Do not apply when inclement weather is imminent within a 24 hr. period.
4. Do not apply to wet, ice, or snow covered surfaces.
5. Before applying, clean surface with wire brush or solvent wipe (not provided).
6. Apply Acu-Shield Roof Coating with 3” wide roller or 3” wide paintbrush (not provided).
7. One quart applied at 45 mils is equal to a 3 inch wide X 33 ft. long section.
8. Cure time will vary with temperature and humidity. Under normal conditions, a rubber coating can be expected within a 24 hr. period.



* Provided with ship loose items in fan section (see table in Section 2 "Receiving & Inspection").

FIG. 10 – OUTDOOR SPLIT ROOF SEALANT PROCEDURE ON ROOFS W/ACU-SHIELD OPTION

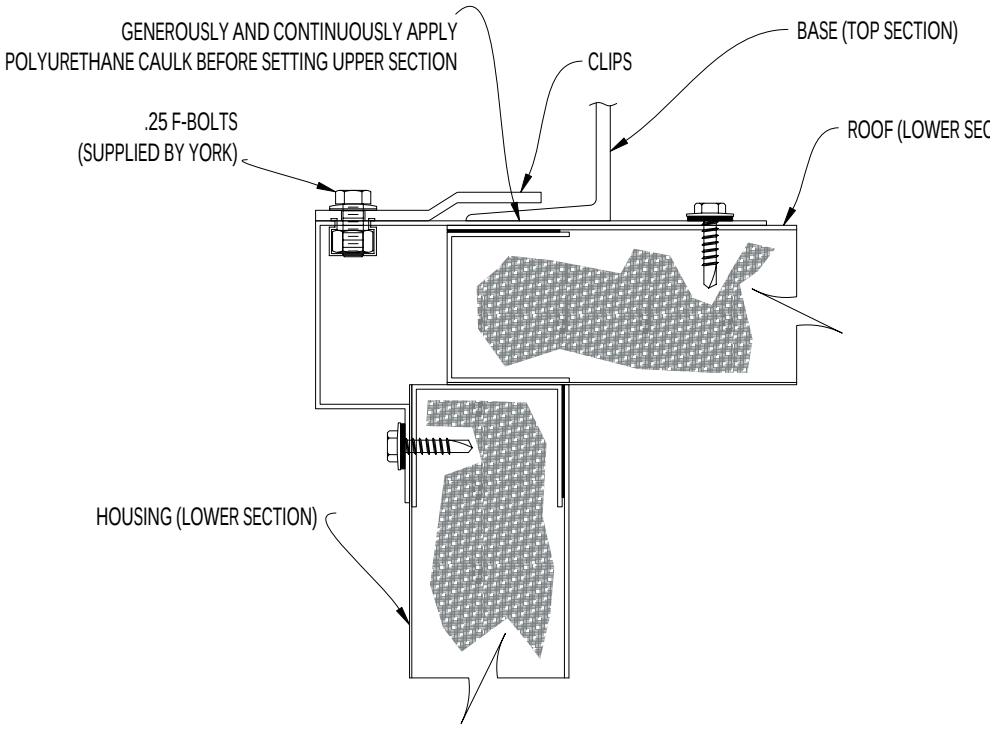


FIG. 11 – HORIZONTAL SPLIT

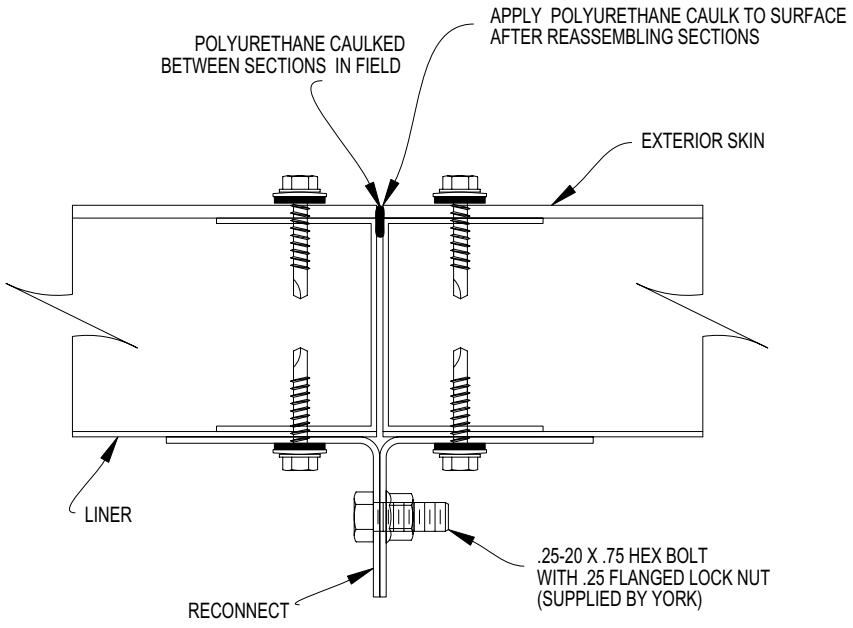


FIG. 12 – CROSS SECTION OF SPLIT WALL ASSEMBLY

THERMAL BREAK RECONNECTION INSTALLATION PROCEDURE:

1. APPLY A GENEROUS AMOUNT OF POLYURETHANE CAULKING TO THE FACE OF THE RECONNECTION FLANGE AND SPLIT PLATE AS SHOWN.
2. CONTRACTOR TO INSTALL GASKET BEFORE JOINING SECTIONS. GASKET TO BE SHIPPED LOOSE.
3. PULL SECTIONS TOGETHER FROM THE BASE SPLIT PLATE UNTIL THEY MEET.
4. CLAMP OFF BOTTOM LEG OF RECONNECT UNTIL NO GAPS ARE VISIBLE.
5. INSTALL RECONNECTION HARDWARE STARTING FROM THE MIDDLE OF THE BOTTOM ANGLE WORKING AROUND TO THE MIDDLE OF THE TOP ANGLE, MAKING USE OF A DRIFT PIN TO ALIGN THE HOLES. BAR CLAMPS MAY BE NEEDED TO ALIGN THE ROOFS TOGETHER. IF BAR CLAMPS ARE NEEDED USE WOOD FOR PROTECTION IN BETWEEN THE BAR CLAMP AND UNIT.
6. ONCE UNIT SECTIONS HAVE BEEN JOINED, CONTRACTOR TO SEAL THE EXTERIOR AND INTERIOR RECONNECT SEAM WITH POLYURETHANE CAULK.

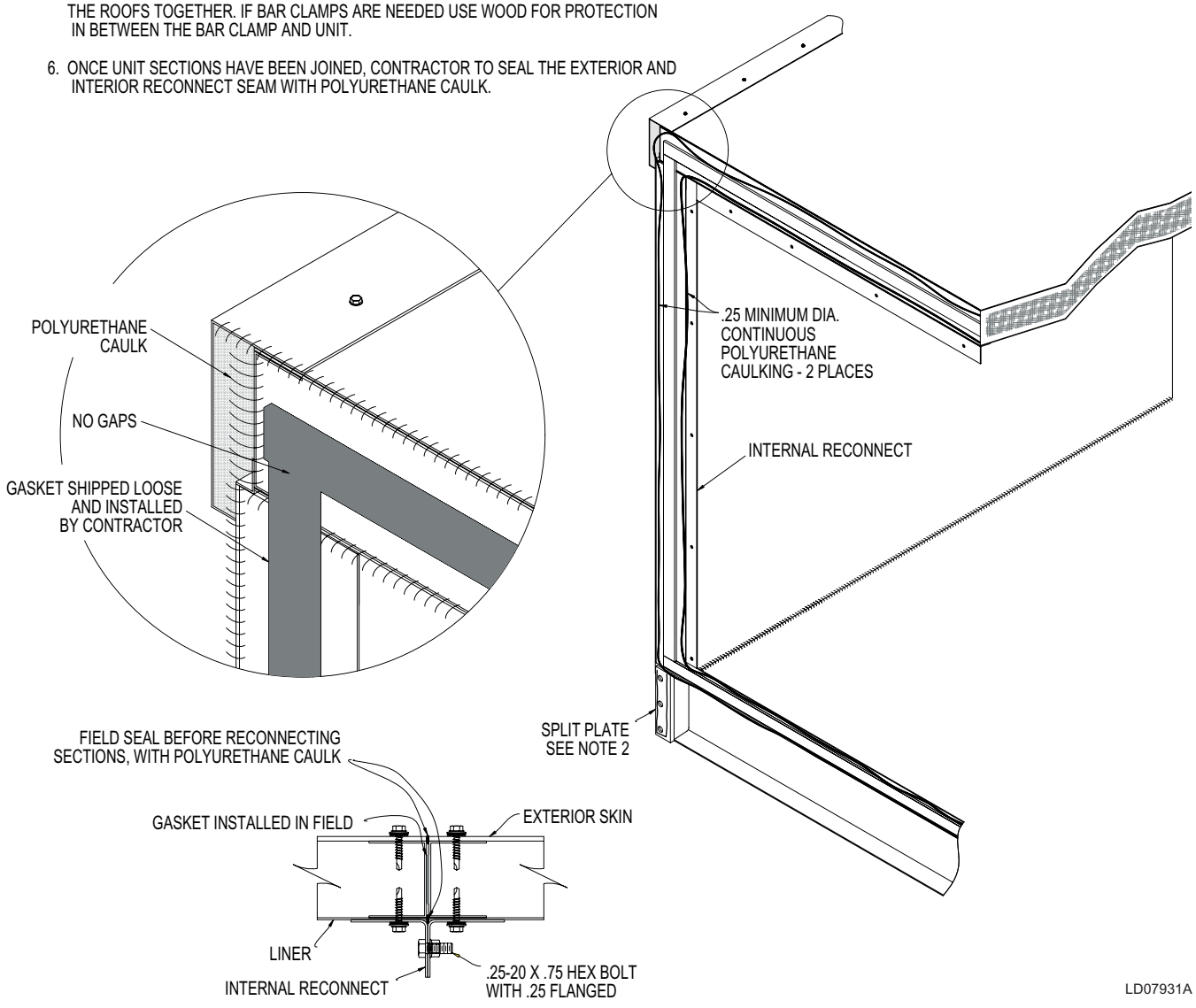


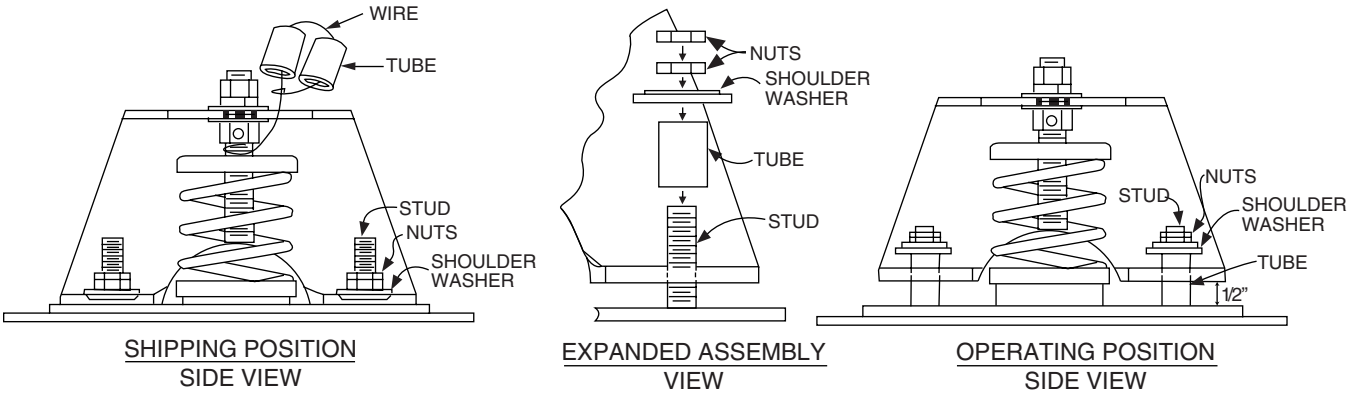
FIG. 13 – MULTI-SECTION GASKET INSTALLATION ON THERMAL BREAK UNITS

FAN HOLD-DOWN / SPRING ISOLATOR SET-UP

All fans are internally spring isolated and will be bolted down *(see Fig. 14)* for unit shipping. After unit is in place, assembled and leveled, Fan Hold-Down can be disassembled by removing two (2) nuts and one (1) washer from each side. Remove tubes from wire and discard wire.

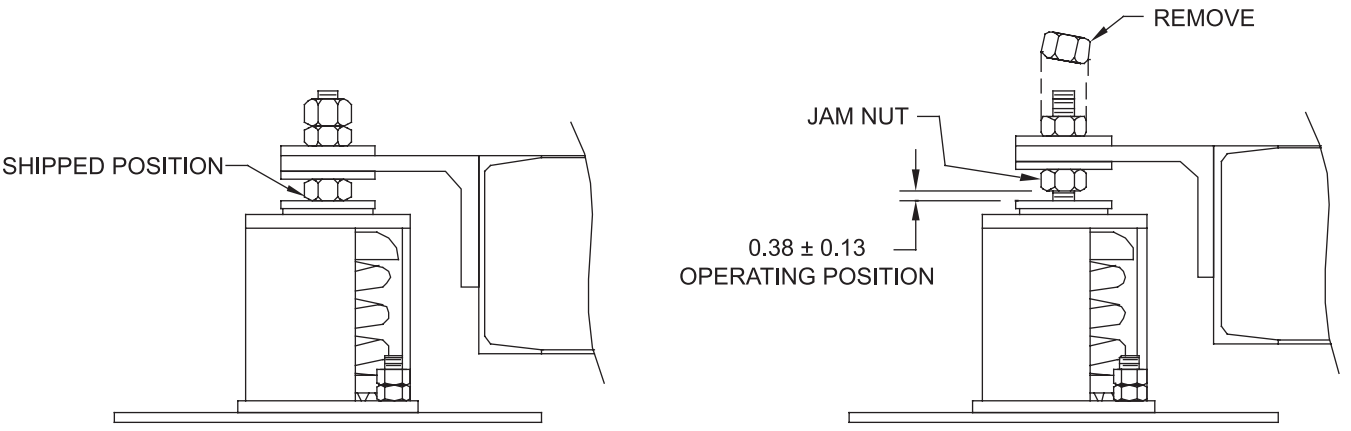
Place tubes on studs and place shoulder washer (shoulder up) on studs. Place one (1) nut on each stud and tighten it on shoulder washer.

Place remaining nuts on studs and tighten to lower nut to lock in place.



P-STYLE PLUG FAN

LD05617



BUY-OUT ISOLATORS

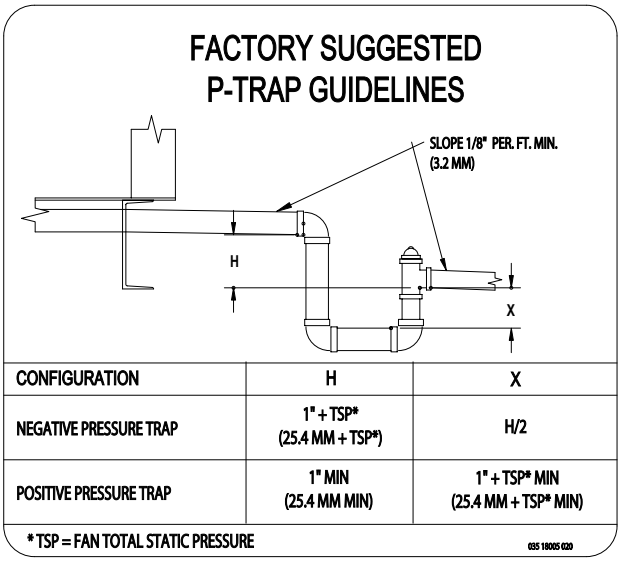
1. Remove the 7/8 nut as shown in the operating position view.
2. Loosen the 7/8 jam nut between the isolator housing and the fan base support angle until the desired level is achieved.
3. Repeat step two until all isolators are set at the proper elevation and the fan base is level.

LD07934

FIG. 14 – SPRING ISOLATOR SET-UP

CONDENSATE DRAIN TRAP SIZING

All condensate drain connections and floor drains must be trapped at the job site location. Failure to properly trap a drain will result in flooding of the drain pan and potential water damage to the air-handling unit and other building facilities.



CONFIGURATION	H	X
NEGATIVE PRESSURE TRAP	1" + TSP* (25.4 MM + TSP*)	H/2
POSITIVE PRESSURE TRAP	1" MIN (25.4 MM MIN)	1" + TSP* MIN (25.4 MM + TSP* MIN)

* TSP = FAN TOTAL STATIC PRESSURE

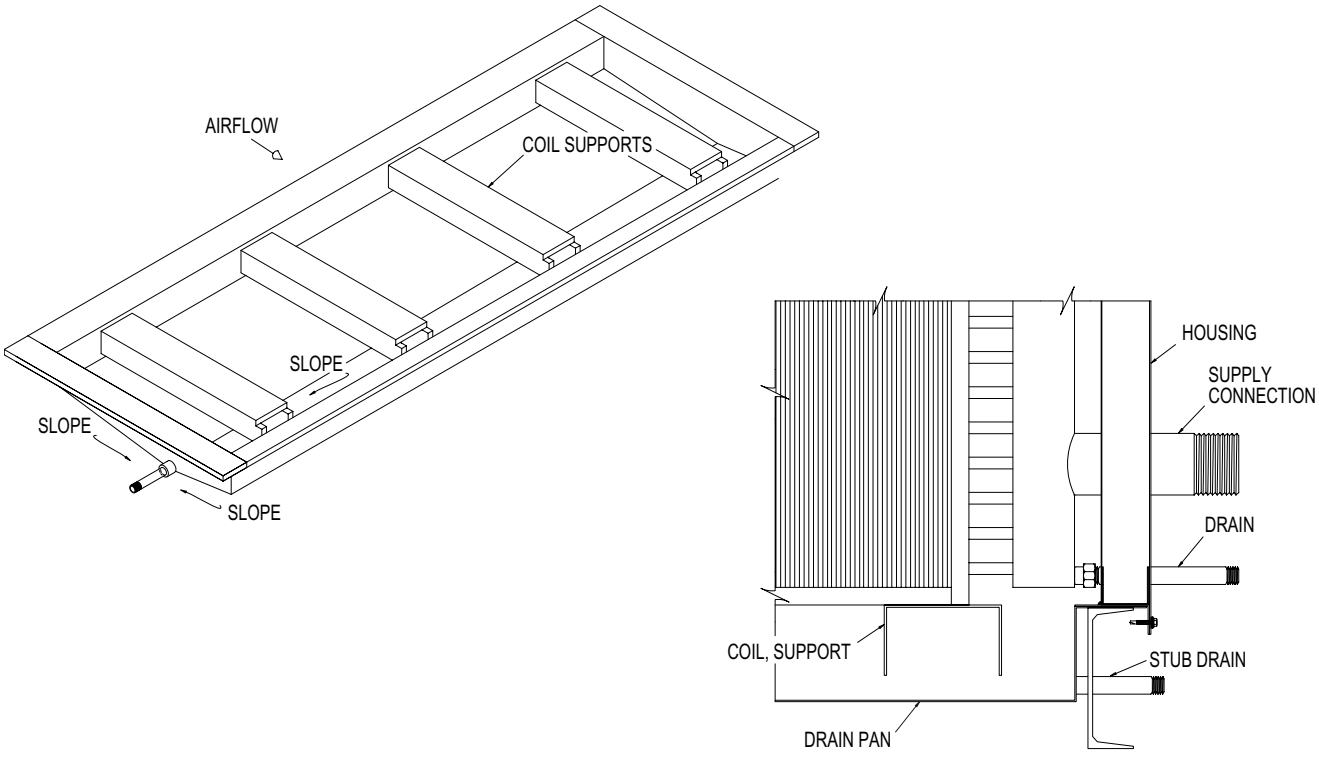
LD05618A

FIG. 15 – CONDENSATE DRAIN TRAP SIZING

2

IAQ DRAIN PAN CONSTRUCTION

IAQ drain pan slopes in two (2) planes, is a minimum of 3" deep at drain connection and is available in galvanized or 304 stainless steel. Drain pan connection, condensate tray, and coil supports are manufactured with same material as drain pan unless otherwise specified.



LD07936B

FIG. 16 – IAQ DRAIN PAN DETAIL

DUCT CONNECTIONS

Make duct connections to the casing by screwing flanged ducts directly to the casing with self-tapping sheet metal screws.

Duct connections to collar-type openings can be made with s-cleats or overlapping joints.

Apply polyurethane caulking around the duct connection. It is important to seal all duct connections to prevent air-leakage and system performance problems.

All duct connections are to be insulated (as required) by the installing contractor.

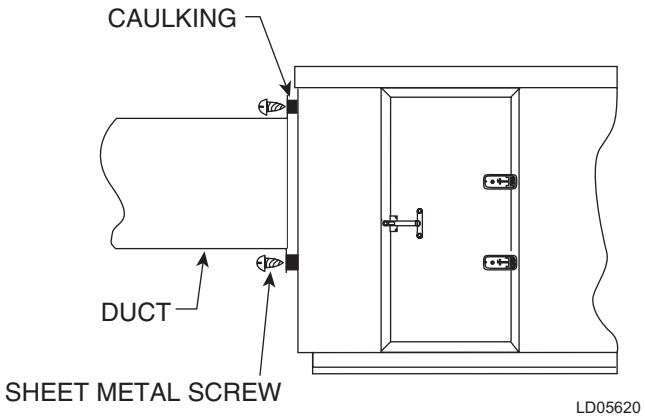


FIG. 17 – DETAIL OF DUCT CONNECTION

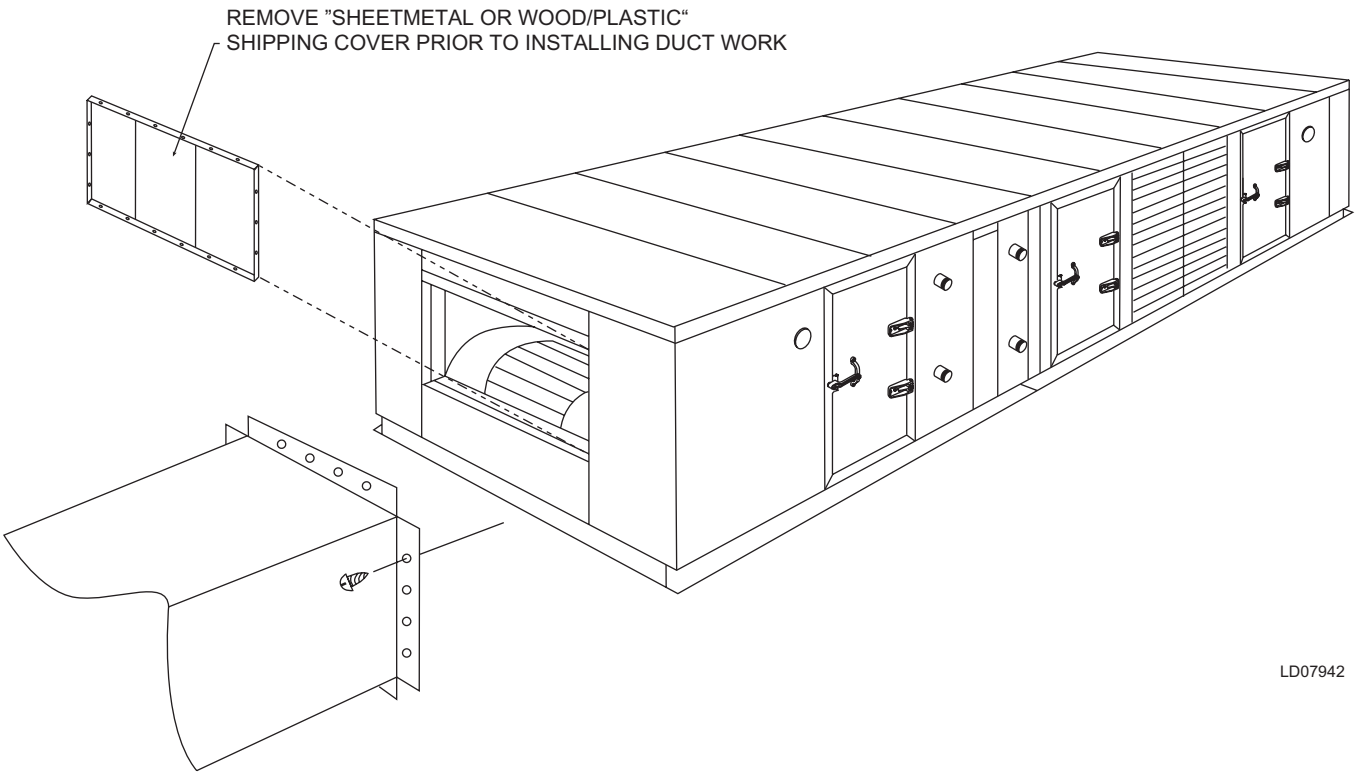


FIG. 18 – CONNECTION OF DUCT

WEATHER HOOD CONNECTION

1. Apply polyurethane caulking to the flange of the hood.
2. Align the hood over the opening. Check for adequate clearance to doors and other openings on the air-handling unit.
3. Install the hood onto the unit using sheet metal screws through the unit casing. On openings requiring multiple hoods, repeat this procedure for each of the hoods.
4. Carefully, remove excess polyurethane caulking from around the flange of the hood.

Any penetration of cabinet skin will cause water and air leakage. Thoroughly seal any screw, piping or electrical holes with appropriate sealant. Self tapping screws are not weather tight.

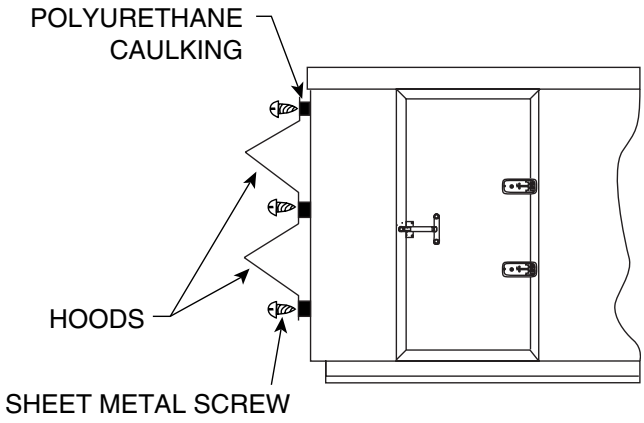


FIG. 19 – CONNECTION OF WEATHER HOOD(S) TO UNIT

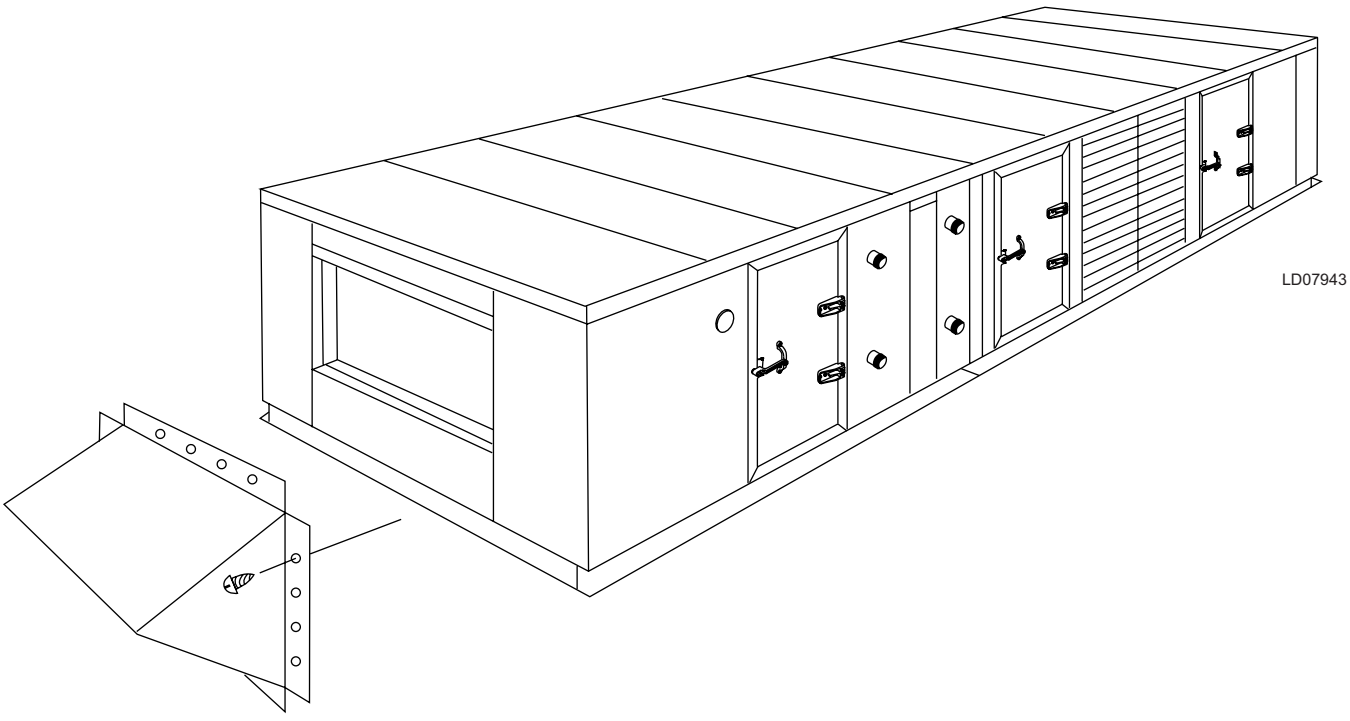


FIG. 20 – WEATHER HOOD INSTALLATION

FAN BEARING LUBRICATION

Standard fan configurations ship with fan bearings factory lubricated (ready for start-up). The fan should be turned off and locked out to prevent accidental start-up of the fan during lubrication procedures. Also, secure sheaves before servicing the unit to insure that the fan cannot free-wheel. Failure to do so may result in severe personal injury.

Proper lubrication of bearings helps to assure maximum bearing life. Generally, lubricate bearings every 1000 hours of operation or more frequently when exposed to wet location, wide temperature variety or severe atmospheric conditions.

Add grease with manual grease gun until a light bead of grease appears at the bearing grease seal or refer to lubrication frequency in the tables 1, 2 & 3. Observation of the condition of the grease expelled from the bearings at the time of re-lubrication is the best guide as to whether lubrication intervals and the amount of grease added should be altered. Always lubricate bearings prior to extended shut-down or storage and rotate shaft monthly.

Recommended Lubricant for Fan Bearings

A Lithium / Petroleum base grease conforming to an NLGI Grade II consistency is normally used. Lubricant must be free of any chemical impurities such as free acid or free alkali, dust, rust, metal particles or abrasives. This light viscosity, low torque grease is rust inhibited and water resistant, has a temperature range of -30°F to +200°F with intermittent highs of +250°F. Lubricate bearings as required by the severity of required duty.

Proper Interval and Quantity

See Tables 1, 2 & 3

TABLE 1 – FAN BEARING – LUBRICATION INTERVALS - BALL BEARING PILLOW BLOCKS

Re-lubrication schedule (months)									
SPEED (RPM)	**500**	**1000**	**1500**	**2000**	**2500**	**3000**	**3500**	**4000**	**4500**
SHAFT DIA.									
1/2" THRU 1-11/16"	6	6	5	3	3	2	2	2	1
1-15/16" THRU 2-7/16"	6	5	4	2	2	1	1	1	1
2-11/16" THRU 2-15/16"	5	4	3	2	1	1	1		
3-7/16" THRU 3-15/16"	4	3	2	1	1	1			

TABLE 2 – FAN BEARING – LUBRICATION INTERVALS - SPHERICAL ROLLER BEARING SOLID PILLOW BLOCKS

Re-lubrication schedule (months)									
SPEED (RPM)	**500**	**1000**	**1500**	**2000**	**2500**	**3000**	**3500**	**4000**	**4500**
SHAFT DIA									
1-3/16" THRU 1-7/16"	6	4	4	2	1	1	1	1	½
1-11/16" THRU 2-3/16"	4	2	1½	1	½	½	½	½	½
2-7/16" THRU 3-7/16"	3	1½	1	½	½	½	½		
3-15/16" THRU 4-15/16"	2½	1	½	¼					

TABLE 3 – FAN BEARING – LUBRICATION INTERVALS - SPHERICAL ROLLER BEARING-SPLIT PILLOW BLOCKS

Re-lubrication schedule (months)										Grease to be added at each interval
SPEED (RPM)	**500**	**750**	**1000**	**15000**	**2000**	**2500**	**3000**	**3500**	**4000**	
SHAFT DIA										
1-7/16" THRU 1-15/16"	6	4½	4	4	3½	2½	2½	1	1	0.50 OZ.
2-3/16" THRU 2-11/16"	5	4½	4	2½	2½	1½	½	¼	¼	0.75 OZ.
2-15/16" THRU 3-15/16"	4½	4	3½	2½	1½	1	½			2.00 OZ.
4-7/16" THRU 4-15/16"	4	4	2½	1	½					4.00 OZ.
5-7/16" THRU 5-15/16"	4	2½	1½	1						7.00 OZ.

FAN SEGMENT-FAN MOTOR

Keep the motor clean, dry and properly lubricated at all times. Blow dust and dirt out of windings periodically using low-pressure (50 psig) air.

Mounting Hardware and Adjustable Motor Base

- Check for loose parts.
- Check for damage.

Motor Condition (visual)

- Check for leaky bearing seals.
- Check for damage.
- Check for dirt, dust & debris in air vents on motor housing.

LD9635

FIG. 21 – ODP (OPEN DRIP PROOF)

LD9639

FIG. 22 – TEFC (TOTALLY ENCLOSED FAN COOLED)

Electrical Checks

- Check all electrical terminations.
- Check conduit fittings and clamps for damage or looseness.
- Check operating amperage and compare to nameplate.

Lubrication

Motor Bearing Lubricant

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program:

- A high-grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).
  - Maximum operating temperature for standard motors = 110°C.
  - Shutdown temperature in case of a malfunction = 115°C.
- **Proper Interval**

  Lubrication Intervals – Recommended lubrication intervals are shown in Table 4. It is important to realize that the recommended intervals of Table 4 are based on average use. *Refer to additional information contained in Tables 5 & 6.*
- **Motor Lubrication Procedure**

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your distributor or an authorized service center if grease other than the recommended type is to be used.

To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your distributor or an authorized Service Center for additional information.

– With Grease Relief Plug

1. Clean all grease fittings.
2. Remove grease relief plug.
3. If motor is stopped, add the recommended amount of grease.
4. If motor is to be greased while running, a slightly greater quantity of grease will have to be added. Add grease slowly until new grease appears at shaft hole in the end plate for purge relief plug.
5. Re-install grease relief plug

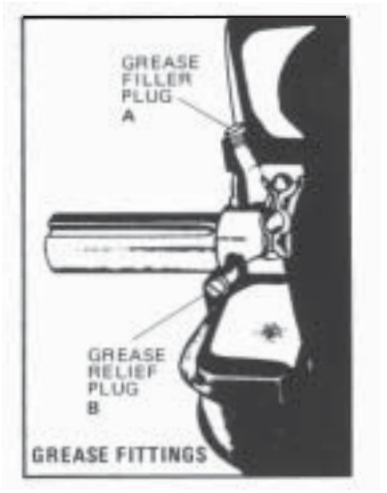


FIG. 23 – GREASE FITTINGS

TABLE 4 – MOTOR BEARING – LUBRICATION INTERVALS

NEMA / (IEC) FRAM SIZE	Rated speed - rpm					
	10000	6000	3600	1800	1200	900
UP TO 210 INCL. (132)	**	2700 HRS.	5500 HRS.	12000 HRS.	18000 HRS.	22000 HRS..
OVER 210 TO 280 INCL. (180)			3600 HRS.	9500 HRS..	15000 HRS.	18000 HRS...
OVER 280 TO 360 INCL. (180)			*2200 HRS.	7400 HRS..	12000 HRS.	15000 HRS.
OVER 360 TO 5800 INCL. (180)			*2200 HRS..	3500 HRS..	7400 HRS..	10500 HRS.

* Lubrication intervals are for ball bearings. For roller bearings, divide the listed lubrication interval by 2.

** For 6205 and 6806 bearings. For 6807 bearings, consult oil mist lubrication (MN410).
Re lubrication interval for 6205 bearing is 1550 HRS. (Using grease lubrication).
Re lubrication interval for 6806 bearing is 720 HRS. (Using grease lubrication).

TABLE 5 – MOTOR BEARING – SERVICE CONDITIONS

SEVERITY OF SERVICE	AMBIENT TEMPERATURE MAXIMUM	ATMOSPHERIC CONTAMINATION	TYPE OF BEARING
STANDARD	40°C	CLEAN, LITTLE CORROSION	DEEP GROOVE BALL BEARING
SEVERE	50°C	MODERATE DIRT, CORROSION	BALL THRUST, ROLLER
EXTREME	>50°C* OR CLASS H INSULATION	SEVERE DIRT, ABRASIVE DUST	ALL BEARINGS
LOW TEMPERATURE	<-30°C**	CORROSION	

* Special high temperature grease is recommended. Note that high temperature grease may not mix with other grease types. Thoroughly clean bearing and cavity before adding grease.

** Special low temperature grease is recommended.

TABLE 6 – MOTOR BEARING – LUBRICATION INTERVAL MULTIPLIER

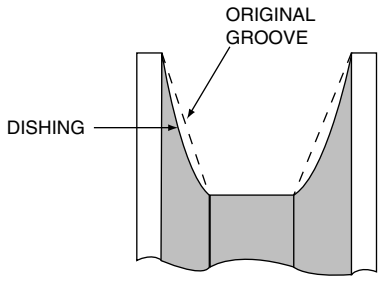
SEVERITY OF SERVICE	MULTIPLIER
STANDARD	1.0
SEVERE	0.5
EXTREME	0.1
LOW TEMPERATURE	1.0

INSPECTING V-BELTS AND SHEAVES

Before a new set of V-belts are installed, check the condition of the sheaves. Dirty or rusty sheaves impair the drive's efficiency and abrade the belts, which result in premature failure.

Inspect and clean sheaves; replace worn or damaged sheaves- Worn sheave grooves are one of the principal causes of premature belt failure. Get your money's worth from a new set of belts by inspecting the sheaves carefully!

- Clean dirty, dusty, or rusty sheaves. They will impair the drive's efficiency and wear out the belt. Feel sheave grooves (wear gloves or use a rag) for nicks or burrs, and file them smooth.
- Belts should ride in sheave grooves so that the top of the belt is just above the highest point of the sheave. If the grooves are worn to the point where the belt bottoms out (a clue: check for shiny groove bottoms), the belts will slip and burn.
- If the groove walls are "dished out," the bottom corners of the belt will quickly wear off and cause rapid failure. Check groove wear by sight, touch, or with a groove gauge. If grooves are "dished out" 1/32" or more - replace the sheaves!



"DISHING" OF GROOVE SIDEWALLS SHORTENS BELT LIFE

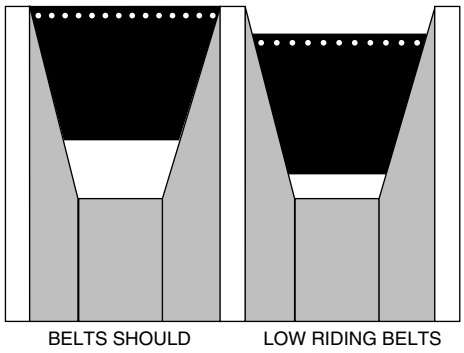


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FIG. 24 – SHEAVE INSPECTION

Check Sheave Alignment

An incorrectly aligned sheave can substantially shorten belt life or overload blower and motor bearings, shortening their life expectancy. A belt tensioned too tightly can overload the motor electrically, causing nuisance tripping of the motor overloads and/or motor failure and/or shaft failure.

Sheave adjustment should be checked by placing a straight edge across the sheave faces so that it touches all four points of contact. Ordinarily, a misalignment of more than one-half of one degree (one-eighth inch in one foot) will adversely affect belt life. Improper sheave alignment produces uneven wear on one side of the belt, causes the belt to roll over in the sheave or throws all the load on one side of the belt, stretching or breaking the cords on that side.

After the proper operating tension has been applied to the belts, a double-check should be made of the following:

- Parallel position of the sheave shafts.
- Correct alignment of sheave grooves.

Sheave alignment and parallelism of shafts is very important. Proper alignment helps equalize the load across the entire belt width, thereby reducing wear and extending belt life. Figure 25 shows how to align a synchronous drive properly using a straightedge (A) or a piece of string (B).

After aligning the sheaves, check the rigidity of the supporting framework. Shafts should be well supported to prevent distortion and a resulting change in the center distance under load. Do not use spring-loaded or weighted idlers.

Alignment Using A Straightedge (Preferred)

Place a straightedge against the outer edge of the sheaves. Figure 25 (A) shows the four points where the straight edge should touch the sheaves. The straight edge should cross the sheaves at the widest possible part of the sheave.

Alignment Using A String

Tie a string around either shaft and pull it around and across the outer edge of both sheaves. Figure 25 (B) shows how the string should touch four points when the drive is properly aligned.

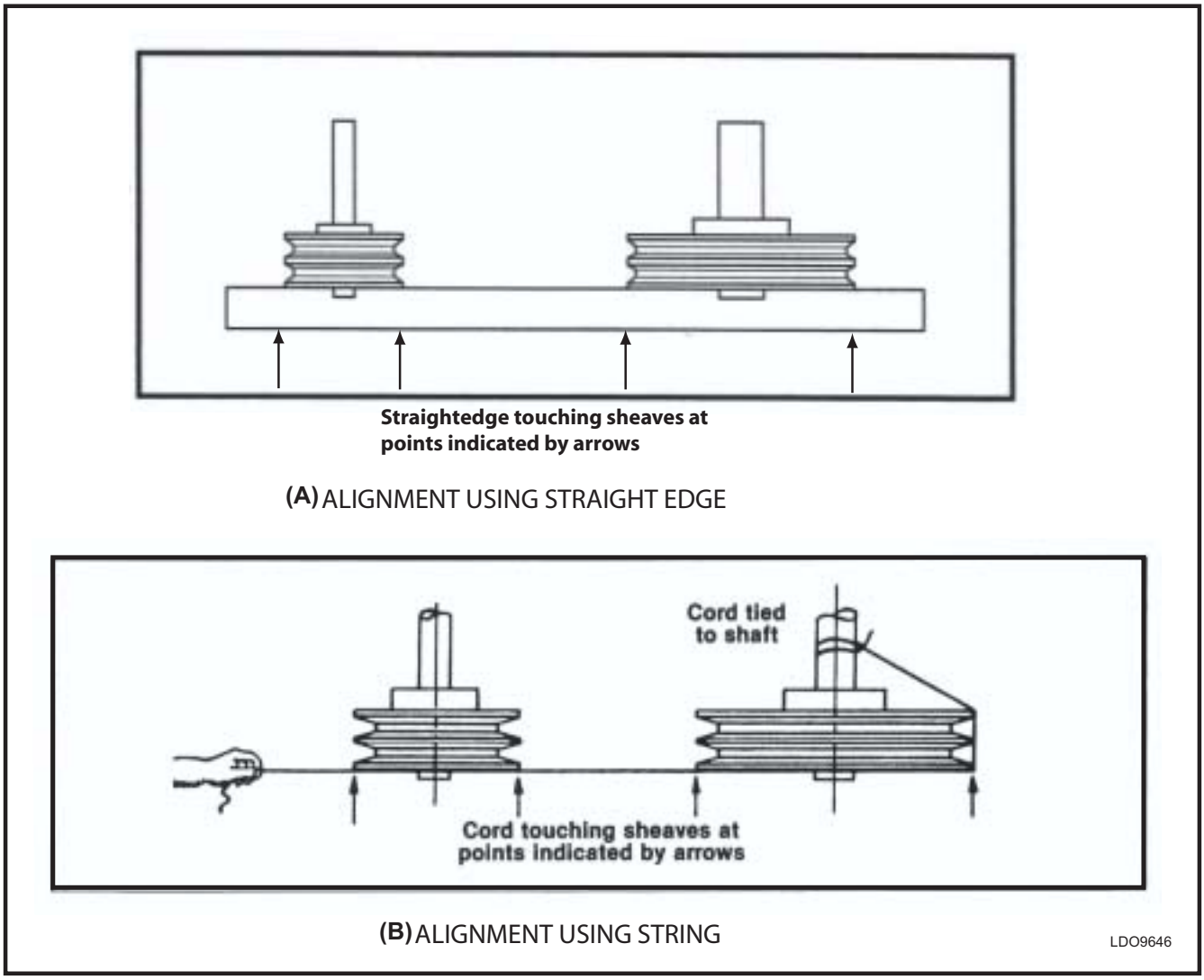


FIG. 25 – SHEAVE ALIGNMENT

Belt Replacement

Always replace belts as a matched set. Used belts will always be longer because of stretching and new belts should never be installed singly on a matched drive.

Follow the steps below to replace belts:

1. Release the tension on the belts by loosening the adjusting nuts on the fan motor.
2. Remove old belts and recheck the sheave alignment with a straight edge.
3. Install the new belts on the sheave.

Never place the belts on the sheaves by using a screwdriver to pry the belt over the rim of the sheave.

TENSIONING V-BELTS & SHEAVES

General Rules Of Tensioning:

1. Correct belt tensioning data is located on "V-belt Drive Kit Label", which is mounted on inside of fan access door.
2. Adjust the belt tension using the adjusting nuts on the motor mount.
3. Ideal tension is the lowest tension at which the belt will not slip during start-up.
4. Check tension after:
   - The first 24 hours of operation.
   - One week of operation.

   New belt tension will drop rapidly during the first few hours of operation.
5. Over tensioning shortens belt and bearing life.
6. Keep belts free from foreign material, which may cause slip.
7. Make V-drive inspection on a periodic basis. Tension when slipping. Never apply belt dressing, as this will damage the belt and cause early failure.

Simple Tensioning Procedure

1. Measure the span length, K.
2. At the center of the span (K), apply a force (perpendicular to the span) large enough to deflect the belt 1/64" for every inch of span length. For example, the deflection of a 100-inch span would be 100/64 or 1-9/16 inches.

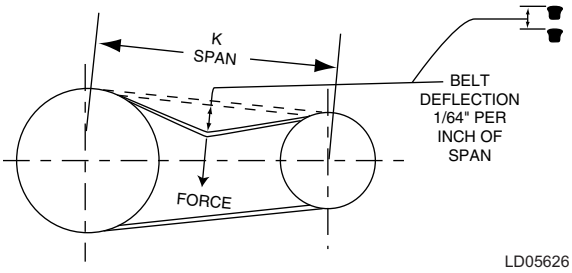


FIG. 26 – SIMPLE TENSIONING PROCEDURE

ECONO-DISK® OPERATING & MAINTENANCE INSTRUCTIONS

Before close inspection or servicing of the fan, or ECONO-DISK®, normal safety precautions must be observed, i.e. power to the fan must be locked out, and red tagged. By design the ECONO-DISK® is inherently maintenance free.

The mechanism has an integral mechanical stop to prevent over travel of the disk at both extremes. The disk is supported by a solid type 416 ground stainless steel shaft and two permanently lubricated bronze bearings. The operating linkage is permanently lubricated and requires no more than occasional routine inspection.

ECONO - DISK® fans sizes 33 through 73 incorporate one or more gas charged springs as part of the diminishing effect balance system. These springs have an estimated life cycle of 5 plus years. Replacement springs may be ordered from YORK INTERNATIONAL by referring to the part number shown on the individual spring. Modification to the existing linkage geometry will affect the proper functioning of this device and will void the warranty.

Do not operate ECONO-DISK® without airflow. It is recommended that the fan be running first for smooth travel and correct operation of ECONO-DISK®. Operation of ECONO-DISK® without airflow may result in damage.

FIG. 27 – ECONO-DISK®

OPERATING & MAINTENANCE INSTRUCTIONS FOR P-CONE®

CAUTION

DO NOT PERFORM MAINTENANCE ON THE P-CONE® WHEN FAN IS ROTATING.

Operation of the P-Cone®

The P-Cone® has no moving parts; it cannot be turned on or off or adjusted. Each of the two piezometer rings on the exterior side of the inlet cone are fitted with a 0.25 union brass tee. The two tees are the connection points for running pneumatic tubing from the P-Cone® to an air pressure gauge/switch/readout. This P-Cone® will automatically produce a pressure differential signal whenever the fan is moving air.

Maintenance of P-Cone®

Basic P-Cone® maintenance involves keeping the eight tiny pressure pickup holes, in the flange and throat of the inlet cone, free from blockage or debris buildup and periodically checking the tubing and fittings attached outside the P-Cone® for wear or damage.

In addition, periodically back-flushing each line gently with compressed air may help to blowout debris in the line and pressure pickup holes. It is helpful to keep the inside surface of the cone clean; especially in a one inch radius immediately around the pressure pick-up holes.

In the unlikely event that the pneumatic tubing on the P-Cone® is damaged, simply remove the damaged section and replace with comparable type of tubing.

PRESSURE DIFFERENTIAL ON TUBING IS LESS THAN 1 PSIG.

In the unlikely event that one of the brass fittings which is sweated to the P-Cone®, breaks loose from the P-Cone®, then simply remove that fitting and replace it with a straight coupling fitting of similar and common sort. In this event, do not attempt to re-solder the fitting to the P-Cone®.

There are four pickup holes on each piezometer ring. Elimination of one of them will not adversely affect the performance of most P-Cone®.

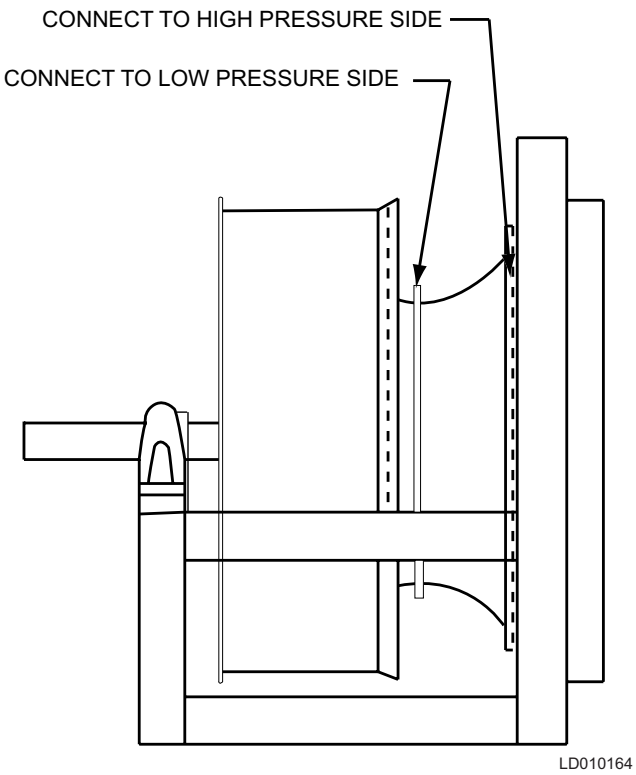


FIG. 28 – PLENUM FAN TAP LOCATION AND CONNECTION ILLUSTRATION

NOTE

For help with set-up and calibration of Econo-Disks, P-Cones and Transducers contact Product Service 814-479-4005.

FIG. 29 – INTEGRAL FACE & BYPASS COIL (HORIZONTAL; TUBES, STEAM SHOWN)

VIFB & IFB

NOTE

A complete IOM is provided with each IFB or VIFB coil unit.

CAUTION

VIFB lower header must be free to float. After coil has been piped, remove yellow colored bolts to allow header to float. Always "back up" on the coil connections when installing fittings.

CAUTION

VIFB Warranty will be voided should return piping on lower header (inlet and return on two-row header) not include flexible connector(s) and if lower header(s) bolts are not removed prior to use.

NOTE

See IFB/VIFB manufacturer's IOM for additional piping details.

Below 35°, the Vertical Tube Integral Face & Bypass (VIFB) or Integral Face & Bypass (IFB) operates with full steam pressure or full water flow at all times. This prevents freeze-up and temperature stratification.

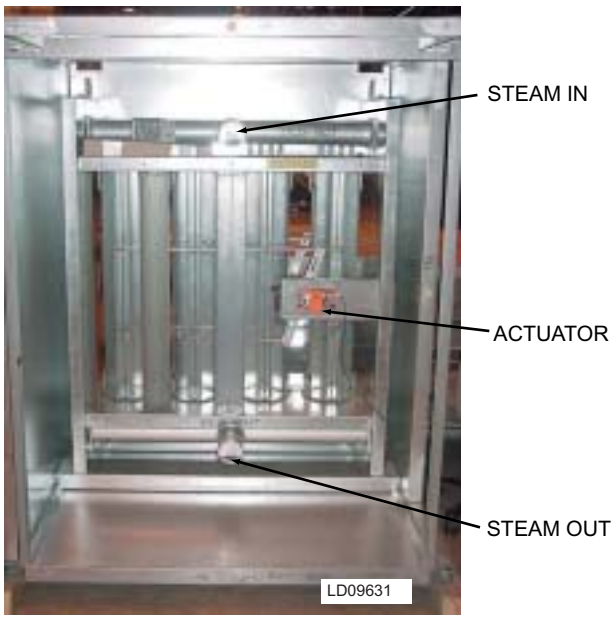
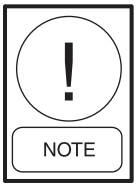


FIG. 30 – VERTICAL INTEGRAL FACE & BYPASS COIL (FACE MOUNTED ACTUATOR SHOWN)

Shipping Bolts (VIFB Only)

Return steam condensate headers or hot water supply and return headers are securely bolted to lower mounting brackets to prevent damage to header and tubes during shipment and piping of the coils. These bolts ***MUST*** be removed before applying steam or hot water but after all piping connections are made.

Piping Suggestions (VIFB & IFB)



See "Field Penetrations for Piping & Electrical Connections".

Steam and hot water field piping must be supported separately after the flexible connector to isolate piping strains and additional expansion from the coils.

Internal steam manifolds and piping should be insulated.

Steam traps should be sized for three times the calculated condensate loading at the coil design conditions, based on the pressure differential across the trap, ***not the boiler pressure***. Traps should be of types that pass condensate and air at saturated steam temperature. Inverted bucket traps should incorporate thermostatic air vents.

Make return connection full size as required and reduce only at trap. Do not use reducing bushing on coil return connection.

Flexible Connectors (VIFB Only)

Return steam condensate headers, hot water supply, and return headers must be free to float. A flexible connector ***MUST*** be installed as close as possible to the coil to accommodate a minimum of 1/2" expansion movement of the headers.

Failure to install connectors will restrict expansion of the headers. This can result in bowing of tubes, bending of fins, interference with damper operation, or eventually tube breakage.

Freezing Conditions

Anti-stratification baffles are standard on all IFB and VIFB coils mounted in units.

The outside air and return air must be thoroughly mixed before passing over the coil. When freezing air enters only part of the coil, it creates a greater hazard than when the airflow entering the coil is of a uniform temperature.

Coils used in series with respect to the airflow must have individual controls with ample space between the coils for sensing devices, when required. Coils with two or more rows are more sensitive to freezing than single row coils.

On 100% O.A. capable applications, locate low limit at least 24" downstream of leaving edge of VIFB/IFB casing. Low limit element must cross both face and bypass areas, parallel to headers.

FIELD PENETRATIONS FOR PIPING & ELECTRICAL CONNECTIONS

Use only metal cutting hole saws and/ or blades to make penetrations thru panels. Never use a cutting torch due to foam insulation.

For small sizes such as 1/2" iron pipe, 1/2" conduit or 5/8" O.D. copper and smaller; it is acceptable to use caulk instead of a grommet.

Electrical conduits must be sealed internally to prevent airflow and moisture condensation.

Tools Required

- Drill motor.
- Pilot starter bit.
- Hole saws-approximately 2-1/2", 3-1/4" & 4-1/2" diameter for holes.
- Power cords as required.

Material Required

- Neoprene grommet, 2-1/2", 3-1/4", 4-1/2" or 5-1/2" as required.
- Cold galvanized paint.
- Touchup spray paint, champagne, P/N 044-03504-000 (for outdoor unit exterior only).
- Caulk, YORK P/N 013-03317-050 aluminum gray or 013-03317-040 for outdoor units with champagne paint.
- Exacto knife.
- Clean up supplies.

Procedure

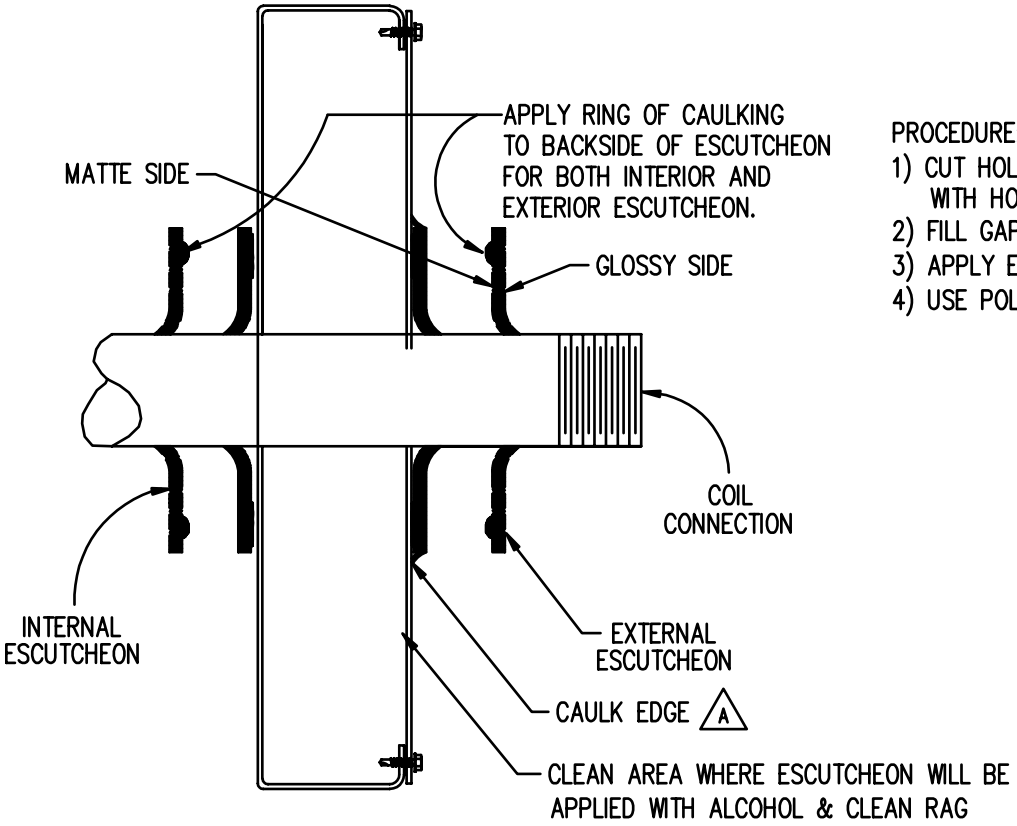
See Fig. 5-31

1. Make sure any components; bulkheads or other obstructions are disconnected from panel inside and out.
2. Layout location and dimensions of hole opening to be cut. Do this on both sides of double wall panels.
3. Carefully cut correct hole size for the application in panel, insuring cuts on both sides line up and a smooth clean cut is made.
4. Paint raw edges of sheet metal with cold galvanized paint.
5. Select appropriate grommet for new panel hole and cut out appropriate hole diameter for penetration with an exacto knife.
6. After paint dries, Install grommet into panel hole opening.
7. Apply sealant all around new hole opening behind lip of grommet, on both sides of panel.
8. Run pipe or conduit through grommet and make appropriate connections.
9. All modified panels must provide integrity equal to original equipment specifications.
10. Reconnect any components, bulkheads or other fixtures that were disconnected from panel in step # 1.
11. Thoroughly clean up inside and outside air unit.

WATER & STEAM COILS		
NOMINAL PIPE SIZE	ESCUTCHEON DIMENSIONS	
	O.D.	I.D.
.500	3.00	.550
.750	3.00	.815
1.000	3.00	.815
1.500	6.00	1.400
2.000	6.00	1.875
2.500	6.00	2.375
3.000	6.00	3.000
4.000	7.00	4.000

DX/REFRIGERANT COILS		
CONNECTION SIZE	ESCUTCHEON DIMENSIONS	
	O.D.	I.D.
.500	3.00	.175
.625	3.00	.550
.875	3.00	.550
1.125	3.00	.815
1.375	3.00	1.000
1.625	6.00	1.315
2.125	6.00	1.875
2.625	6.00	2.375
3.125	6.00	2.875

ESCUTCHEON			
YORK PART NO.	O.D.	I.D.	THICKNESS
028 14910 001	3.00	.175	.125
028 14910 002	3.00	.550	.125
028 14910 003	3.00	.815	.125
028 14910 004	3.00	1.000	.125
028 14910 005	6.00	1.315	.125
028 14910 006	6.00	BLANK	.125
028 14910 007	6.00	1.400	.125
028 14910 008	6.00	1.875	.125
028 14910 009	6.00	2.375	.125
028 14910 010	6.00	2.875	.125
028 14910 011	6.00	3.000	.125
028 14910 012	7.00	4.000	.125



PROCEDURE:
1) CUT HOLE ½" LARGER THAN PIPE O.D. WITH HOLE SAW
2) FILL GAP WITH FOAM
3) APPLY ESCUTCHEON AS SHOWN
4) USE POLYURETHANE CAULK.

PART	PART NUMBER
Caulking Gray	013-03317-050
Champagne	013-03317-040
Champagne Touch-up Spray Paint	044-03504-000

For these and all other parts contact York Product Service at 814-479-4005

Use only metal cutting hole saws and/or blades to make penetrations thru panels. Never use a cutting torch due to foam insulation.

FIG. 31 – PENETRATIONS DETAILS

FILTER INSTALLATION TABLE OF CONTENTS

FILTER LATCHES

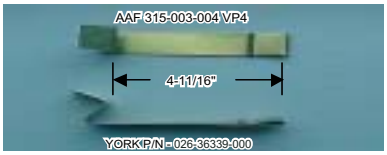
NOTE: Typically when filters are by others, so are the filter clips.

Used with 2" Perfectpleat, Premium or Premium HM and SH Single Headered Filters.

Used with 2" (C86) & 4" (C89)” Amair 300 X Pleated Prefilter in combination with a Single Header Final Filter.

Used with 2” & 4" Prefilter in combination with a Double Header Final Filter and Varicel DH Double Headered Filter.

Used with 2” Prefilter in combination with a Double Header Final Filter.



Used with 4” Prefilter in combination with a Double Header Final Filter.

Used to attach HEPA Filters to Holding Frame.

LD13303

FIG. 32 – FILTER LATCHES

YORK MATRIX: AAF FILTERS AND AAF FRAMES / LATCHES

Single Filter Application				
	2" AAF PerfectPleat, Premium or Premium HM	4" AAF AmAir 300X	AAF VariCel SH or AAF DriPak 2000	AAF VariCel DH
AAF FRAME - 312-300-000 12x24 - 16 ga. Galvanized				
AAF 315-004-003 (C70) YORK 026-35778-000	X		X	
AAF 315-004-000 (C86) YORK 026-35778-007		X		
AAF 315-004-001 (C80) YORK 026-35778-006				X
AAF FRAME - 312-300-006 24X24 - 16 ga. Galvanized				
AAF 315-004-003 (C70) YORK 026-35778-000	X		X	
AAF 315-004-000 (C86) YORK 026-35778-007		X		
AAF 315-004-001 (C80) YORK 026-35778-006				X

Prefilter / Final Filter Application				
	AAF PerfectPleat, Premium or HM AND AAF Varicel SH or DriPak 2000	AAF PerfectPleat, Premium or HM AND AAF Varicel DH	AAF 4" AmAir 300X AND VariCel SH or DriPak 2000	AAF 4" AmAir 300X AND VariCel DH
AAF FRAME - 312-300-000 12x24 - 16 ga. Galvanized				
AAF 315-004-000 (C86) YORK 026-35778-007 & AAF 315-004-003 (C70) YORK 026-35778-000	X			
AAF 315-004-001 (C80) YORK 026-35778-006 & AAF 315-003-002 VP2 - YORK 026-36339-001		X		
AAF 315-004-000 (C86 & C89) YORK 026-35778-007 & 026-35778-008 & AAF 315-004-003 (C70) YORK 026-35778-000			X	
AAF 315-004-001 (C80) YORK 026-35778-006 & AAF 315-003-004 VP4 - YORK 026-36339-000				X
AAF FRAME - 312-300-006 24X24 - 16 ga. Galvanized				
AAF 315-004-000 (C86) YORK 026-35778-007 & AAF 315-004-003 (C70) YORK 026-35778-000	X			
AAF 315-004-001 (C80) YORK 026-35778-006 & AAF 315-003-002 VP2 - YORK 026-36339-001		X		
AAF 315-004-000 (C86 & C89) YORK 026-35778-007 & 026-35778-008 & AAF 315-004-003 (C70) YORK 026-35778-000			X	
AAF 315-004-001 (C80) YORK 026-35778-006 & AAF 315-003-004 VP4 YORK 026-36339-000				X

NOTE: Typically when filters are by others, so are the filter clips.

INSTALLATION OF 2" PERFECTPLEAT, PREMIUM OR PREMIUM HM

These instructions are for installing a 2" filter (typically AAF PerfectPleat) into AAF 16 ga. galvanized holding frames.

- Latches needed for these applications are four (4) AAF P/N 315-004-003, *as shown in Figure 32.*
- A single latch should be installed at each of the four (4) corners of the frame.
- The latch fits into the set of knockouts, which consists of two (2) rows of three (3) knockouts. The row of knockouts closest to the gasketing should be used for nominal 1" filters or filters with a 13/16" single header. The second set of knockouts should be used for nominal 2" filters.

Installation of Spring Latches

1. Insert the straight end of the latch between the two (2) knockouts furthest from the corner.
2. Using a moderate amount of pressure, force the latch over the third knockout.
3 The latch installation should now be complete. The latch should now be "trapped" within the three (3) knockouts, but should be able to freely rotate *(see Figure 33).*

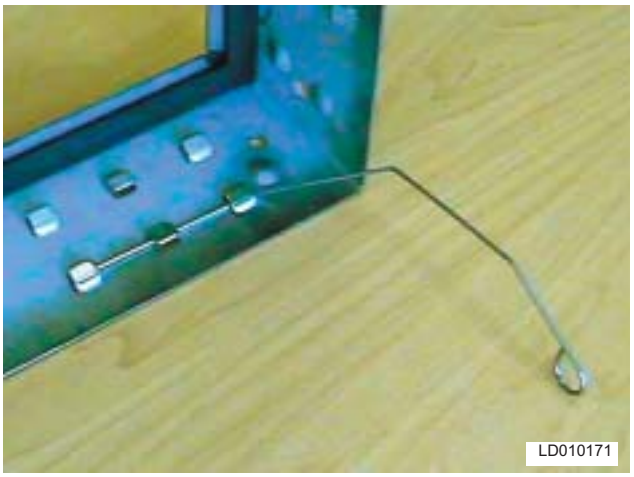


FIG. 33 – CORRECTLY INSTALLED LATCH P/N 315-004-003.

Repeat the installation process with the remaining latches in the other three corners.

4. Rotate all of the latches outward, and insert the filter into the frame.
5. After the filter has been placed into the frame, grasp the circular end of the latch and rotate it across the corner of the filter.

   Push the end of the latch towards the filter, until the latch catches beneath the knockout on the frame.

   Repeat for the remaining latches.
6. The filter should now be securely installed into the frame *(see Figure 34*).

FIG. 34 – FULLY INSTALLED FILTER

INSTALLATION OF 4" AMAIR 300X PLEATED FILTER

These instructions are for installing a four (4)" filter (typically AAF AmAir 300X pleated filter) into AAF 16 ga. galvanized holding frames.

- Latches needed for these applications are four (4) AAF P/N 315-004-000, *as shown in Figure 32.*
- A single latch should be installed at each of the four (4) corners of the frame.
- The latch fits into the set of knockouts, which consists of two (2) rows of three (3) knockouts. The row of knockouts closest to the gasketing should be used for filters with a 13/16" single header in combination with a nominal 2" prefilter. The second set of knockouts should be used for nominal 4" filters.

Installation of Spring Latches

1. Insert the straight end of the latch between the two (2) knockouts furthest from the corner.
2. Using a moderate amount of pressure, force the latch over the third knockout.
3. The latch installation is now complete. The latch should now be "trapped" within the three (3) knockouts *(see Figure 35).*

   Repeat the installation process with the remaining latches.

FIG. 35 – CORRECTLY INSTALLED LATCH P/N 315-004-000

4. Insert the filter into the frame.
5. After the filter has been placed into the frame, grasp the loose end of the latch and place it over the filter frame, so that the latch secures the filter into the frame *(see Figure 36).*

   Repeat for the remaining latches.

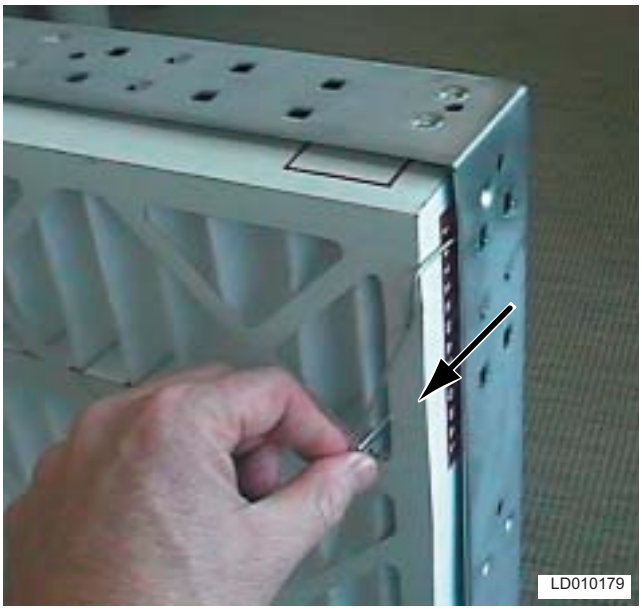


FIG. 36 – PLACE THE END OF THE LATCH OVER THE FILTER FRAME, SECURING THE FILTER TO THE FRAME.

6. The filter should now be securely installed into the frame.

INSTALLATION OF SH SINGLE HEADERED FILTERS

These instructions are for installing single header filter (typically AAF VariCel SH or DriPak 2000 filter) into AAF 16 ga. galvanized holding frames

- Latches needed for these applications are four (4) AAF P/N 315-004-003, *as shown in Figure 32.*
- A single latch should be installed at each of the four (4) corners of the frame.
- The latch fits into the set of knockouts, which consists of two (2) rows of three (3) knockouts. The row of knockouts closest to the gasketing should be used for nominal 1" filters or filters with a 13/16" single header. The second set of knockouts should be used for nominal 2" filters.

Installation of Latches

1. Insert the straight end of the latch between the two (2) knockouts furthest from the corner.
2. Using a moderate amount of pressure, force the latch over the third knockout.
3. The latch installation should now be complete. The latch should now be "trapped" within the three (3) knockouts, but should be able to freely rotate.

   Repeat the installation process with the remaining latches.
4. Rotate all of the latches outward, and insert the SH filter into the frame. The bulk of the filter should be inserted through the frame, protruding out the backside. Only the header of the filter should be contacting the flange of the frame.
5. After the filter has been placed into the frame, grasp the circular end of the latch and rotate it across the corner of the filter.

   Push the end of the latch towards the filter, until the latch catches beneath the knockout on the frame.

   Repeat for the remaining latches.

FIG. 37 – FULLY INSTALLED FILTER

6. The filter should now be securely installed into the frame *(see Figure 37).*

INSTALLATION OF A 2" PREFILTER IN COMBINATION WITH A SINGLE HEADER FINAL FILTER

These instructions are for installing a 2" prefilter, (typically AAF PerfectPleat, Premium or Premium HM pleated filter) used in combination with a single header final filter (typically AAF VariCel SH or DriPak 2000) into AAF 16 ga. galvanized holding frames.

- Latches needed for this application are four (4) AAF P/N 315-004-000 and four (4) 315-004-003 *as shown in Figure 32.*

NOTE

Follow instructions for Single Headered (SH) filters then proceed with this procedure for 2" Pre-filters.

Installation of Latches

1. Insert the straight end of the latch (P/N 315-004-000) between the two (2) knockouts furthest from the corner.

FIG. 38 – INSTALL LATCH P//N 315-004-000

2. Using a moderate amount of pressure, force the latch over the third knockout *(See Fig. 33 on page 37).*
3. After both filters have been placed into the frame, grasp the loose end of the latch and place it over the prefilter frame, so that the latch secures the prefilter to the SH filter. Repeat for the remaining latches.
4. The filters should now be securely installed into the frame, *as shown in Figure 39.*

FIG. 39 – FULLY INSTALLED FILTERS

INSTALLATION OF A VARICEL DH DOUBLE HEADERED FILTER

These instructions are for the installation of an AAF VariCel DH filter (nominal 12" deep double header) into AAF 16 ga. galvanized holding frames.

- The latches needed for this application are four (4) spring latches, AAF P/N 315-004-001 *(as shown in Figure 32).*
- Two latches should be attached on each side of the filter frame.
- The latches should only be installed, two (2) per side of the frame. There should be no latches used on the top or bottom. This is done to match the holes in the filter frame, used to secure the latch to the filter. *See Figure 40* for the sets of knockouts that should be used for the latches.

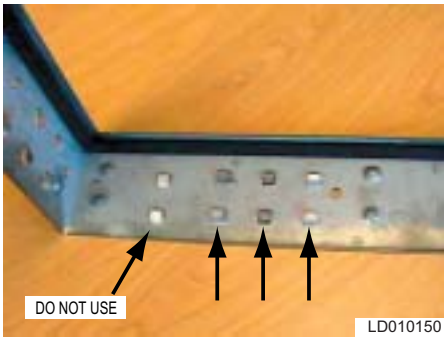


FIG. 40 – CORRECT USE OF KNOCKOUTS

Installation of Spring Latches

1. Insert the straight end of the latch between the knockouts furthest from the corner.
2. Using a moderate amount of pressure, force the latch over the third knockout.
3. The latch installation should now be complete. The latch should now be "trapped" within the three (3) knockouts.

FIG. 41 – CORRECT LATCH/KNOCKOUT CONFIGURATION.

4. Repeat the latch installation with the remaining latches. *Note the orientation of the latch to the knockouts in Figure 41.*

   After the latches have been installed, the frame should be configured like that *shown in Figure 42.*

FIG. 42 – FRAME WITH 4 LATCHES INSTALLED.

The frame contains 2 latches per side, none on the top or bottom.

5 Insert the VariCel DH filter into the frame. While holding the filter in the frame, grasp the loop on the end of the latch and pull it until it stretches over the header and rests into the pre-drilled hole in the header of the filter *(see Figure 43).* Repeat this with the remaining latches.

6. The filter should now be securely installed into the frame.

FIG. 43 – SPRING LATCH SHOULD BE PULLED AND FASTENED IN HOLE IN THE HEADER OF THE FILTER.

INSTALLATION OF A 2” & 4" PREFILTER IN COMBINATION WITH A DOUBLE HEADER FINAL FILTER

These instructions are for installing either a 2” or 4" prefilter (typically AAF PerfectPleat, Premium or Premium HM pleated filters) used in combination with an AAF VariCel DH (nominal 12” deep) final filter into AAF 16 ga. galvanized holding frames.

- Two sets of latches are needed for these applications. Four (4) spring latches, AAF P/N 315-004-001 are used to hold the VariCel DH into the frame. In addition, four (4) prefilter latches, AAF P/N 315-003-002 are used to hold the 2” and P/N 315-003-004 are used to hold the 4” prefilter onto the face of the VariCel DH filter.
- For the spring latches, two (2) latches should be attached on each side of the filter frame.
- The latches should only be installed, two (2) per side of the frame. There should be no latches used on the top or bottom. This is done to match the holes in the filter frame, used to secure the latch to the filter.

Installation of Spring Latches

1. Insert the straight end of the latch between the knockouts furthest from the corner.
2. Using a moderate amount of pressure, force the latch over the third knockout.
3. The latch installation should now be complete. The latch should now be “trapped” within the 3 knockouts *(see Figure 44).*

FIG. 44 – CORRECT LATCH/KNOCKOUT CONFIGURATION. P/N 315-004-001

4. Repeat the latch installation with the remaining latches; *note the orientation of the latch to the knockouts on Figure 44.*
5. Insert the VariCel DH filter into the frame. While holding the filter in the frame, grasp the loop on the end of the latch and pull it until it stretches over the header and rests into the pre-drilled hole in the header of the filter *(see Figure 45).* Repeat this with the remaining latches.

FIG. 45 – FRAME WITH 4 LATCHES INSTALLED

Installation of Prefilter Latches

6. To install the prefilter latches, slide the end of the latch with the 180 ° turn, over the edge of the header, *as shown in Figure 46.* The latch should be installed at the approximate midpoint of the filter leg.

   The prefilter latch should be slid over the header *as shown in Figure 46.*

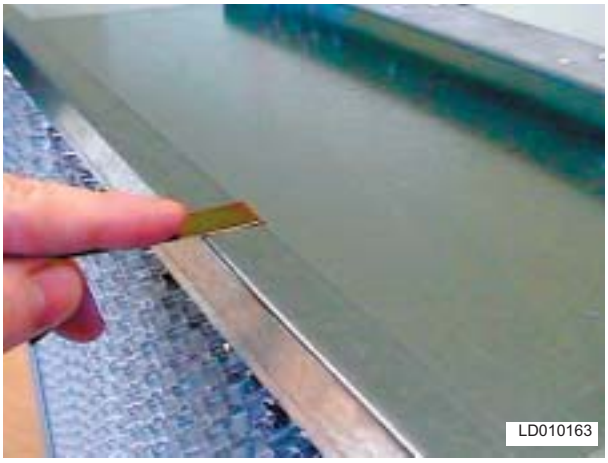


FIG. 46 – PREFILTER LATCH AFTER INSTALLATION ONTO FILTER HEADER.

INSTALLATION OF A 2” & 4" PREFILTER IN COMBINATION WITH A DOUBLE HEADER FINAL FILTER (CONT)

7. Repeat the installation for the remaining prefilter latches.
8. Place the prefilter against the face of the VariCel DH filter. The prefilter latches may have to be re-positioned *as shown in Figure 47*, to allow the proper placement of the prefilter.

FIG. 47 – POSITION PREFILTER IN FRONT OF THE FINAL FILTER. (2" W/315-003-002 LATCH

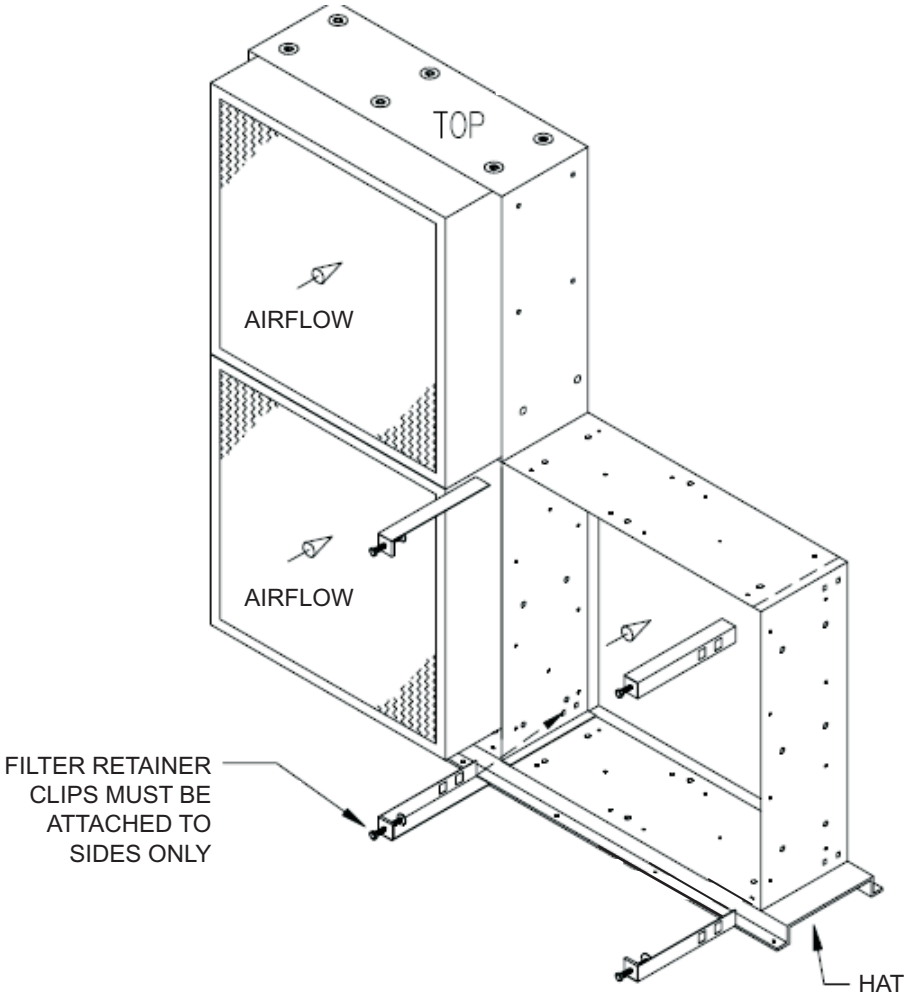
9. Grasp the end of the prefilter latch and “spring” it so that it fits over the edge of the prefilter. Repeat with the remaining latches.

   After all remaining prefilter latches have been placed around the prefilter, the finished assembly should look *like that in Figure 49*.

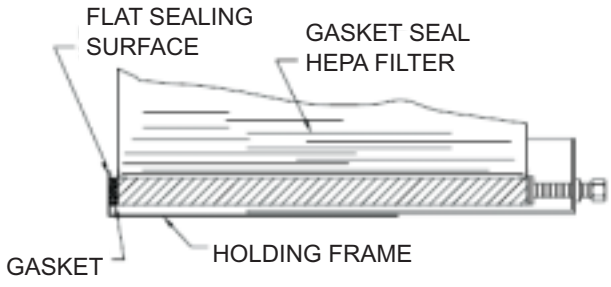
FIG. 48 – SPRING THE END OF THE LATCH SO THAT IT FITS OVER THE EDGE OF THE PREFILTER. (4" W/315-003-004 LATCH SHOWN)

FIG. 49 – COMPLETED ASSEMBLY

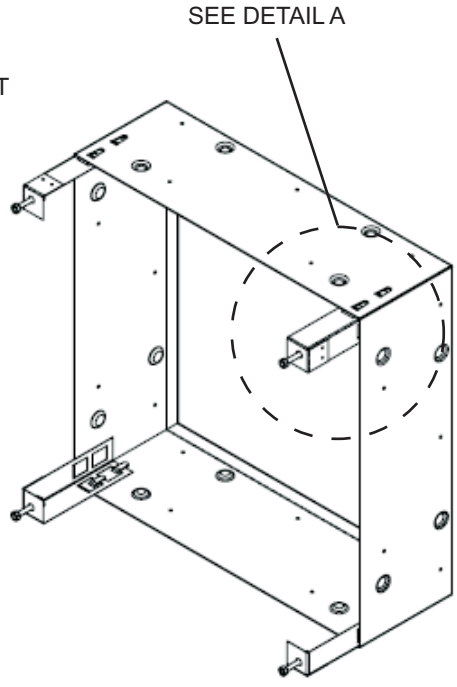
INSTALLATION OF HEPA FILTERS



FILTER CLIP INSTALLATION



GASKET SEAL DETAIL A



FILTER CLIPS INSTALLED

FIG. 50 – INSTALLATION OF HEPA FILTERS

YORK®	AIR HANDLING UNITS	
START-UP CHECKLIST	Supersedes: 100.00-CL1 (303)	Form 100.00-CL1 (1007)

AIR HANDLER START-UP CHECKLIST

OFFICE LOCATION _____ unit tag # _____

Qualified TECHNICIAN's Name: _____ unit model # _____

JOB NAME _____ UNIT SERIAL # _____

YORK JOB OR CONTRACT # _____ START DATE _____

JOB SITE LOCATION _____

JOB SITE CONTACT AND PHONE # _____

NON-STANDARD SPECIFIED COMPONENTS _____

PRE START-UP

GENERAL UNIT INSPECTION

Identify and perform appropriate "lock out/tag out" and safety rules. For details on points below see appropriate section of Installation, Operation, Maintenance manual provided with each air handler.

For VFD equipped air handlers, refer to the VFD forms for additional start-up requirements.

AMI Belt Drive	AH Units		Air Mod VI	VFD	Form 100.40-NO3
Custom	AH Units	Form 100.31-NOM1	Air Modulator	VFD	Form 100.41-NO1
			Solution (Table 3-2)	AH Units	Form 102.20-NOM1

❑ Equipment received as ordered.	❑ Make sure all ductwork is complete and available for full air flow.
❑ Unit checked for damage interior and exterior.	❑ Unit installed with proper clearances.
❑ Unit installed on flat and level surface. Outdoor unit mounted within roof slope limitations where applicable.	❑ Visually inspect roof curb for tight seal around unit.
❑ Terminal screws and wiring connections secure in control, electric and Air Modulator panels.	❑ Clean air filters installed properly and secured.
❑ Air hoods installed properly.	❑ Filter gauge set to zero
❑ Condensate drain properly trapped.	❑ All field wiring complete and inspected.
❑ All wiring and tubing connections made at shipping splits.	❑ All shipping splits sealed and secured properly.
❑ All field piping connections complete.	❑ Pipe chase floor sealed at penetrations.
❑ All shipped loose parts installed.	❑ All shipping bolts and other material have been removed. (Fan, VIFB, Energy Recovery Wheel, Damper)
❑ Installer has cleaned out interior.	❑ Damper linkage is tight and in correct "power off" position.
❑ Verify all plastic spacers have been removed between door and door frame.	❑ Controls installation complete.
❑ Verify Energy Recovery Wheel turns freely and wheel segments are fully engaged.	

Fan INSPECTION	
❑ Check bearings and locking collars for properly tightened setscrews, bolts and nuts.	❑ Fan wheel properly aligned, tight on shaft and freely moving.
❑ Sheaves properly aligned and tight on shaft.	❑ Check fan base isolators and thrust restraints for proper adjustment. **Note: Do not remove functional bolts from seismic isolators.**
❑ Belt tension adjusted properly per drive pkg. label on fan.	
❑ Check fan alignment with unit discharge. Adjust with isolation.	❑ Fan bearings properly lubricated.

START-UP

PERFORM THE FOLLOWING STEPS IN ORDER:
Refer to safety standards Ensure all door latches are secured before starting.

- ❑ 1. Energize power to the unit disconnect switch.
- ❑ 2. Verify correct voltage, phase and cycles.
- ❑ 3. Energize fan motor(s) briefly (bump) and check for correct fan rotation.
- ❑ 4. Check operation of dampers. Insure unit will not operate with all dampers closed.
- ❑ 5. Energize fan motor(s). Observe fan(s) for smooth operation.
- ❑ 6. Check motor nameplate Full Load Amp rating.
- ❑ 7. Immediately check current draw of each leg of each motor.
- ❑ 8. VFD, refer to manufactures start up guide.
- ❑ 9. Check doors and latches for air leaks.
- ❑ 10. Check for obvious audible leaks.
- ❑ 11. Apply steam to cold coils slowly to prevent damage.

RECORD DATA

POWER SUPPLY: Unit Nameplate V___ PH___ CYC, ____ Verify V _____/ _____/ _____

DATA	SUPPLY FAN MOTOR	RETURN FAN MOTOR
Nameplate	Volts _____ Amps _____	Volts _____ Amps _____
Run Amps	_____ / _____ / _____	_____/ _____ / _____
Catalog Number	_____	_____
Spec Number	_____	_____
Horse Power	_____	_____
RPM	Nameplate _____ Actual_____	Nameplate _____ Actual _____
Frame size	_____	_____
Service Factor	_____	_____
Jump (Skip) Frequencies	_____ / _____ / _____	_____/ _____ / _____
	SUPPLY FAN	RETURN FAN
Manufacture Name	_____	_____
Type or Model Number	_____	_____
Code or Shop Order Number	_____	
Serial Number	_____	_____
	SUPPLY FAN DRIVE KIT	RETURN FAN DRIVE KIT
Belts (Quantity & ID Number)	_____	_____
Belt Tension	Tag_____ Actual _____	Tag_____ Actual _____
Fan RPM (DN)	Tag_____ Actual _____	Tag_____ Actual _____

other utilities

Steam Pressure	Heating Coils _____PSI,	Humidifier _____PSI
Hot Water Pressure/Temp.	Supply _____PSI, _____°F,	Return _____PSI, _____°F
Chilled Water Pressure/Temp.	Supply _____PSI, _____°F,	Return _____PSI, _____°F
Potable Water Pressure	_____PSI,	Pneumatic Air Pressure _____PSI

MAINTENANCE

Upon completion of start-up the customer assumes responsibility for periodic maintenance of this equipment in order to continue warranty. Refer to the Installation Operation and Maintenance Manual provided with this equipment.

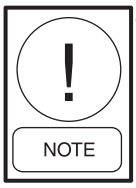
Customer's agent signature: _____ , **Date:** _____

3

APPENDIX 1 – LONG-TERM STORAGE

YORK®	LONG-TERM STORAGE REQUIREMENT - FIELD PREPARATION AIR HANDLING UNITS
SERVICE POLICY & PROCEDURES	New Release Form 50.20-NM3 (307)

Failure to comply with these requirements will render any written or implied YORK warranty null and void.



Upon completion of the long-term storage period, the warranty commences:
Solution - 12 months labor, 18 months parts (not to exceed 36 months from ship date with delayed start up).
Custom - 18 months parts (not to exceed 18 months from ship date).
Labor 12 months only w/ delayed start up.

I. Supplementary Documentation

The following documentation is required to FULLY COMPLY with the Long-Term Storage requirements.

A. Long-Term Storage Requirements – GENERAL (refer to Form 50.20-NM1)

B. Long-Term Storage Requirements – PERIODIC CHECK LIST AND LOGS, AIR HANDLING UNITS (refer to Form 50.20-CL3).

II. Field Preparation For Long-Term Storage

A. GENERAL

1. Remove and dispose of shipping materials.
2. Perform a visual inspection of the equipment.

Indoor Units

"It is JCI's intention that a shipping wrapper be applied to unpainted indoor units for protection from weather, road dirt, etc. during inland transit and that the wrapper be removed at the time of delivery to allow for a thorough inspection, both inside and out. Visible damage should be noted on the signed and dated bill of lading with a request that the carrier inspect the damage within 72 hrs of notification. The shipping wrapper must be removed and replaced with a tarp or similar protective covering. Any concealed damaged reported after 15 days will compromise a claim settlement. Inspection requests may be done by telephone or in person, but should be confirmed in writing. If assistance is needed with the claim process, contact your JCI Sales person."

Outdoor Units

Outdoor units are not fully wrapped. Exposed openings are covered for protection from weather, road dirt, etc. during inland transit. A thorough inspection, both inside and out, should be done at the time of delivery. Visible damage should be noted on the signed and dated bill of lading with a request that the carrier inspect the damage within 72 hrs of notification. Concealed damage must be reported within 15 days of delivery with a request that the carrier inspect the damage within 72 hrs of notification. Any concealed damaged reported after 15 days will compromise a claim settlement. Inspection requests may be done by telephone or in person, but should be confirmed in writing. If assistance is needed with the claim process, contact your JCI Sales person."

3. Touch up any paint that has worn or chipped off using paint supplied in ship loose items. Prepare the surface as required using a wire brush.
4. Verify that all ship loose items are present. Note any missing items on the Periodic Check List and Log Sheet (50.20-CL3).
5. Locate unit(s) so that passing traffic will not damage shafts, coil connections, damper linkages or unit panels.
6. Refrigerant coils must be evacuated and pre-charged with 5 PSI holding charge of nitrogen. DO NOT damage or disturb these coils and connections.
7. Water coils must have all inlet and outlet connections capped or closed tight to prevent foreign materials and liquids from gaining entrance during the storage period.

B. ELECTRICAL EQUIPMENT AND COMPONENTS
(Control Panels, Power Panels, Option Panels, Motors, etc.)

1. Electrical Equipment and Components shall not be stored or left in an outdoor environment.
2. Electrical Equipment and Components shall not be stored or left in a wet or damp environment. Components sealed in plastic shrink-wrap do not exempt this requirement. Moisture will collect inside the plastic, resulting in corrosion of the cabinet, the electronic components and/or copper bus bars.
3. Cortec® spray, Part VpCL-248, shall be applied to all components in the motor terminal box. The spray shall be applied to all exposed areas of concern.
4. YORK Vapor Emitter(s) shall be installed inside each electrical and electronic components cabinet(s) to protect against corrosion. Openings in cabinets shall be taped closed to minimize air infiltration during the storage period. The quantity of emitters is determined by measuring the gross volume of the component space occupied. YORK Part Number 026-37705-000 will protect a volume up to 5 cubic feet. YORK Part Number 026-37706-000 will protect a volume up to 11 cubic ft. Both emitters have a service life of 12 months.
5. A Vapor Type Corrosion inhibitor must be installed in the following equipment and components:

a. Place one corrosion inhibitor, YORK part number 026-37706-000, inside the power panel.

b. Place one corrosion inhibitor, YORK part number 026-37705-000, inside the control panel.

c. Place one corrosion inhibitor, YORK part number 026-37705-000, inside each VFD panel.

B. MECHANICAL

1. Spray all exposed shafts and sheaves with anti-corrosion spray, YORK part number 026-37707-007.
2. Disconnect belts and wrap all motors, sheaves in plastic with a YORK vapor emitter, part number 026-37705-000.

YORK®	LONG-TERM STORAGE PERIODIC CHECKLIST AND LOGS AIR HANDLING UNITS	
SERVICE POLICY & PROCEDURES	Supersedes: Nothing	Form 50.20-CL3 (107)

Contract No. _____ Date Delivered _____

Job Name _____ Date of Storage Prep. _____

Serial No _____ Condition of Unit Delivered _____

Unit Model No _____ Explain: _____

_____

_____

_____

Failure to comply with these requirements will render any written or implied YORK warranty null and void.

I. Supplementary Documentation

The following documentation is required to FULLY COMPLY with the long-term storage requirements.

A. Long-term Storage Requirements - GENERAL (refer to Form 50.20-NM1).

B. Long-term Storage Requirements - LONG -TERM STORAGE FIELD PREPARATION, AIR HANDLING UNITS (refer to Form 50.20-NM3).

II. Checks

1.0 Monthly Checks

1.1 Visually inspect Air Handler for damage.

1.1.1 Motors, Drives - The motors and sheaves should be inspected externally for evidence of damage to the protective covering. An inspection is necessary only if it is apparent that the control protection has been disturbed. If this is found, the motor should be re-protected by wrapping and tightly sealing the control with plastic and inserting a desiccant to absorb moisture.

1.2 Refrigerant Coils - Check holding charge pressure monthly to be sure that the pressure has not dropped. If pressure has dropped, the unit should be inspected for signs of visible damage which may have caused loss of pressure. If pressure drops more than 2 psi, the unit should be pressure tested to locate the leak; the leak should be repaired and the unit recharged with nitrogen to 5 psig pressure. Note this in the comments section of the monthly log sheet (see page 2 of this document).

1.3 Rotate fan shaft several revolutions by hand every month.

2.0 Quarterly Checks

2.1 Complete Assembly - The unit should be checked quarterly to see that no damage has occurred to the protective covering. Any apparent damage to the covering or units should be noted in the comments section of the quarterly log sheet (see page 3 of this document).

2.2 Grease bearings every three months. The greasing procedure is explained in the product service manual.

3.0 Semi Annual Checks

3.1 None

4.0 Annual Checks

4.1 Unwrap all electrical cabinets and install new Vapor Emitters (YORK P/N 026-37705-000); reseal.

4.2 Re-spray all exposed shafts and sheaves with anti-corrosion spray, YORK P/N 026-37707-007.

1.0 Monthly				
	Rotate Shafts	5 PSI Coil Pressure	Motor Belts & Drives Protected and Dry	Comments
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				
Date				
Initial				

2.0 Quarterly			
	Grease Bearings	**Inspect Protective Covering**	**Comments**
Date			
Initial			
Date			
Initial			
Date			
Initial			
Date			
Initial			

4.0 Annual			
	Install New Vapor Emitters	**Re-spray Exposed Shafts and Sheaves**	**Comments**
Date			
Initial			

NOTES

P.O. Box 1592, York, Pennsylvania USA 17405-1592
Tele. 800-861-1001
www.york.com

Form 100.31-NOM1 (208)
Replaces 100.31-NOM1 (205)

For Product Warranty Support and Parts call 814-479-4005

Johnson Controls	LOOSE COILS	
INSTALLATION, OPERATION & MAINTENANCE	New Release	Form 105.00-NOM1 (408)

WATER, DX, STEAM & BOOSTER COILS

IMPORTANT!
READ BEFORE PROCEEDING!
GENERAL SAFETY GUIDELINES

During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, and materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

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

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

It is the responsibility of operating/service personnel to verify the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

TABLE OF CONTENTS

LIST OF FIGURES

SECTION 1 - INSTALLATION

COIL PIPING

Do not test, clean and flush piping through this equipment.

Isolate this equipment from pressure testing of water, steam, gas and air piping.

Consult the job specifications and submittal drawings for specific piping requirements, coil connection sizes and location. The coil should be level to assure proper venting and draining of coils. The piping arrangements must provide for a balanced flow in multiple coil installations (*see Fig. 1 showing factory coil connections*).

Support all connecting piping independently of the coils. Provide swing joints or flexible fittings in all piping connections, particularly adjacent to heating coils, to absorb expansion and contraction strains. Rigid piping connections can cause coil damage

The coil supply and the return pipe connections are labeled. When attaching piping to the coil header, make the connection only tight enough to prevent leaks. Excessive tightening may cause damage to the header. A backup wrench must be firmly held on the coil connection so that in tightening the connecting piping the torque is not transmitted to the coil header, thus damaging the coil connection.

Application Notes - Drain and vent taps on water coils are pipe thread shipped with plugs installed. These taps are installed approximately two inches back from the end of the threaded connections and require a hexagon (Allen) wrench to remove.

WATER

Water Coils - Drainable Water

Connect the water supply to the header connection on the leaving air side of the coil to achieve the counter flow of water and air. The return pipe will be connected to the remaining coil connection.
Install an air vent in place of the top pipe plug on the return header. In order to provide for drainage, install a drain line and shutoff valve in the supply near the coil or in place of the plug in the supply connection.

Hot Water Coils

The temperature rise of the air leaving the coil is dependent on the airflow across the coil, the gallons of water flow through the coil and the entering water temperature into the coil. Consult the submittal for each specific job for the above information.

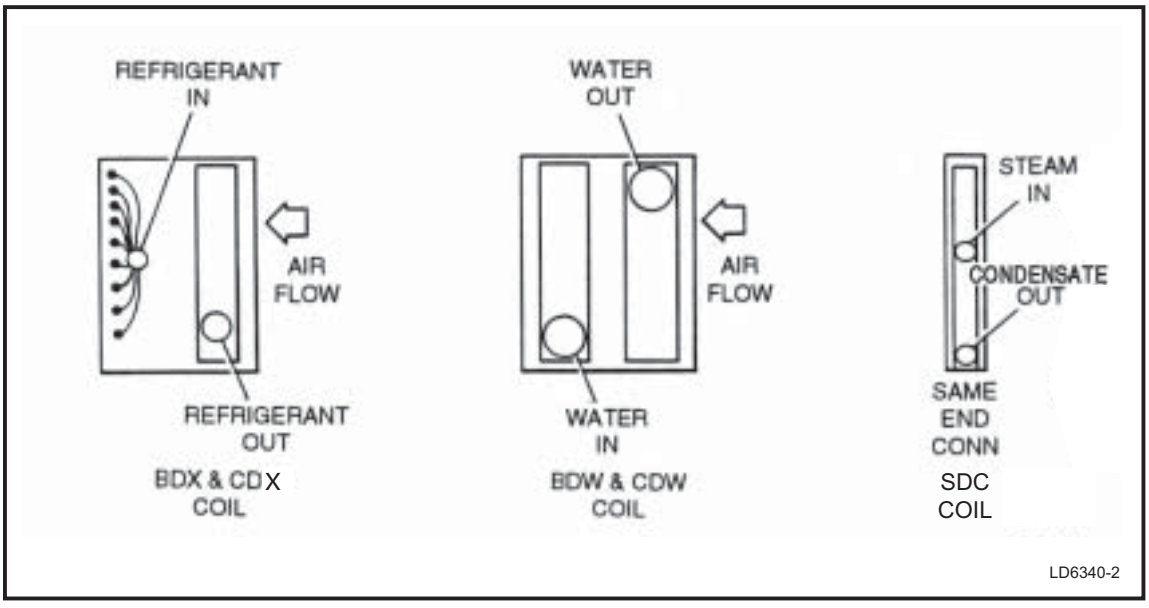


FIG. 1 – FACTORY COIL CONNECTIONS

Chilled Water Coils

See Fig. 2 for piping diagram.

Water Treatment

Any copper tube coils may be attacked by acid condensate. The practice of boiler water treatment should include CO_2 removal to assure longer tube life.

Freeze Protection

Chilled water, hot water and steam coils can be damaged during freezing weather. Precautionary measures must be taken to prevent freezing such as:

- Positive coil freeze protection must be used in installations where any part of the water coil is subjected to temperatures of 32 degrees or lower. This may be accomplished by using a suitable antifreeze solution. If the coil is not in use, it is recommended that the coil be completely drained and the inside of the tubes blown dry with compressed air.
- After draining, flush coils with an antifreeze solution such as ethylene glycol. A solution of 50% ethylene glycol and 50% water will protect from freezing to approximately 35 degrees F below zero at sea level. *Also refer to ASHRAE and ARI guidelines.*
- During winter operation due to the possibility of shutdowns such as power failure, night shutdown and weekend shutdown, the controls should be installed so the return air dampers will go to the full open position, and all fresh air dampers go to the full closed position. A source of auxiliary heat must be maintained inside the unit cabinet.
- Other means of protection such as various electro-mechanical switches and the full constant flow of water can be used; however, Johnson Controls will not be responsible for water coils damaged by freezing.

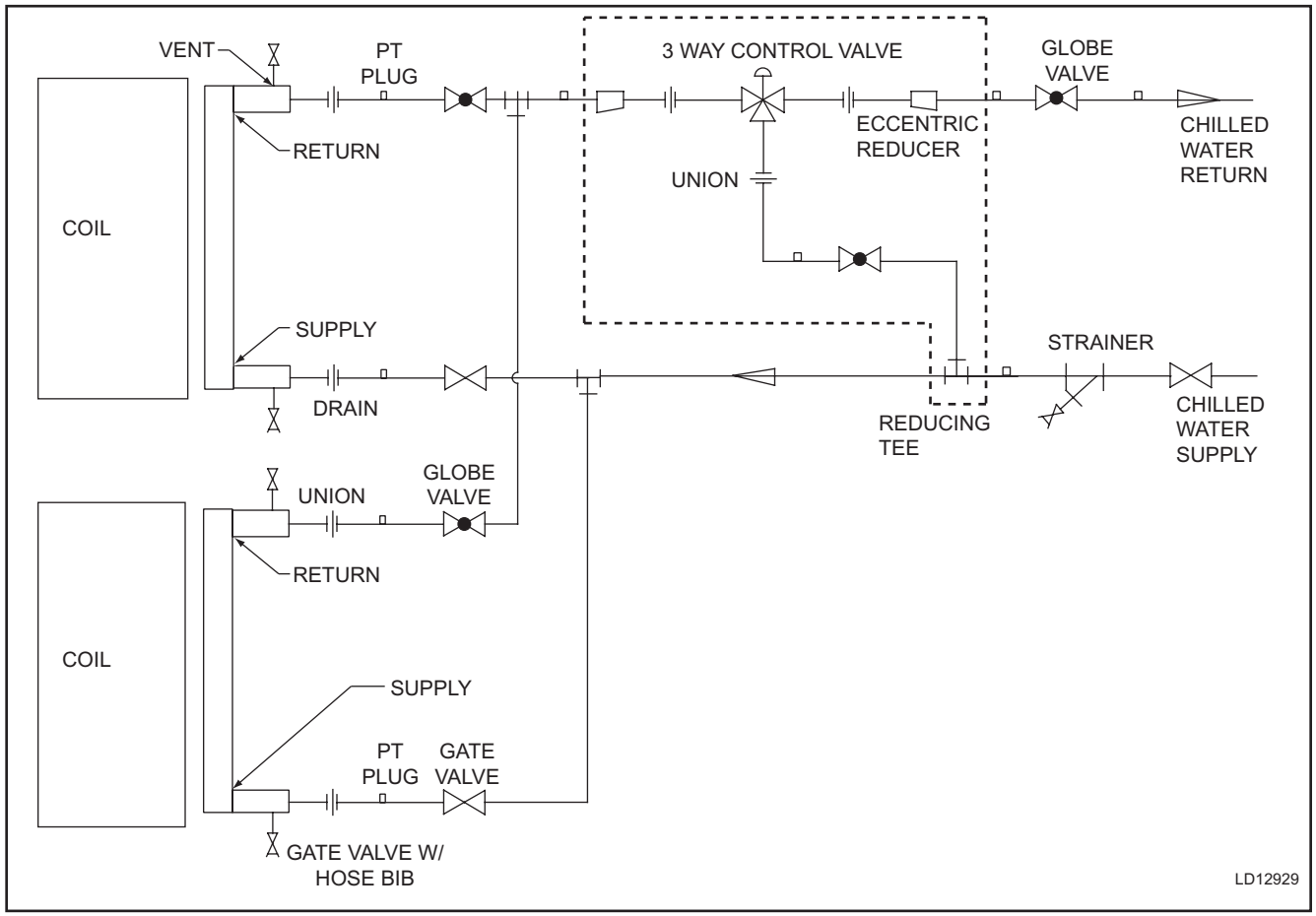


FIG. 2 – CHILLED WATER COIL CONNECTIONS

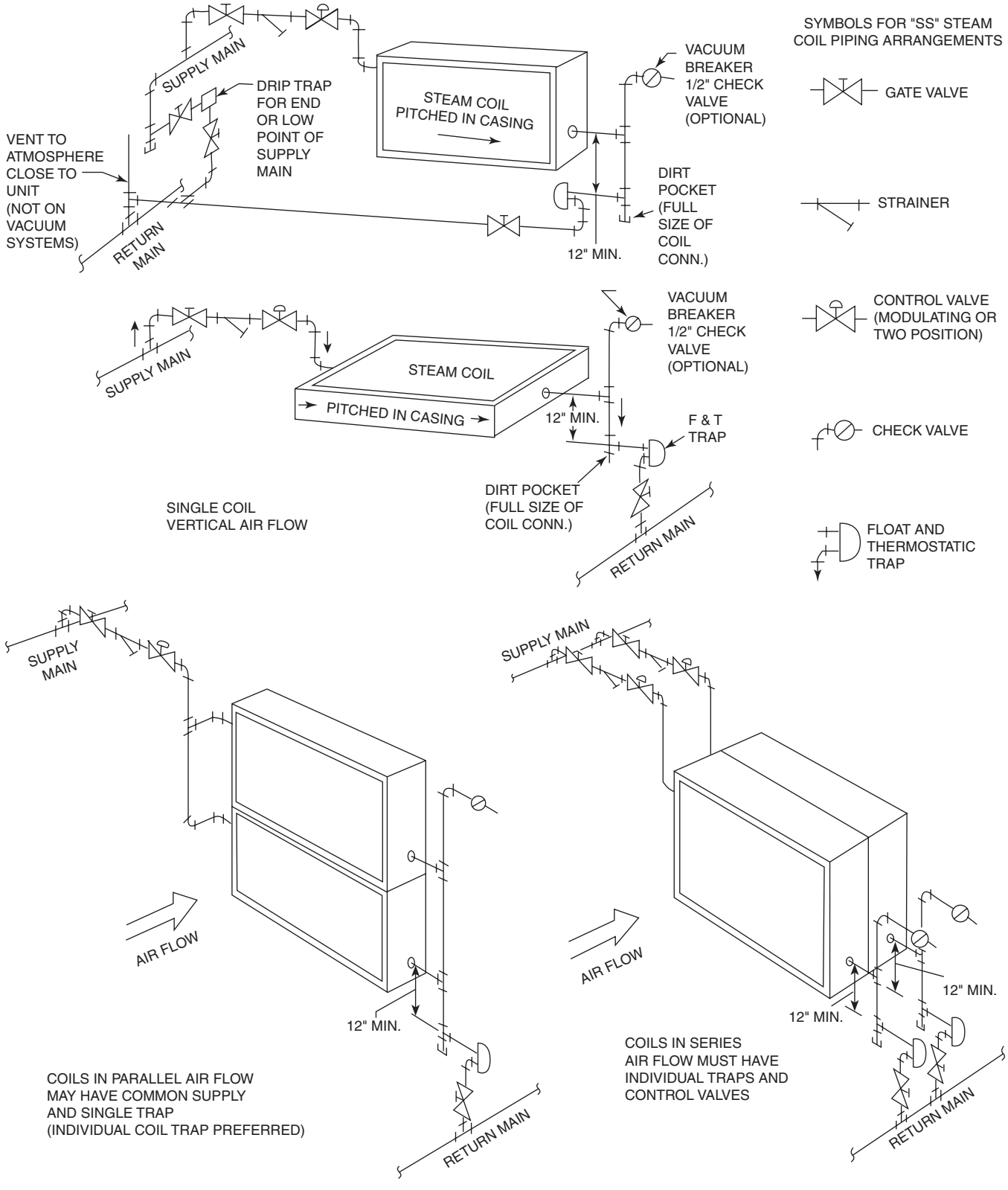


FIG. 3 – STEAM COIL PIPING ARRANGEMENTS

STEAM

Refer to Fig. 3 "Steam Coil Piping Arrangements."

Steam Coils

The operation of steam coils is dependant on airflow quantity and temperature. Consult the submittal issued for each specific unit for above information.

Steam Distributing Coils

Do not bush or reduce the coil return pipe size. Use a full size return pipe to the bottom of a dirt pocket. The supply pipe may be reduced at the coil connection if necessary. Install the coil casing level with the return down. A coil must be sufficiently elevated to allow a 12 inch minimum drop between the return connection on the coil and the trap. A greater than 2 inch drop is required for protection from freezing. The return main should be located below the trap. *Refer to Fig. 3.*

Steam Control

Continuous steam supply ensures long coil life and minimizes potential trapping, venting and freezing problems. A rapid cycling of the modulating steam supply or a frequent on-off steam supply control results in repeated thermal and piping stresses which will shorten the coil life. Modulating steam control valves must not be oversized but must be carefully selected, and cannot be used on 100% outside air applications. A substantial variation in the supply pressure will require the installation of a pressure-reducing valve ahead of the automatic control valve.

Light load operation with a modulated steam supply can be improved by the installation of a vacuum breaker check valve. An open relief line to the atmosphere from the return line near the coil is desirable, except on vacuum systems.

With a modulated steam supply, it is not practical to lift the condensate to an overhead return. Locate the coil well above the return, or provide condensate unit, or a boiler return trap below the coil.

Individual control valves are required on each coil installed in series with respect to airflow. When a modulating steam valve supplies two or more coils in parallel, with respect to airflow, the piping must be designed to provide for uniform steam distribution to each of the coils.

Steam Traps

Float and Thermostatic (F. & T.) traps are recommended for all low or medium pressure applications. Use thermostatic traps only for air venting, for outdoor applications where an F. & T. trap might be subject to freezing. Use bucket traps only for a non-modulated steam supply. Size the steam traps in accordance with the manufacturer's recommendations (usually several times the steady state steam flow). Use the actual operating conditions (coil pressure vs. return pressure) for the selection of a trap.

It is preferable to provide an individual trap for each coil but a single trap may be used for coils operating in parallel with respect to the airflow. Coils in series with respect to airflow must be supplied with individual traps. Locate the trap at least 12 inches below the coil return connection and even lower when freeze protection is required. Do not attempt to lift condensate modulated steam supply.

REFRIGERATION

Direct Expansion Coils (DX)

DX coils are divided into splits depending upon the unit size and coil circuiting. Each split requires its own distributor nozzle, expansion valve and suction piping. Suction headers are on the air entering side with suction connection at bottom end of headers when the coil is properly installed. Matching distributor connections for each coil refrigeration circuit are on the air leaving side. *See certified drawing and/or connection labeling to ensure correct matching of suction and distributor connections.*

CAUTION

Direct-expansion coils are shipped charged with nitrogen.

Do not leave piping open to the atmosphere unnecessarily. Water and water vapor are detrimental to the refrigerant system. Until the piping is complete, recap the system and charge with nitrogen at the end of each workday. Clean all piping connections before brazing joints. Use nitrogen when brazing connections to prevent scaling.

The orientation of the refrigerant distributor is not critical but the distributor tubes must not be kinked or bent in a non-uniform configuration. For this and other piping & sundry tips, *refer to Fig. 4.*

The orientation of the refrigerant distributor is not critical but the distributor tubes must not be kinked or bent in a non-uniform configuration. For this and other piping & sundry tips, *refer to Fig. 4.*

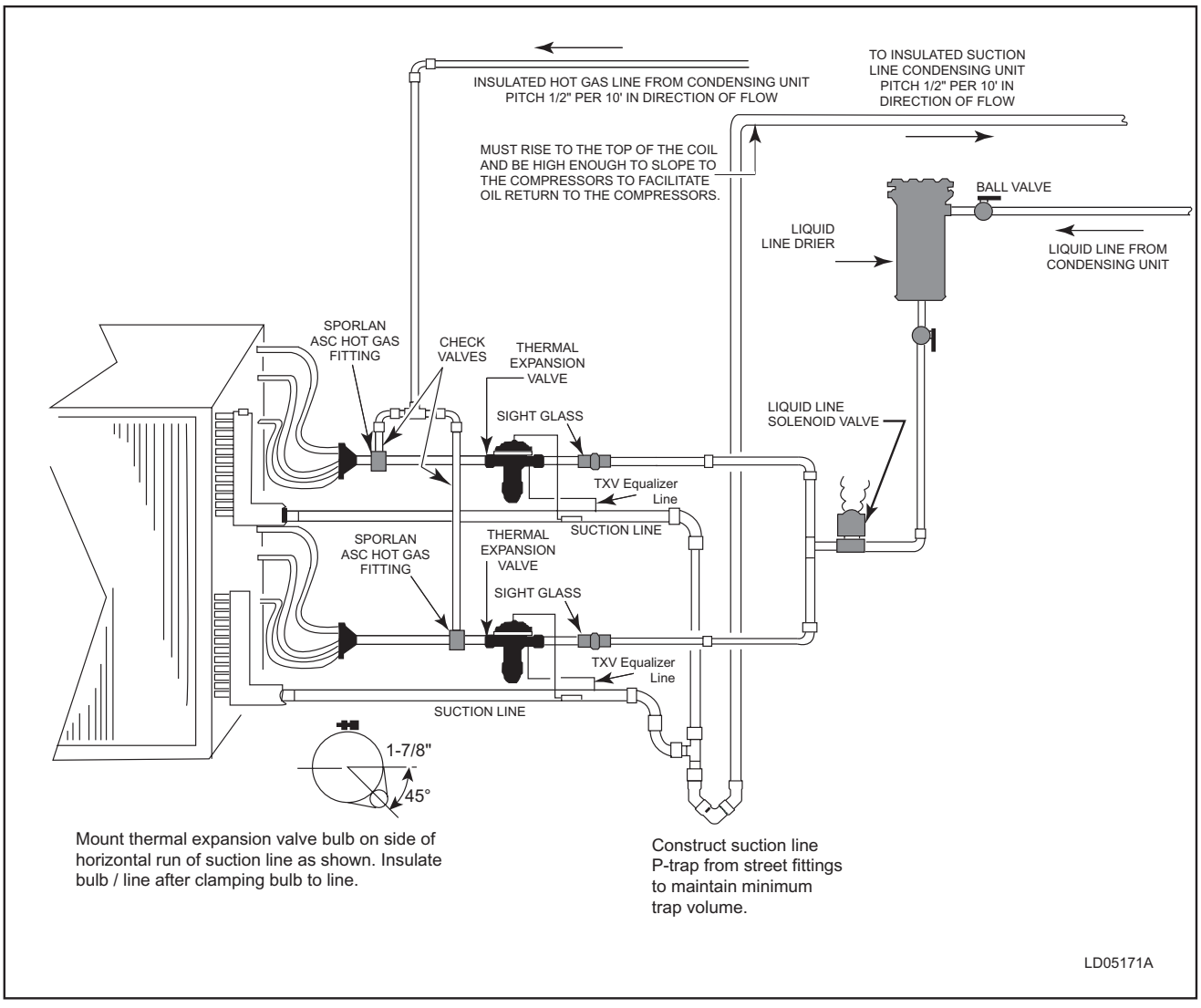


FIG. 4 – TYPICAL PIPING AND SUNDRIES AT THE DX COIL

DX Coil Types

There are three basic types of coil arrangements used in field erected split systems, interlaced, row split and face split.

Interlaced

Interlaced coils are the most desirable type of coil "field erected" designs. Interlaced coils ensure the entire face of the coil is active with any number of compressors operating. Interlaced circuitry interweaves coil tubing in both circuits across the entire face of the coil assuring uniform cooling of the air by the refrigerant. This type of coil also allows one circuit to operate while the other circuit is turned off. Interlaced coils provide excellent temperature control at full and part loads as well as good TXV superheat control. TXV control is essential for compressor reliability.

Row Split

Row split coils arrangements place coils back to back in the air stream. Air passes through one coil before passing through the next. Generally, the last coil in the air stream is activated first. Each circuit may be controlled independently in this arrangement. When both coils are operating, the coil closest to the leaving air will operate at a lower temperature. This type of coil may not permit lead lag of the circuits and it may be difficult to balance the capacity between the coils.

Face Split

On a face split coil, the circuiting is divided between two separate coils. In field-erected systems, this arrangement may suffer from TXV superheat control problems and compressor reliability. At low airflow, low load situations, the TXV may have difficulty controlling system superheat.

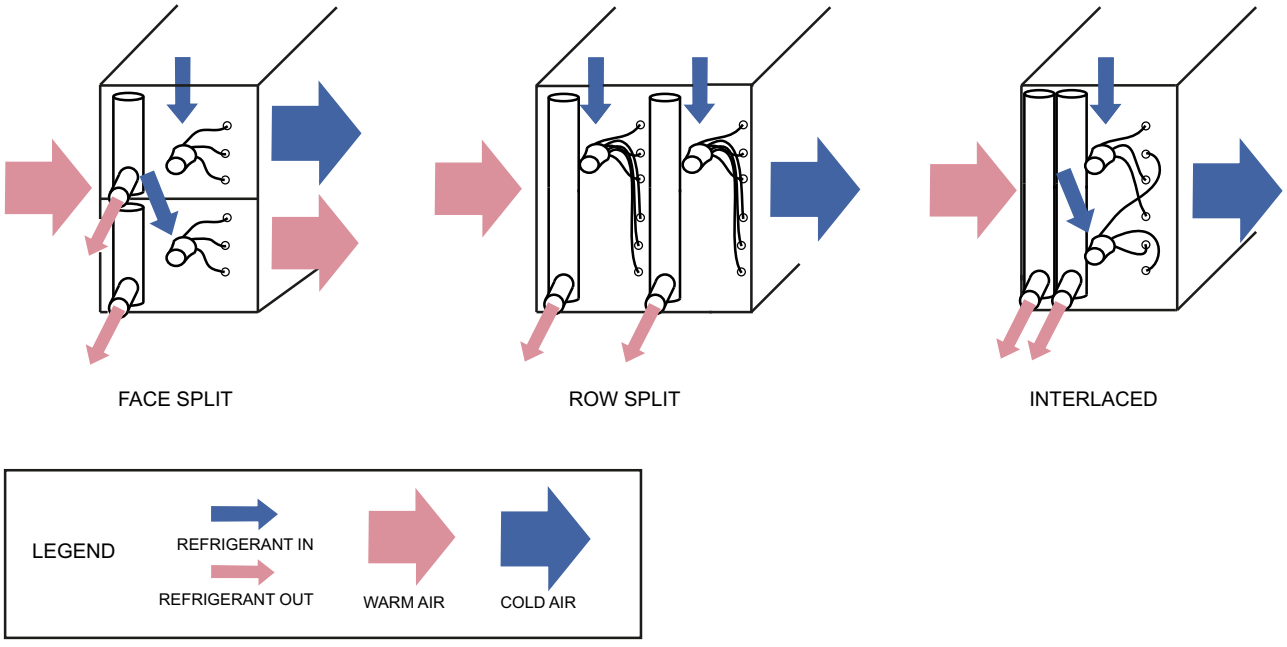
Air stratification, poor humidity control and condensation on downstream components can also occur when using face split coils. One way to address TXV control at part load is to provide a face damper to shutoff airflow when a coil face is inactive.

Combined Coil Types

Coil types may be combined in some systems. This requires special care. Control sequences and piping tying the multiple systems and coils together should be well thought out and advice from an experienced design engineer is necessary.

DX Coil Circuiting

On many coil banks, two, or even all three of the methods of circuiting may be combined depending upon the cooling capacity and the level of control required. However, coil sections must be married or combined so that they provide for full-face operation (*see Fig. 5*).



LD13319B

FIG. 5 – DX COIL CIRCUITING TYPES

The coil designs fall into the two following categories.

Coil Design	Fin Height
Non-Stacked	48" and less
Stacked	Greater than 48"

Fig's. 6 through 8 illustrate the available coil arrangements.

NOTE

Face-split DX coils must be configured to provide full-face coverage at all condensing unit load steps. Johnson Controls assumes no responsibility for compressor failure if full-face coverage is not applied. Consult the factory, if application assistance is needed to convert split face to full-face operation.

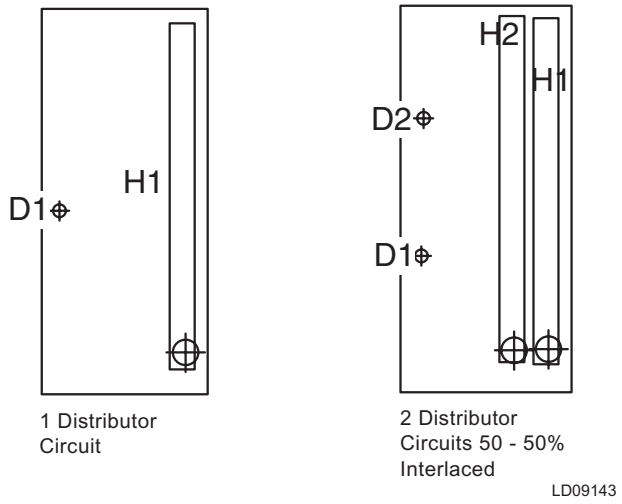


FIG. 6 – NON-STACKED COIL DESIGN

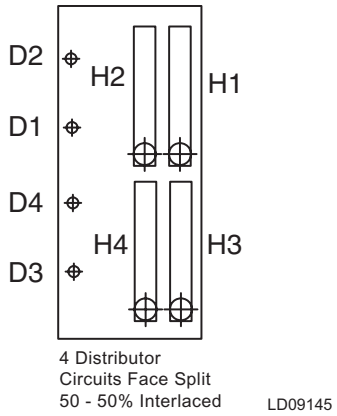


FIG. 7 – STACKED COIL DESIGN

DX Coil Circuiting and Staging

On tall coils, a minimum of four coil circuits should be used to achieve full-face control (Fig. 8). Each coil distributor circuit requires its own Thermostatic Expansion Valve (TXV). Each condensing unit circuit requires its own liquid line solenoid valve (LLSV). When the condensing unit has two compressors per refrigerant circuit, either one or two coil circuits may be used for each refrigerant circuit depending upon the cooling capacity.

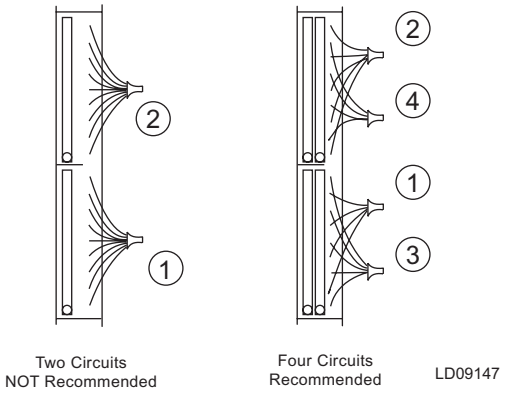


FIG. 8 – STACKED COIL CIRCUITING

If one coil circuit is used (Fig. 9), the LLSV and TXV must be sized to handle the full capacity of the refrigerant circuit. When two coil circuits are used per refrigerant circuit (Fig. 10), each TXV should be sized to handle half of the capacity of the refrigerant circuit and the LLSV should be sized to handle the full capacity of the refrigerant circuit.

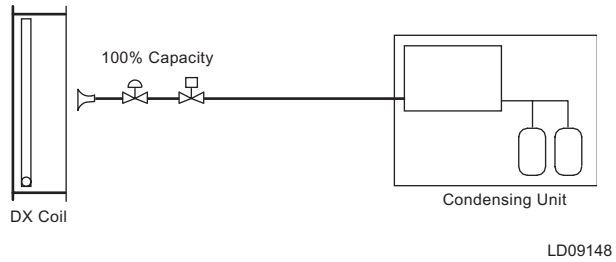


FIG. 9 – ONE COIL CIRCUIT PER REFRIGERANT CIRCUIT

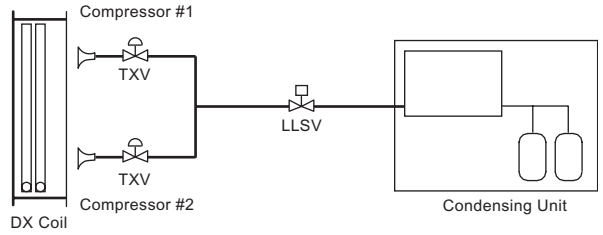


FIG. 10 – TWO COIL CIRCUITS PER REFRIGERANT CIRCUIT

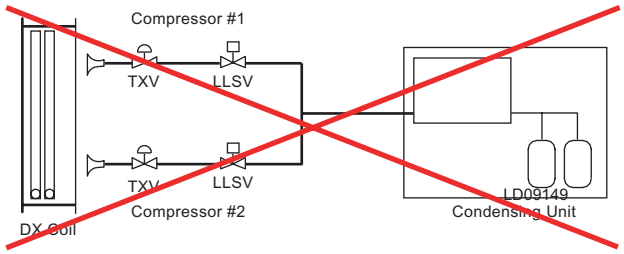


FIG. 11 – DO NOT USE THE ABOVE CONFIGURATION.

When the condensing unit has three compressors per circuit, two coil circuits should be used for each refrigerant circuit (Fig. 12). Each coil circuit must have a dedicated TXV and distributor to handle one coil circuit and the LLSV should be sized to handle the full capacity of the refrigerant circuit. The hot gas bypass line should be connected to all of the distributors in the coil circuit.

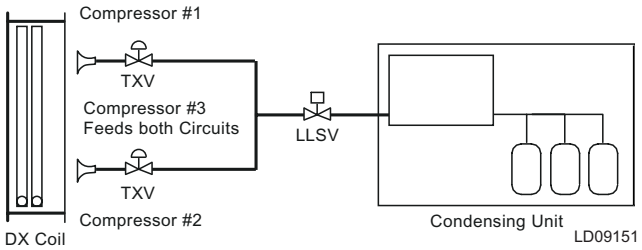


FIG. 12 – THREE COMPRESSOR YCUL

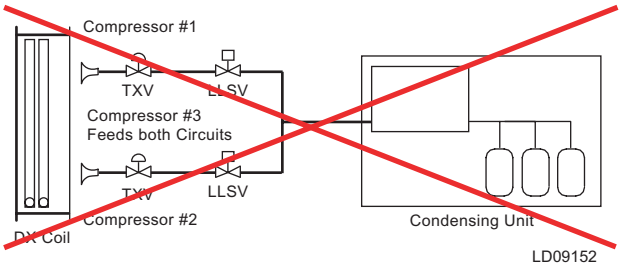


FIG. 13 – DO NOT USE THE ABOVE CONFIGURATION.

In the case of a tall coil with four coil circuits piped to a condenser with six compressors, the coil circuits would be face-split and interlaced with two interlaced circuits on the lower coil section and two on the upper (Fig. 14).

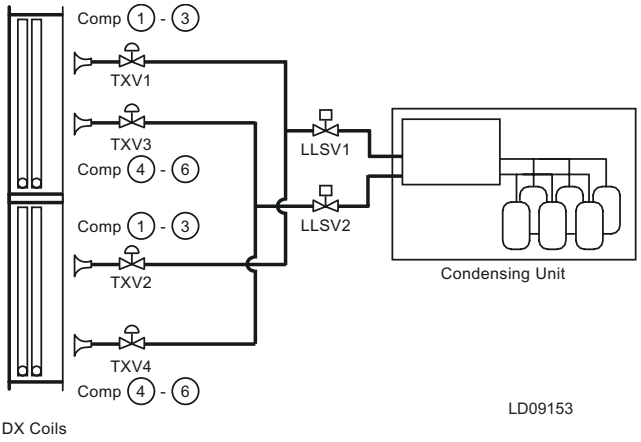


FIG. 14 – SIX COMPRESSOR YCUL

NOTE

When sizing TXV's, each TXV must be sized for the refrigerant circuit tonnage divided by the number of DX coil liquid distributors. The TXV should be equal to or smaller than the calculated value.

The first three compressors (*see Fig. 14*) would be tied into LLSV1, TXV1 and TXV2. This would provide full-face control of the coil at even the lowest cooling loads. Both distributors on each of the coil circuits would include auxiliary side connectors for HGBP.

The second set of 3 compressors would be tied into LLSV2, TXV3 and TXV4 to maintain full-face control at higher loads. *Reference Form 050.40-ES3 Section 9 for compressor staging solutions.*

The more control stages used, the more precise the control of the air temperature will be. Smaller incremental changes in capacity will result in a more consistent DX coil leaving air temperature. This will eliminate temperature swings in the conditioned space and improve the comfort level, but more importantly, a consistent space temperature is crucial to many process applications. The smaller changes in capacity that result from using a greater number of control stages will also extend equipment life. The most important thing to remember is to maintain full-face control of the coil at all cooling loads. When row split coils are used, make sure that the first LLSV is energized with the last coil circuit in the leaving air stream. This is always the last one de-energized too.

Thermostatic Expansion Valves (TXV)

Each coil distributor circuit requires its own Thermostatic Expansion Valve (TXV). Each condensing unit circuit requires its own liquid line solenoid valve (LLSV). TXV's 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 valve manufacturer's recommendations, allowing approximately 35 PSI pressure drop throughout 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, not recommended therefore, 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.

Hot Gas Bypass

When using discharge air temperature control or systems with outside air economizer cooling, always include hot gas bypass (HGBP). It is not as critical to use HGBP with return duct air temperature control, or suction pressure control, but it provides better capacity control at low loads.

The HGBP line should be sized for 100% of the capacity of one compressor and the hot gas lines must be insulated. YCUL discharge head pressure control is required on hot gas bypass applications. At low ambient temperatures, the condensing unit is very efficient and there is very little hot gas available for capacity control. Discharge pressure control assures enough differential pressure to push sufficient hot gas from the high side to the low side of the system.

Typical distributors utilize a selectable nozzle versus the older venturi type. Either device requires the use of an auxiliary side connector (ASC) for introducing the hot gas into the system and mixing it with saturated liquid refrigerant just ahead of the distributor. Most distributors are ordered with an integral ASC. Where multiple coils are stacked (or side by side), and ASC must be provided on all coils for that YCUL system. When ASC’s are field installed, the ASC must be located direct to the distributor, or a maximum of 2” to 3” away. Additionally, the side connection must be positioned upward to eliminate oil and refrigerant logging in the hot gas line when not in operation.

Hot gas must be fed to all coils to assure that full-face operation is achieved. Since all applications have job specific operating characteristics, the hot gas bypass valve setting must be field adjusted for the proper setting, after the system has been put into operation.

Hot gas piping must never be designed to trap liquid. If the hot gas line traps liquid during off periods, it will send a large slug of liquid into the DX coil when the hot gas is activated. This slug of liquid will not be fully evaporated in the DX coil and a liquid slug will be fed to the compressor, potentially causing damage. A hot gas line should be sloped so that it drains into the DX coil distributor from above the distributor, which also promotes oil return.

Local, state and federal energy standards such as ASHRAE 90.1 may limit the use of hot gas bypass in some applications. Be sure to consult local code requirements before installing the system.

Check Valves – All multiple HGBP auxiliary connections on a single circuit MUST include check valves as shown in Fig. 4. The use of these valves prevents one coil circuit from short circuiting to the other and influencing its operating pressure. This short circuiting produces unwanted TXV hunting and refrigerant over and under feed.

Check valves shall be refrigeration grade selected for suitable pressures involved. Valve bodies shall be constructed of copper with an integral check ball permitting flow only to the distributor (not reversed). Valves installed in the near horizontal must include a spring-loaded design. Valves must not exceed a 1 psi pressure drop at the design flow-tons for hot gas applications.

Maintaining Adequate Airflow

An electrical interlock between the air handler and the condenser must be included for permissive run of the condenser. In addition, a differential pressure switch mounted across the supply fan must always be included to ensure airflow across the coil before the condensing unit is energized. The condenser must never be operated unless the air handler fan is operating and air is flowing across the active coil. Insufficient airflow will result in liquid refrigerant returning to the condensing unit, which could damage the compressors by liquid slugging or washing oil from the bearing surfaces.

In variable volume systems, the minimum acceptable airflow for fixed speed or VAV systems is 350 FPM face velocity across each DX coil, as applied to split DX systems. This is critical to assure that the TXV does not overfeed, causing compressor failure.

The air velocity flowing through chilled water and direct expansion coils must not exceed specific recommended values, to prevent water carryover.

SECTION 2 - OPERATION AND MAINTENANCE

COIL SEGMENT

Coil Cleaning Procedure

Suggested Tools, Equipment & Materials List

- Pressure washer that does not exceed 2000 PSI.
- Sprayer (utility garden, etc.) applicator.
- Plastic sheeting.
- Duct tape.
- Screening.
- Coil cleaner (safe, commercial grade, disinfecting).
- Garden hose.
- Garden hose spray nozzle.
- Rags.
- Pail.
- Trash bags.
- Power cords.
- Four inch paintbrush.

Cleaning Procedure

Perform cleaning of dehumidification coils at least once a year or when air pressure drop exceeds 125% of design.

1. Cover electrical components such as fan motors, damper motors, compressors, thermostats, etc. with plastic. Care should be taken on interior coil cleaning. Remove filters; cover fan bearings and any insulation to keep these items free of water damage. Condensate drain piping should be screened to allow coil-cleaning water to flow freely. Screening keeps traps and drain lines from clogging with debris washed from the coils.
2. Prior to any application of wet cleaning materials, use a wide soft bristle paint brush to dust off any heavy dust, leaves, bugs or other foreign matter that may be on the coil fin surface.

Safety glasses should be worn when cleaning coils.

3. When possible, remove dirt lodged in the depth of the coil by using clean oil-free air under pressure. Caution should be taken not to use extreme high-pressure air as this may cause fin surface damage. Direct the air straight at the openings between the fins and never at an angle, which may bend the fins against one another. Always apply the air from the air leaving side of the coil.
4. On heavily soiled coils, use a safe commercial grade coil cleaner.

Follow the safety and mixing instructions as noted on or with the cleaning agent.

5. Spray the cleaning agent on both sides of the coil to be cleaned. Allow the cleaning agent to remain in contact with the dirty surface for about 5 minutes or as recommended by the agent instructions. Then flush the coil with clean water from a hose (with spray nozzle or from pressure washer). Flush from the air leaving side of the coil. Caution should be taken, as extreme water pressure may result in fin surface damage. Direct the water straight at the openings between the fins and never at an angle, which may bend the fins against one another. This process will wash away surface dirt on the air entering side of the coil, and prevent it form loading within the depth of the coil.
6. Most cleaners are concentrated detergents and can be diluted with up to 10 parts of water. Dilute as per cleaning agent instructions and coil condition. Re-spray both sides of the coil with cleaner. Allow to stand 5 minutes and flush as described previously. Finish flushing from both sides of the coil.

Follow cleaning agent instructions. Agent should meet environmental and OSHA standards.

7 Some extreme oil and dirt conditions may require steam cleaning. Most steam equipment can be adjusted to provide a mixture of water and steam at a moderate pressure. Steam alone without the presence of water does not work well with most cleaning agents. Cleaning the coils with steam should be done as described previously.

8. Comb out any bent or flattened areas of fin surface.
9. Restore equipment to operational state.

Condensate Drain Pan, Trap and Drain Line Cleaning Procedure

Tools and Materials

- Toilet bowl brush or similar utility cleaning brush.
- Cleaning agent (safe, commercial grade, disinfecting).
- Rags.
- Trash bags.
- Garden hose with spray nozzle or power washer.
- Scraper.
- Screening.
- Wet vacuum.

Cleaning Procedure

Clean condensate drain pan, trap, drain line and adjacent wetted surfaces at least once per year or as often as required to retard growth of microbial substances.

Testing of Drain Pans - ***To minimize conditions of water stagnation that may result in microbial growth, drain pans shall be field-tested under normal operating conditions to ensure proper drainage.***

Exception: ***Field testing of drain pans is not required if units with factory-installed drain pans have been certified (attested in writing) by the manufacturer for proper drainage when installed as recommended.***

1. Cover any nearby components such as motors, control devices or wiring.
2. Sweep, gather and remove debris from drain pan, auxiliary pans and splash guards.
3. Scrape loose and remove any clinging substances.
4. Cover drain pan outlet with screening to prevent drain clogging.
5. Prepare cleaning agent per manufacturer's instructions.
6. Apply cleaning agent with spray applicator or brush.
7. Apply cleaner to ***ALL*** surfaces including: under side of coil, header and return bends if in air stream, coil supports, coil wall or bulkhead, auxiliary drain pans, splash guards, any other surfaces subject to wetting by condensation dripping or carried by normal air flow, drain pan and outlet.
8. Add ample amount of cleaning agent to drain line and trap.
9. Allow cleaner to stand for time required by manufacturer's instructions.
10. Flush with clean water from pressure washer or garden hose with spray nozzle.
11. Apply as much water under pressure as possible to drain outlet to clean trap and drain line.
12. Remove water from any puddle areas with wet vacuum.
13. Wipe down if necessary to remove any stubborn material.
14. Restore equipment to operational state.

Winterizing Drain Traps

During the winter months when the cooling system is turned off and the unit is exposed to freezing conditions, an antifreeze solution, which is environmentally friendly and safe for the roof can be poured in the condensate drain trap to prevent freezing and possible damage. The condensate drain trap may also be removed as well as heat traced and insulated.

MONTHLY MAINTENANCE CHECK

Refrigerant Coils - Check holding charge pressure monthly to be sure that the pressure has not dropped. If pressure has dropped, the unit should be inspected for signs of visible damage which may have caused loss of pressure. If pressure drops more than 2 psi, the unit should be pressure tested to locate the leak; the leak should be repaired and the unit recharged with nitrogen to 5 psig pressure.

WARRANTY

The standard warranty policy is described by Form 50.05-NM2.

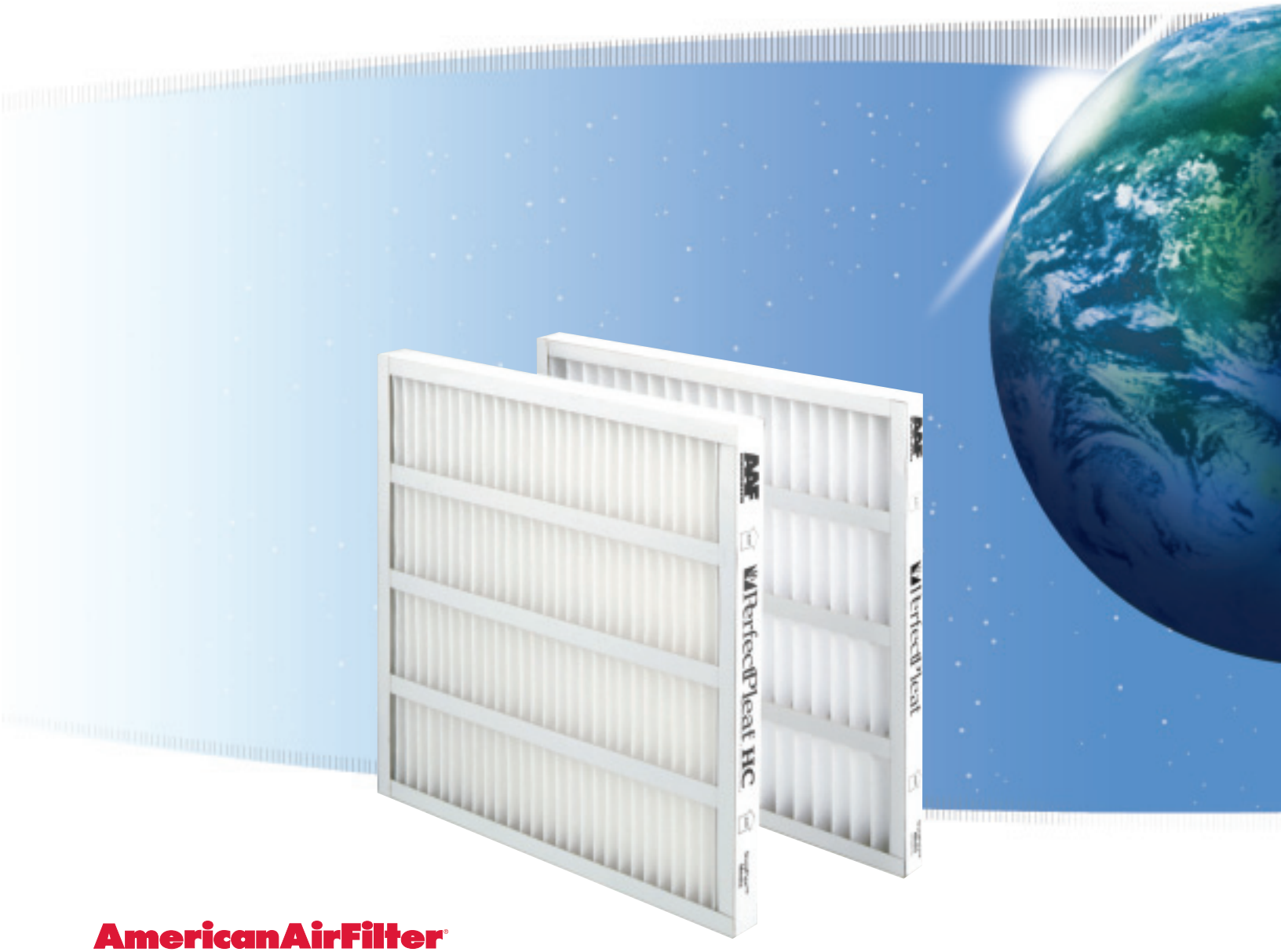
COIL LEAKS

Reporting coil leaks that occur during the standard warranty period must be done in accordance with the procedure outlined in Service Bulletin SB0033. This form is required for warranty claim processing.

REPLACEMENT COILS

To order coils, refer to the Loose Coil Quick Shipment Guide for product offering and ordering instructions.

NOTES:



AmericanAirFilter®

PerfectPleat®
PerfectPleat® HC

1" and 2" Extended Surface, Pleated Filter with Process-Controlled Quality

With DuraFlex® Media

Better Air is Our Business®

AAF® INTERNATIONAL

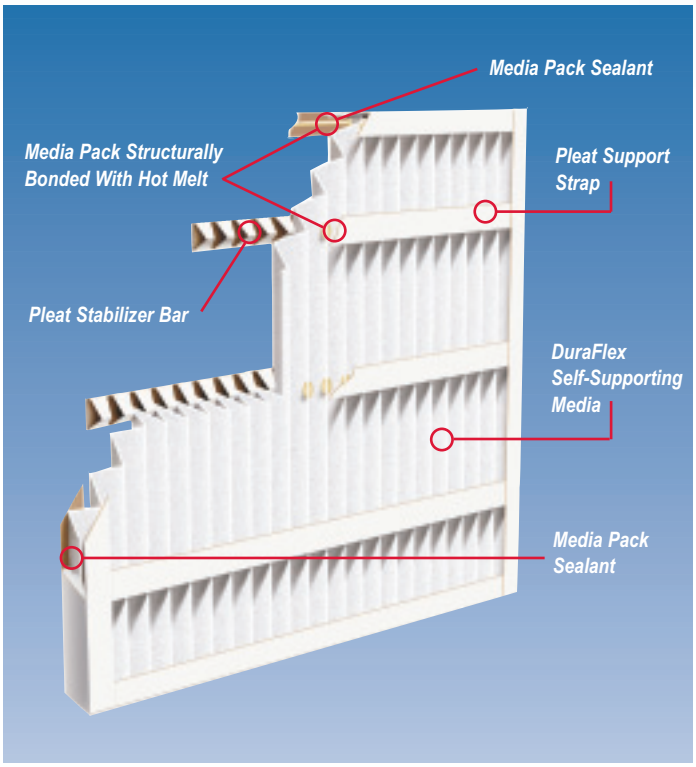
AmericanAirFilter®

PerfectPleat®
PerfectPleat® HC

Extended Surface, Pleated Filter with Process-Controlled Quality

MERV 7

- ***Patented media, filter design, and manufacturing process. Patents covered under one or more of the following US 6398839 B2; US 6254653 B1; US 6159318; US 6165242; US 6387140 B1 (1" model only)***
- ***Form and fit unlike any other pleat available today***
- ***Self-supporting DuraFlex® media made from virgin fiber; no wire support needed***
- ***Consistent media with controlled fiber size and blend***
- ***HC (High Capacity) model available for applications where airflow and longer life are issues***
- ***Available in 1", 2" and *4" models***



PerfectPleat 2" Construction

The Air Filtration Leader

AAF International, one of the world's largest manufacturers of air filtration products, is known for technical innovation and excellence. Designed, developed, and patented by AAF, the PerfectPleat is a product with form and fit unlike any other pleated filter in the marketplace today. In addition, the PerfectPleat has the filtering efficiency you need and expect.

Superior Design and Construction

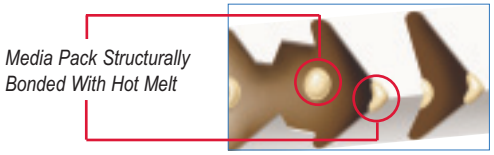
Drawing on years of experience in manufacturing quality air filters, AAF has created a state-of-the-art process for producing pleated filters. The extremely high quality of these filters is a result of three unique innovations: a new automated manufacturing process; a unique, self-supporting media; and a filter construction that provides incredible strength without wire support.

Since their introduction, pleated filters have become a larger and more important segment of the filtration marketplace. However, current design and process are not conducive to the manufacture of consistently pleated media packs or finished filters. Inconsistency in pleat arrangement, variations in media, improper bonding of media to frame, along with antiquated manufacturing techniques, have a negative impact on efficiency, resistance, durability, and strength.

The automated and controlled process AAF has developed for the PerfectPleat eliminates these inconsistencies and irregularities. Our automated manufacturing process offers consistency our competitors cannot match in the everyday manufacture of pleated filters.

** See brochure AFP-1-206 for 4' model.*

Pleat Stabilizer Adhesive Detail



DuraFlex® Media - Patented Media Design

Uniform size virgin fibers are assembled in closely controlled blends to create a media that is both self-supporting and remarkably consistent in performance. The self-supporting characteristics allow a pleating pattern that promotes excellent dust holding and low resistance to airflow. The PerfectPleat also meets or exceeds all current expectations for service life. PerfectPleat HC and PerfectPleat are classified MERV 7.

DuraFlex® Media is Self-Supporting

DuraFlex media's unique construction makes it self-supporting. When pleated, DuraFlex will hold its shape without the wire support characteristic of conventional pleated filters. That means no potential for the formation of rust and safer handling - no nicks or cuts for the installer. With the superior resiliency of DuraFlex media and no need for wire support, the PerfectPleat can sustain significant abuse and maintain its shape and pleat spacing. The absence of the wire also makes the filter totally incinerable, which simplifies disposal.

PerfectPleat with DuraFlex media produces a filter with excellent form and fit.

As a result of its unique design, PerfectPleat can withstand significant damage.

DuraFlex media has "memory" which allows PerfectPleat to remain functional, even when the frame has been compromised.

2" PerfectPleat — Heavy Duty Frame

The perimeter frame of the PerfectPleat HC and PerfectPleat is constructed from the highest wet-strength 28 pt. beverage carrier board available, securely bonded to the media pack. The 28 pt. thickness improves filter strength and helps resist damage.

Uniquely designed pleat stabilizers are bonded to the media on the air leaving side to ensure uniform pleat spacing and provide additional strength. On the air-entering side, support straps add to the PerfectPleat's rigidity. The support straps and pleat stabilizers ensure integrity against turbulent airflow and provide excellent lateral stability for installation in side-access systems.

Applications

The PerfectPleat HC is ideal for applications where pleated filters are currently in use and higher efficiencies are required or desired.

The PerfectPleat is identical to the PerfectPleat HC but with approximately 25% less media. It is best suited for standard capacity pleated filter applications.

Every PerfectPleat offers superior durability and performance when properly installed and maintained.

A Heavy Duty (HD) PerfectPleat is available for applications where extremely low temperature and high airflow are present. See Brochure AFP-1-201.

1" PerfectPleat - Strength and Durability

The 1" PerfectPleat HC and PerfectPleat have the same durability and performance as the 2" models. Both are made using DuraFlex media encased in a 28 pt. beverage carrier board frame. PerfectPleat 1" models feature a perimeter frame, with three supporting straps on the air entering and air leaving sides of the filter. Both models resist crushing and abuse and can be used in any application where 1" filters are currently in place. PerfectPleat HC and PerfectPleat are rated MERV 7.

PerfectPleat HC 1" air entering side.

AmericanAirFilter®

PerfectPleat®
PerfectPleat® HC

Product Information Standard Sizes

Nominal Sizes (Inches) (W x H x D)	Actual Sizes (Inches) (W x H x D)	Rated Airflow Capacity (SCFM) 300 FPM	500 FPM	625 FPM	Pleats Per Filter PerfectPleat HC 1"	PerfectPleat 1"	PerfectPleat HC 2"	PerfectPleat 2"
10 x 10 x 1	9½ x 9½ x ¾	200	**350**		11	10		
10 x 20 x 1	9½ x 19½ x ¾	400	**700**		11	10		
12 x 12 x 1	11½ x 11½ x ¾	300	**500**		14	12		
12 x 20 x 1	11½ x 19½ x ¾	500	**850**		14	12		
12 x 24 x 1	11⅜ x 23⅜ x ¾	600	**1000**		14	12		
14 x 20 x 1	13½ x 19½ x ¾	600	**1000**		16	14		
14 x 25 x 1	13½ x 24½ x ¾	750	**1200**		16	14		
15 x 20 x 1	14½ x 19½ x ¾	650	**1050**		17	15		
16 x 16 x 1	15½ x 15½ x ¾	550	**900**		19	16		
16 x 20 x 1	15½ x 19½ x ¾	650	**1100**		19	16		
16 x 25 x 1	15½ x 24½ x ¾	850	**1400**		19	16		
18 x 20 x 1	17½ x 19½ x ¾	750	**1250**		21	18		
18 x 24 x 1	17⅜ x 23⅜ x ¾	900	**1500**		21	18		
18 x 25 x 1	17½ x 24½ x ¾	950	**1550**		21	18		
20 x 20 x 1	19½ x 19½ x ¾	850	**1400**		24	20		
20 x 25 x 1	19½ x 24½ x ¾	1050	**1750**		24	20		
24 x 24 x 1	23⅜ x 23⅜ x ¾	1200	**2000**		29	24		
25 x 25 x 1	24½ x 24½ x ¾	1300	**2200**		30	25		
10 x 20 x 2	9½ x 19½ x 1¾	400	**700**	850			11	8
12 x 20 x 2	11½ x 19½ x 1¾	500	**850**	1050			14	10
12 x 24 x 2	11⅜ x 23⅜ x 1¾	600	**1000**	1250			14	10
14 x 25 x 2	13½ x 24½ x 1¾	750	**1200**	1500			16	11
15 x 20 x 2	14½ x 19½ x 1¾	650	**1050**	1300			17	12
15 x 25 x 2	14½ x 24½ x 1¾	800	**1300**	1650			17	12
16 x 16 x 2	15½ x 15½ x 1¾	550	**900**	1100			19	13
16 x 20 x 2	15½ x 19½ x 1¾	650	**1100**	1400			19	13
16 x 24 x 2	15⅜ x 23⅜ x 1¾	800	**1350**	1650			19	13
16 x 25 x 2	15½ x 24½ x 1¾	850	**1400**	1750			19	13
18 x 25 x 2	17½ x 24½ x 1¾	950	**1550**	1950			21	15
18 x 24 x 2	17⅜ x 23⅜ x 1¾	900	**1500**	1900			21	15
20 x 20 x 2	19½ x 19½ x 1¾	850	**1400**	1750			24	17
20 x 24 x 2	19⅜ x 23⅜ x 1¾	1000	**1650**	2100			24	17
20 x 25 x 2	19½ x 24½ x 1¾	1050	**1750**	2150			24	17
24 x 24 x 2	23⅜ x 23⅜ x 1¾	1200	**2000**	2500			29	20
25 x 25 x 2	24½ x 24½ x 1¾	1300	**2150**	2700			30	21

PerfectPleat and PerfectPleat HC filters are classified U.L. Class 2. Testing was performed according to U.L. Standard 900 and CAN 4-S111.

Performance Data

Filter	Pleats Per Lineal Foot	Rated Initial Resistance (In. W.G.) 300 FPM	500 FPM	625 FPM	Recommended Final Resistance (In. W.G.)	ASHRAE 52.2 MERV	Continuous Operating Temperature Limits °F	°C
PerfectPleat HC 2"	15.0	.12	**.28**	.43	1.0	7	170°	77°
PerfectPleat 2"	10.0	.14	**.30**	.45	1.0	7	170°	77°
PerfectPleat HC 1"	15.0	.23	**.48**	----	1.0	7	170°	77°
PerfectPleat 1"	12.0	.27	**.56**	----	1.0	7	170º	77º

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www.aafintl.com

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AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.

AFP-1-200K JAN '07 MP 5M

AAF INTERNATIONAL *Better Air is Our Business®*

AmericanAirFilter®
PerfectPleat® HC 2"

ENGINEERING DATA
Supplement to Bulletin AFP-1-200

Product Information — Standard Sizes

Nominal Sizes (Inches) (W x H x D)	Actual Sizes (Inches) (W x H x D)	Rated Airflow Capacity (SCFM) 300 FPM	500 FPM	625 FPM	Pleats Per Filter	Media Area (Sq. Ft.)
10 X 20 X 2	9 1/2 X 19 1/2 X 1 3/4	400	700	850	11	5.2
12 X 20 X 2	11 1/2 X 19 1/2 X 1 3/4	500	850	1050	14	6.6
12 X 24 X 2	11 3/8 X 23 3/8 X 1 3/4	600	1000	1250	14	8.0
14 X 25 X 2	13 1/2 X 24 1/2 X 1 3/4	750	1200	1500	16	9.5
15 X 20 X 2	14 1/2 X 19 1/2 X 1 3/4	650	1050	1300	17	8.1
15 X 25 X 2	14 1/2 X 24 1/2 X 1 3/4	800	1300	1650	17	10.1
16 X 16 X 2	15 1/2 X 15 1/2 X 1 3/4	550	900	1100	19	7.2
16 X 20 X 2	15 1/2 X 19 1/2 X 1 3/4	650	1100	1400	19	9.0
16 X 24 X 2	15 3/8 X 23 3/8 X 1 3/4	800	1350	1650	19	10.8
16 X 25 X 2	15 1/2 X 24 1/2 X 1 3/4	850	1400	1750	19	11.3
18 X 25 X 2	17 1/2 X 24 1/2 X 1 3/4	950	1550	1950	21	12.5
18 X 24 X 2	17 3/8 X 23 3/8 X 1 3/4	900	1500	1900	21	11.9
20 X 20 X 2	19 1/2 X 19 1/2 X 1 3/4	850	1400	1750	24	11.4
20 X 24 X 2	19 3/8 X 23 3/8 X 1 3/4	1000	1650	2100	24	13.6
20 X 25 X 2	19 1/2 X 24 1/2 X 1 3/4	1050	1750	2150	24	14.3
24 X 24 X 2	23 3/8 X 23 3/8 X 1 3/4	1200	2000	2500	29	16.5
25 X 25 X 2	24 1/2 X 24 1/2 X 1 3/4	1300	2150	2700	30	17.9

PerfectPleat filters are classified U.L. Class 2. Testing was performed according to U.L. Standard 900 and CAN 4-S111.

Performance Data

Pleats Per Lineal Foot	Rated Initial Resistance (In. W.G.) 300 FPM	500 FPM	625 FPM	Recommended Final Resistance (In. W.G.)	ASHRAE 52.2 MERV	ASHRAE 52.1 Rated Average Efficiency (%)	Continuous Operating Temperature Limits °F	°C
15.0	.12	**.28**	.43	1.0	7	25-30	170°	77°

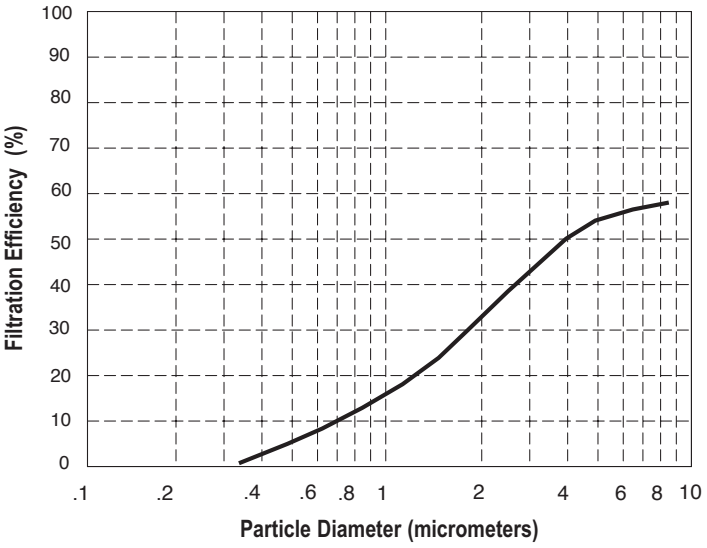
AmericanAirFilter®

PerfectPleat® HC 2"

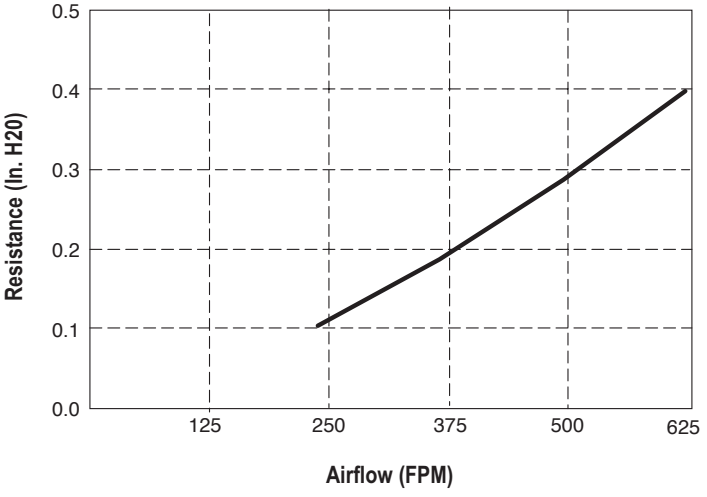
Performance Data

Composite Minimum Efficiency

Efficiency Vs. Particle Size



Resistance to Airflow



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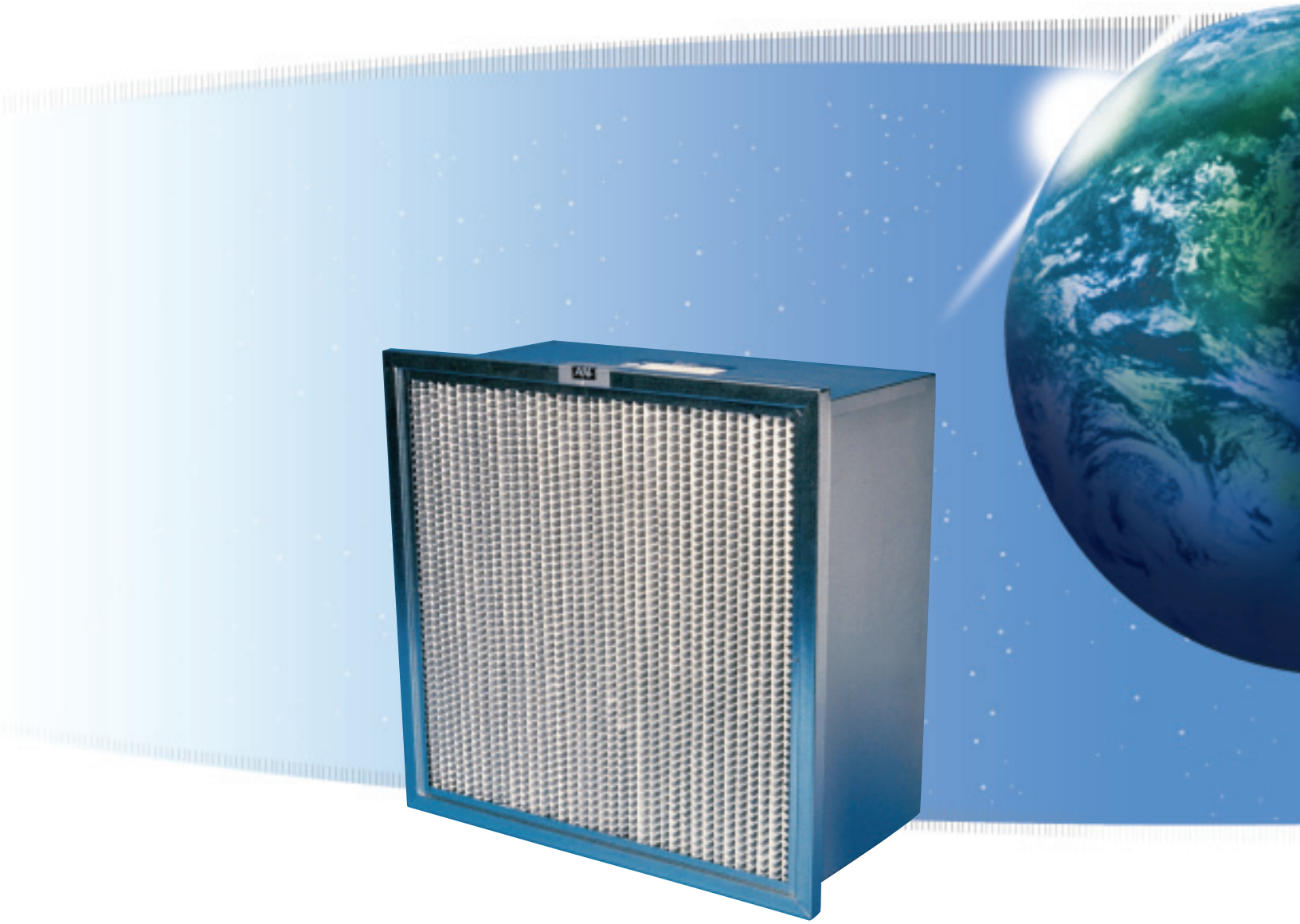
AFP-7-200C DEC '05 CP 2M



AmericanAirFilter®

VariCel®

High and Medium Efficiency
Extended Surface
Supported Pleated Filters

VariCel® with Antimicrobial

IAQ Engineered Media Treated
with Antimicrobial

Better Air is Our Business®

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AmericanAirFilter®

VariCel® and VariCel® with Antimicrobial

Extended Surface Supported Pleated Filters

- ***Available in three efficiencies MERV 14 (90-95%), MERV 13 (80-85%), and MERV 11 (60-65%)***
- ***Available with antimicrobial in 90-95% & 60-65% efficiency***
- ***UL Class 1***
- ***Ideal for difficult operating conditions***
  - ***Variable air volume***
  - ***Turbulent airflow***
  - ***Repeated fan shutdown***
  - ***High temperature operation***
  - ***High humidity***
  - ***Intermittent exposure to water such as seacoast installations***

Designed to Improve Indoor Air Quality

VariCel filters with antimicrobial are designed specifically to improve Indoor Air Quality (IAQ). Air filters are designed to trap and concentrate particulate air contaminants including viable fungal and bacterial spores. The presence of antimicrobial preservative in the filter media is intended to preserve the integrity of the media throughout the useful life of the filter. Antimicrobial preservatives are not meant to increase the efficiency of the filter, nor to kill microorganisms "on the fly" as they pass through a filter. Antimicrobial is EPA registered and environmentally safe.

Engineered for a Variety of Applications

Type SH Single Header VariCel filters are designed for systems originally supplied by AAF International. A unique $^{13}/_{16}$" flanged header on the air entering side allows the filter to be easily inserted and latched into front and side access systems.

Type DH Double Header VariCel filters are designed to upgrade air cleaning performance and reliability. Two $^{13}/_{16}$" thick flanged headers make the filters compatible with the holding frames and latching devices of various manufacturers, including rear access systems.

XL Series VariCel filters, single header (XL-S) and double header (XL-D), contain up to 67% more media and offer more than twice the service life of standard single and double header models.

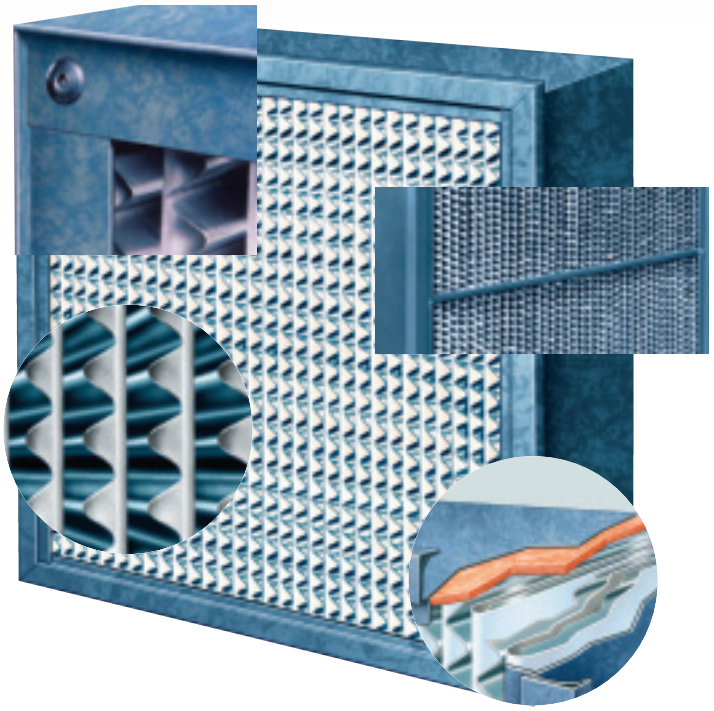
High Temp Series VariCel filters are designed for systems operating from 350°-900°F. Constructed of aluminized steel, High Temperature VariCel filters offer rated efficiency with proven reliability over the life of the filter. See page 4 for models and temperature limits.

Type NH Series VariCel filters are designed for special sizes and applications, including incineration and compaction disposal systems. Manufactured of fire-retardant, $^{3}/_{4}$" thick, heavy wall particle board, Type NH VariCel filters (U.L. Class 1) are operable at temperatures up to 200°F. The filters are constructed without headers and cell sides are flush with front face dimensions.

Built Rugged for Dependable Performance

Crimped Rear Flanges *(SH) are rolled over and riveted to add strength, eliminate sharp edges, and prevent bypass leakage.*

Corrugated Aluminum Separators with Rolled Edges *maintain uniform pleat spacing for optimum airflow. The separators are rolled to eliminate sharp edges, preventing media damage during shipping and personal injury during installation.*

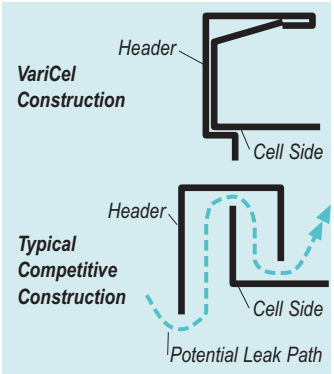


Media Pack Restraint
Steel brace on air leaving side adds support to the media pack.

Media Pack Sealant *— A layer of high efficiency media seals the media pack into the cell sides. The media sealant prevents by-pass leakage and damage to the media and separators during shipping and handling. By allowing slight movement of the media pack when the filter is jarred, the cushioning sealant helps prevent tears and punctures to the media.*

VariCel's rigid construction with supported pleat media pack maintains a compact, unitized structure even under tough operating conditions. Variable air velocity and repeated fan shutdown do not compromise performance.

Unitized Construction
Interlocked header and cell sides, along the entire length of each side, provide maximum sealing. Competitive filters are designed with loose fitting headers which allow greater potential for bypass leakage.



Pleats and Separators Bonded For Strength
During the pleating process, spots of glue are applied to bond each separator to the adjacent pleat. This solidifies the media pack to minimize movement and prevent media damage. Burst strength is increased to prevent the filter from blowing out under variable air volume conditions or unusually high resistance.

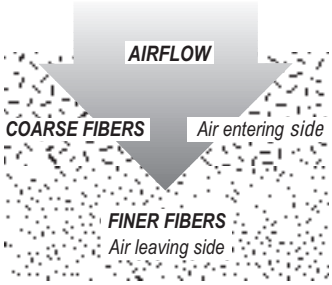
Galvanized steel headers and cell sides resist damage during shipping and handling, and prevent corrosion over long service life. (HT VariCel filters are constructed of aluminized steel.)

Easy Installation
Rigid construction and minimum depth make VariCel filters easy to install in all types of systems.

Dual Density Media Reduces Operating Costs

VariCel media is manufactured with two layers of glass fibers: coarser fibers on the air entering side and finer fibers on the air leaving side.

Our dual density design allows dirt particles to be collected throughout the entire depth of the filter utilizing the full cleaning potential of the media. Maximum dust holding capacity extends the life of the filter, minimizing operating costs.



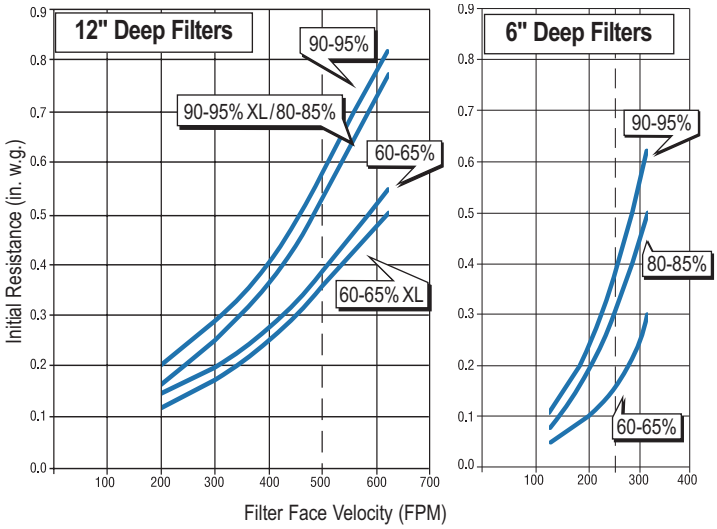
The water resistant media can withstand intermittent exposure to water, making VariCel filters ideal for installations in humid areas or where the filters are exposed to moisture.

AmericanAirFilter®

VariCel® and VariCel® with Antimicrobial

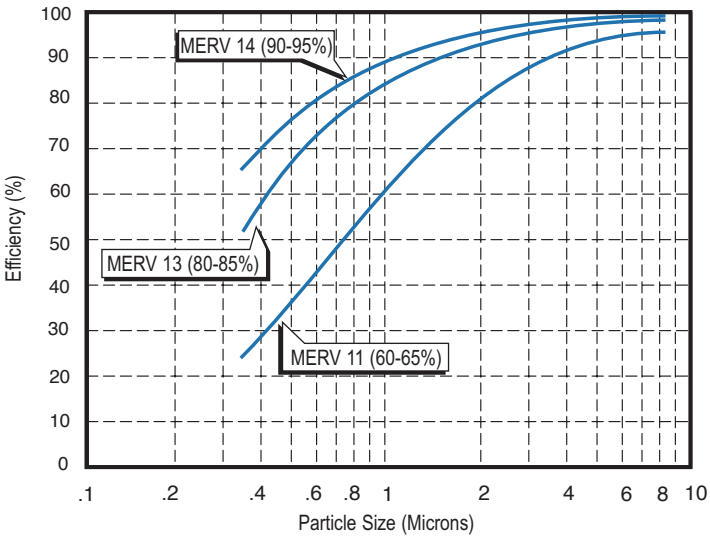
Operating Data

Initial Resistance vs. Filter Face Velocity



12" deep filters are rated at 500 FPM filter face velocity.
6" deep filters are rated at 250 FPM filter face velocity.
Recommended final resistance for all VariCel filters is 1.5" w.g.

Efficiency by Particle Size*



** Tested in accordance with ASHRAE Standard 52.2-1999*

Operating Temperature Limits

VariCel Model	Temperature Limit	
Types SH, DH, XL	350°F	177°C
Type HT-500	500°F	260°C
Type HT-725	750°F	385°C
Type HT-900	900°F	482°C
Type NH	200°F	93°C

Underwriters Laboratories Inc. Classification: All VariCels are Class 1. Testing was performed according to UL Standard 900 and CAN 4-S111.

Prefilters Can Double VariCel Life

Using prefilters, such as AAF's PerfectPleat® pleated filters or "5700" panel filters, will greatly extend the life of VariCel filters.

Options

- *VariCel filters can be ordered with faceguards made of flattened, expanded, galvanized or aluminized steel on one or both sides of the filter.*
- *Factory installed gaskets are available on the front or back of the header.*
- *Vinyl coated separators are available for corrosive conditions.*
- *1⅛" Single Header VariCels, designed for other manufacturers' equipment, are also available.*

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AAF has a policy of continuous product research and improvement and reserves the right to change design and specifications without notice.

AFP-1-158T JAN '07 MP 5M

AAF INTERNATIONAL *Better Air is Our Business®*

AmericanAirFilter®
VariCel® and VariCel® with Antimicrobial

Engineering Data

Supplement to Bulletin AFP-1-158

[1,2]Nominal Size (Inches) (W x H x D)	[3]Rated Airflow Capacity (SCFM)	Resistance (in. w.g.) [4]Initial Standard	[5]XL Series	Recommended Final	Gross Media Area (ft²) Standard	[5]XL Series
[6]Rated Filter Face Velocity — 500 FPM						
24 x 24 x 12	2000	.58	.56	1.5	125	175
[7] 24 x 24 x 12	2000	.58	.56	1.5	132	187
20 x 25 x 12	1750	.58	.56	1.5	108	152
20 x 24 x 12	1650	.58	.56	1.5	103	145
20 x 20 x 12	1400	.58	.56	1.5	84	118
18 x 24 x 12	1500	.58	.56	1.5	91	129
16 x 25 x 12	1400	.58	.56	1.5	84	118
16 x 20 x 12	1100	.58	.56	1.5	65	92
12 x 24 x 12	1000	.58	.56	1.5	57	80
[6]Rated Filter Face Velocity — 500 FPM						
24 x 24 x 12	2000	.56	-	1.5	105	-
[7] 24 x 24 x 12	2000	.56	-	1.5	113	-
20 x 25 x 12	1750	.56	-	1.5	90	-
20 x 24 x 12	1650	.56	-	1.5	86	-
20 x 20 x 12	1400	.56	-	1.5	70	-
18 x 24 x 12	1500	.56	-	1.5	76	-
16 x 25 x 12	1400	.56	-	1.5	70	-
16 x 20 x 12	1100	.56	-	1.5	54	-
12 x 24 x 12	1000	.56	-	1.5	47	-
[6]Rated Filter Face Velocity — 500 FPM						
24 x 24 x 12	2000	.39	.37	1.5	105	175
[7] 24 x 24 x 12	2000	.39	.37	1.5	113	187
20 x 25 x 12	1750	.39	.37	1.5	90	152
20 x 24 x 12	1650	.39	.37	1.5	86	145
20 x 20 x 12	1400	.39	.37	1.5	70	118
18 x 24 x 12	1500	.39	.37	1.5	76	129
16 x 25 x 12	1400	.39	.37	1.5	70	118
16 x 20 x 12	1100	.39	.37	1.5	54	92
12 x 24 x 12	1000	.39	.37	1.5	47	80

	[1,2]Nominal Size (Inches) (W x H x D)	[3]Rated Airflow Capacity (SCFM)	Resistance (in. w.g.) [6]Initial	Recommended Final	Gross Media Area (ft²)
[4]90-95% Average Efficiency	**[6]Rated Filter Face Velocity — 250 FPM**				
	24 x 24 x 6	1000	.38	1.5	60
	[7] 24 x 24 x 6	1000	.38	1.5	63
	20 x 25 x 6	875	.38	1.5	52
	20 x 24 x 6	825	.38	1.5	49
	20 x 20 x 6	700	.38	1.5	40
	18 x 24 x 6	750	.38	1.5	44
	16 x 25 x 6	700	.38	1.5	40
	16 x 20 x 6	550	.38	1.5	31
	12 x 24 x 6	500	.38	1.5	27
[4]80-85% Average Efficiency	**[6]Rated Filter Face Velocity — 250 FPM**				
	24 x 24 x 6	1000	.31	1.5	50
	[7] 24 x 24 x 6	1000	.31	1.5	54
	20 x 25 x 6	875	.31	1.5	43
	20 x 24 x 6	825	.31	1.5	41
	20 x 20 x 6	700	.31	1.5	33
	18 x 24 x 6	750	.31	1.5	36
	16 x 25 x 6	700	.31	1.5	33
	16 x 20 x 6	550	.31	1.5	26
	12 x 24 x 6	500	.31	1.5	22
[4]60-65% Average Efficiency	**[6]Rated Filter Face Velocity — 250 FPM**				
	24 x 24 x 6	1000	.16	1.5	50
	[7] 24 x 24 x 6	1000	.16	1.5	54
	20 x 25 x 6	875	.16	1.5	43
	20 x 24 x 6	825	.16	1.5	41
	20 x 20 x 6	700	.16	1.5	33
	18 x 24 x 6	750	.16	1.5	36
	16 x 25 x 6	700	.16	1.5	33
	16 x 20 x 6	550	.16	1.5	26
	12 x 24 x 6	500	.16	1.5	22

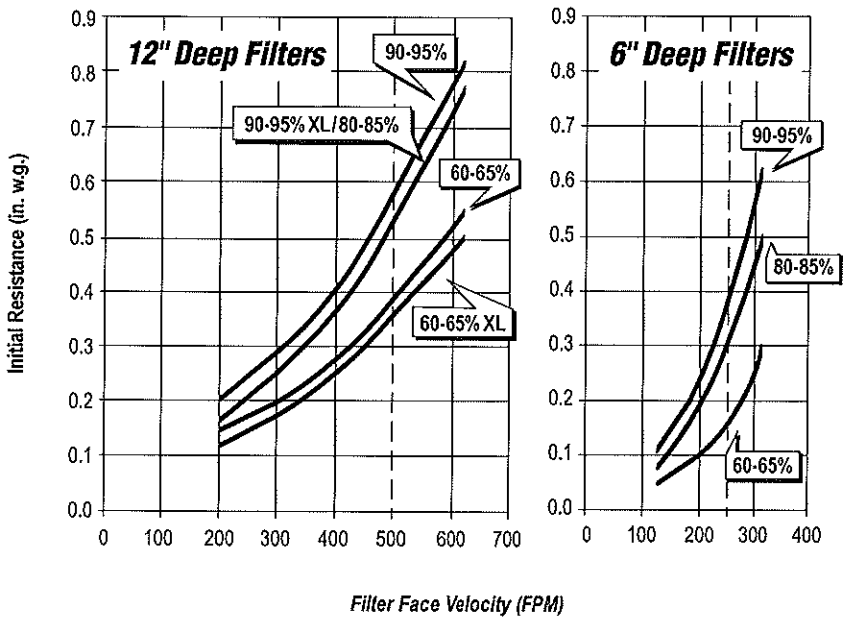
(1) Width and height dimension are interchangeable. VariCels can be installed with the pleats either vertical or horizontal.
(2) Actual dimensions are 5/8" less than nominal. (24" x 24" is 23 3/8" x 23 3/8").
(3) SCFM (Standard Cubic Feet per Minute): Rated Airflow Capacity at "Standard" Conditions - 68°F (20°C) at Sea Level (29.92" of Mercury).
(4) All performance data is based on the ASHRAE 52.1-1992 test method. Performance tolerances conform to Section 7.4 of ARI Standard 850-84.
(5) XL Series VariCels are available with single header and double header construction, 12" deep, and 90-95% and 60-65% efficiencies.
(6) VariCel filters can be operated up to 125% of rated filter face velocity.
(7) Full size 24" x 24" actual face dimensions. Available in double header construction only.

AmericanAirFilter

VariCel®/VariCel® with Antimicrobial

Performance Information

Initial Resistance vs. Filter Face Velocity



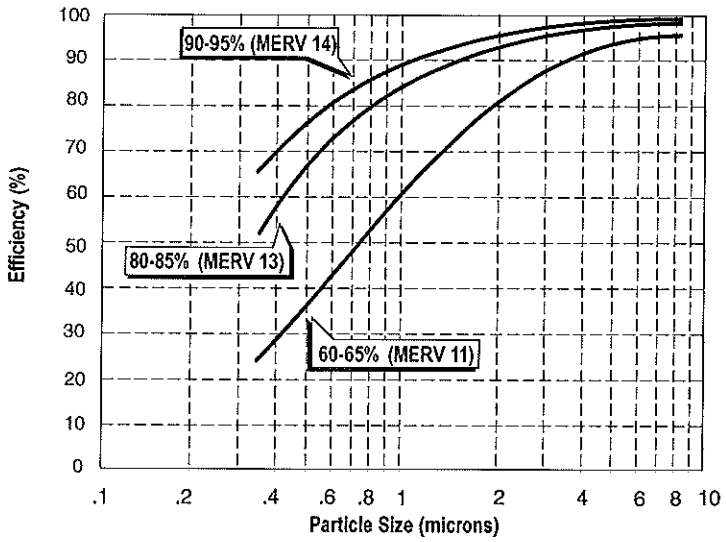
12" deep filters are rated at 500 FPM filter face velocity.
6" deep filters are rated at 250 FPM filter face velocity.
Recommended final resistance for all VariCel filters is 1.5 in. w.g.

Operating Temperature Limits

VariCel Model	Temperature Limit	
Types SH, DH, XL	350°F	177°C
Type HT-500	500°F	260°C
Type HT-725	750°F	385°C
Type HT-900	900°F	482°C
Type NH	200°F	93°C

Underwriters Laboratories Inc. Classification:
All VariCels are Class 1. Testing was performed according to UL Standard 900 and CAN 4-S111.

Efficiency by Particle Size*



* Tested in accordance with ASHRAE Standard 52.2-1999

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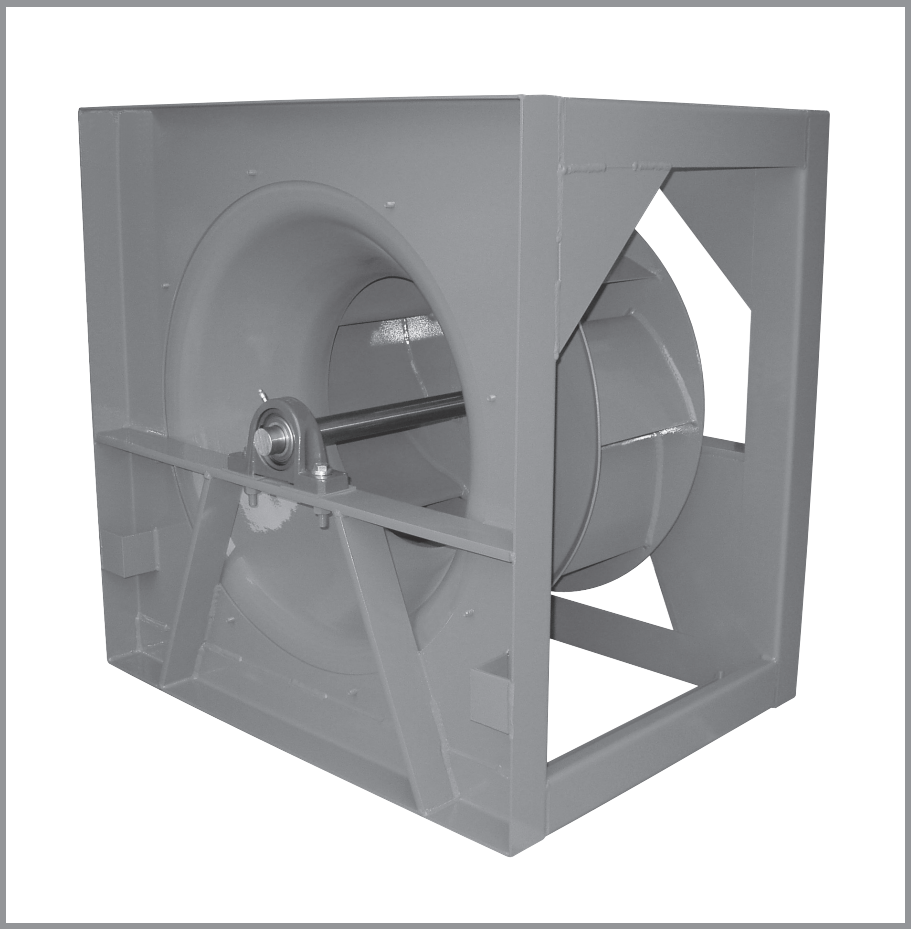
AFP-1-158A SUP APR '06

Twin City Fan & Blower

BULLETIN 470
January 2007

E-SERIES PLENUM FANS

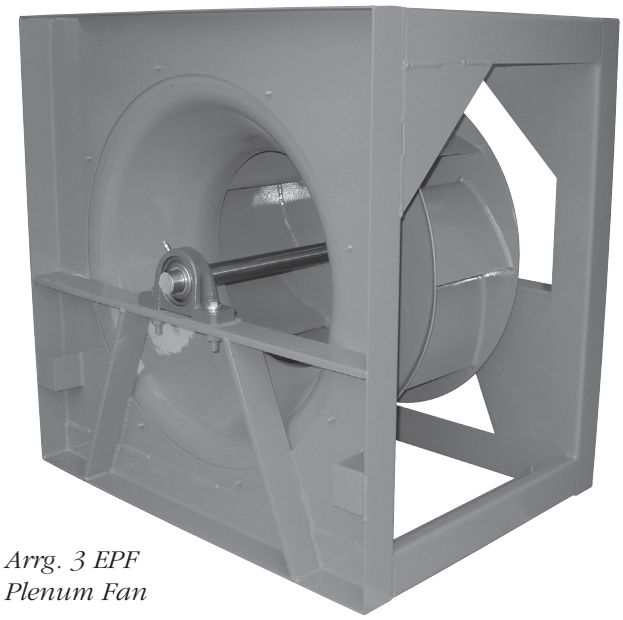
TYPE EPF, EPFN (High Efficiency)
TYPE EPQ, EPQN (Better Sound Quality)



E-Series Plenum Fans

Twin City Fan & Blower, the world's largest supplier of plenum fans, now offers the completely redesigned E-Series, the first plenum fan to be AMCA licensed for sound and air in both an Arrangement 1 and 3 configuration.

The E-Series offers the flexibility of two plenum fan designs, with each model offering its own unique performance characteristics. While every E-Series fan is highly efficient and quiet, you can choose an E-Series design option that optimizes the performance requirements most important to your application.



Arrg. 3 EPF Plenum Fan

9-Bladed Wheel Models

EPF (Arr. 3)

The model EPF features a highly efficient and cost effective, nine-bladed airfoil wheel design. The high efficiency of the EPF will often allow the use of smaller fans without increasing power requirements. The EPF is an Arrangement 3 design.

EPFN (Arr. 1 and 4)

The model EPFN features the same highly efficient, nine-bladed airfoil wheel design as the EPF, but is available in Arrangement 1 or 4 designs without inlet obstructions.

12-Bladed Wheel Models

EPQ (Arr. 3)

The Better Sound Quality model EPQ features a twelve-bladed airfoil wheel design that flattens the sound spectrum and reduces the dominance of pure tones. The EPQ is an Arrangement 3 design.

EPQN (Arr. 1 and 4)

The model EPQN features the same Better Sound Quality, twelve-bladed airfoil wheel design as the EPQ, but is available in Arrangement 1 or 4 without inlet obstructions.

Ultra Low Vibration Options

The standard E-Series plenum fans already offers a low vibration design, but when faced with stringent vibration requirements, Twin City Fan & Blower offers patent pending Ultra Low Vibration (ULV) designs with a full spectrum dynamic balance.

Along with the ULV balance guarantee, a full vibration report is provided that includes a summary of banded spectrum limits, spectrum plots on 3 axes, a waterfall (cascade) plot, a time waveform plot, and a transient capture (coast down) plot.

Compact Designs with Performance Assurance

Space is often a key consideration in the selection of plenum fans, making the compact Arrangement 3 configuration very popular.

The Arrangement 3 configuration is constructed with a bearing and bearing bar in the inlet, which will affect fan performance. These performance affects should be taken into account to ensure that your system functions as designed.

As the leading supplier of plenum fans, Twin City Fan & Blower understands the importance of having confidence in performance ratings. Twin City Fan provides our customers that confidence as the only plenum fan manufacturer to offer AMCA licensed sound and air performance on both the Arrangement 1 and 3 fan designs.

amca CERTIFIED RATINGS SOUND AND AIR PERFORMANCE ® AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

Twin City Fan & Blower certifies that the Type EPF, EPFN, EPQ & EPQN Plenum Fans shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

Refer to Bulletin 475 for sound power levels.

Application Information

Plenum fans are unhoused fans designed to operate inside of field-fabricated or factory-built air handling units.

The fan wheel pressurizes the entire surrounding air plenum in which the fan is installed, allowing air ducts from any direction to be directly connected to the air handling unit enclosure. This design generally saves space by eliminating the fan housing, transitions, and diffusers within the air handling unit.

Plenum fans have found a ready acceptance in the air conditioning industry. In addition, the construction versatility, adaptability in the direction of the discharges, suitability for internal isolation and application of sound panels, and generally lower cost makes it a very popular fan arrangement.

Benefits of a Plenum Fan

Saves Space – There are no housings, transitions, or diffusers within the air handling unit.

Efficiency – Plenum fans can be as efficient or more efficient than scroll type fans at specific operating points towards the bottom of the fan curve.

Lower cost – Plenum fans are less expensive than scroll type fans.

EPQ / EPQN Advantage

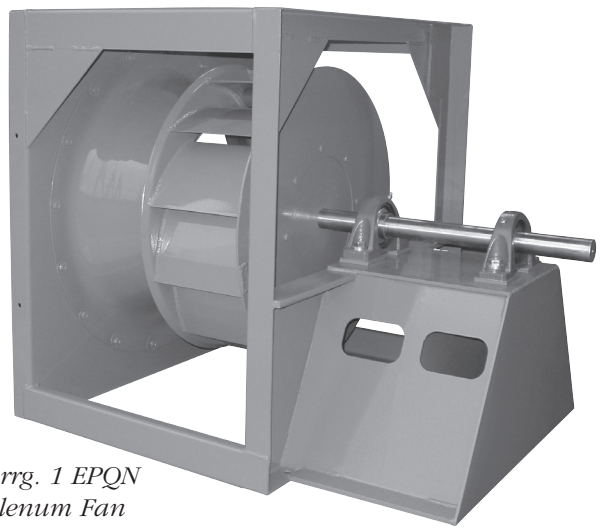
The EPQ/EPQN plenum fans offers unique performance features that are beneficial for many sound sensitive and higher pressure applications.

The EPQ/EPQN features a twelve-bladed airfoil wheel versus the nine-bladed wheel of our type EPF/EPFN plenum fans or eight- to ten-bladed wheels with most other competition. The "Q" in the EPQ/EPQN designation stands for Better Noise Quality. Noise quality is a subjective description for noise that is less objectionable.

Looking at the sound comparison, you will notice that the type EPQ/EPQN offers noise (SPL) that is more equally distributed across all frequencies. This can be more pleasant to hear than the sound characteristics of a nine-bladed design. Fans are often dominated in noise by the noise occurring at the blade pass frequency. (Blade pass frequency = RPM x Number of blades/60.) Noise quality is improved by reducing the difference in amplitude between the blade pass amplitudes and the neighboring frequency amplitudes. The increased higher frequency sound power levels on the twelve-bladed wheels mask the blade pass frequency offering a better sounding fan. Although the overall A-weighted sound power levels of the nine-bladed EPF/EPFN fans are slightly lower, the sound "quality" of the twelve-bladed EPQ/EPQN fans may be desirable for the application.

A higher blade pass frequency allows for easier attenuation of the noise, especially when installed inside an air handler cabinet. In many applications, the use of the EPQ/EPQN design will move the blade pass frequency from the second octave band to the third octave band. Acoustic silencers will normally perform about 10 dB better in the third band.

In addition to sound considerations, there are also additional benefits to using the EPQ/EPQN at higher pressures. Selections over 8" wg static pressure are often near the peak pressure of the fan. The additional blades give a higher peak pressure and also add stability to the fan. Twelve smaller passages through the fan wheel are more resistant to flow disturbances on the inlet than nine larger passages. The EPQ/EPQN is thus more resistant to system effects when operating at high pressures and the higher inlet velocities that accompany these selections.



Arrg. 1 EPQN Plenum Fan

TYPE	CFM	SP	RPM	BHP	FREQUENCY, HZ								LwA
					63	125	250	500	1000	2000	4000	8000	
EPQN – 12 Blades	20,000	3	977	13.42	86	89	(90)	83	81	77	69	64	87
EPFN – 9 Blades	20,000	3	967	12.92	89	(94)	87	79	80	74	67	63	85

NOTE: Circled figures indicate blade pass frequency.

Construction Features

Wheels

High efficiency, non-overloading airfoil wheels are provided on all sizes and arrangements.

Arr. 1 and 3 – Aluminum wheels using extruded aluminum blades are standard to size 245 on arrangement 1 and 3 fans, and available as an option on larger sizes. Steel wheels are standard on sizes 270 and larger.

Arr. 4 – Aluminum wheels using extruded aluminum blades are standard to size 600 on direct drive arrangement 4 fans, a popular choice for applications requiring precision balance and improved reliability.

Inlet Cones

Heavy-gauge, spun steel inlet cones are closely matched to the wheel intake rim to ensure efficient and quiet operation.

Structural Frame

Frames are constructed of heavy-gauge steel, continuously welded at all connections for maximum strength and rigidity. The "cross frame" bearing support is designed for maximum stability and load distribution.

Shafts

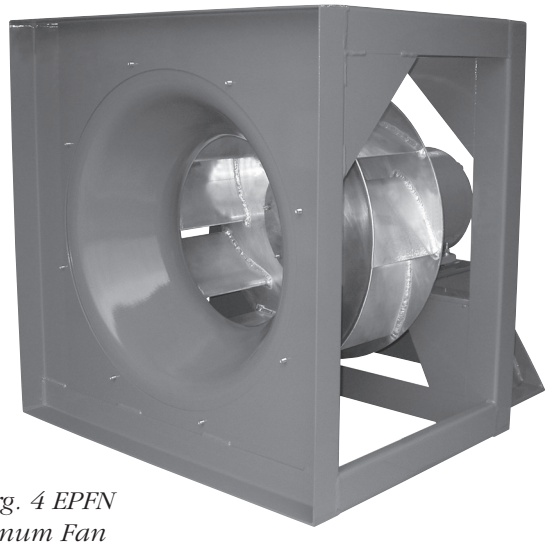
Shafts are AISI Grade 1040 or 1045 hot-rolled steel accurately turned, ground, polished, and ring-gauged for verification. Shafts are generously sized for a first critical speed of at least 1.43 times the maximum speed for the class.

Fan Bearings

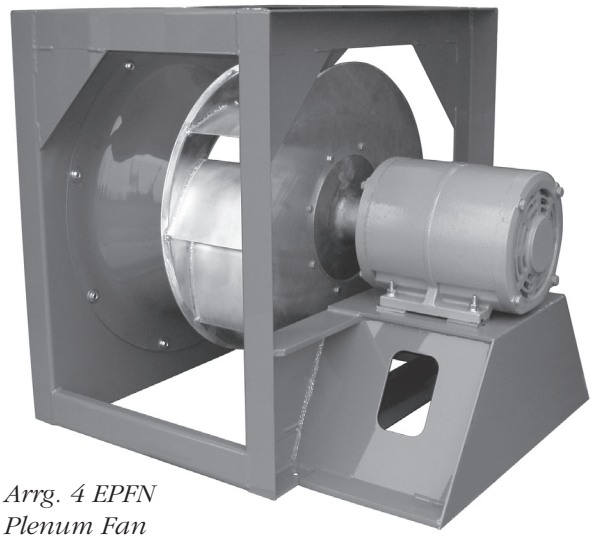
Either ball (adapter mount) or spherical roller, heavy-duty, self-aligning, pillow block type bearings are provided. Bearing selection is based on minimum L-10 life of 80,000 hours. Considering the long life offered with our standard bearing selections, we do not recommend upgrades to split-roller bearings due to their large size, especially on Arrangement 3 fans.

Inlet Collar

Horizontal configurations are designed to be flex-connected to the perimeter of the square panel without the addition of an inlet collar.



Arrg. 4 EPFN Plenum Fan



Arrg. 4 EPFN Plenum Fan

Flow Measurement System

Piezometer Ring (Airflow Measuring System)

A piezometer ring is available on plenum fans, as well as other Twin City Fan housed fans, as part of an airflow measuring system, based on the principle of a flow nozzle. The inlet cone of the fan is used as the flow nozzle. The flow can be calculated by measuring the pressure drop through the inlet cone. No tubes or sensors are inserted in the high velocity airstream which could obstruct airflow.

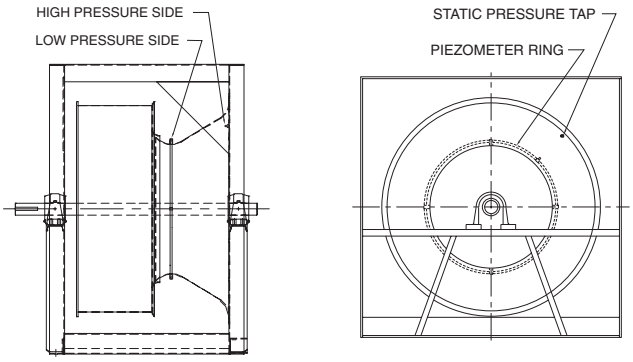
The system, consists of a piezometer ring mounted at the throat and a static pressure tap mounted on the face of the inlet cone. A differential pressure transducer and digital display can also be provided.

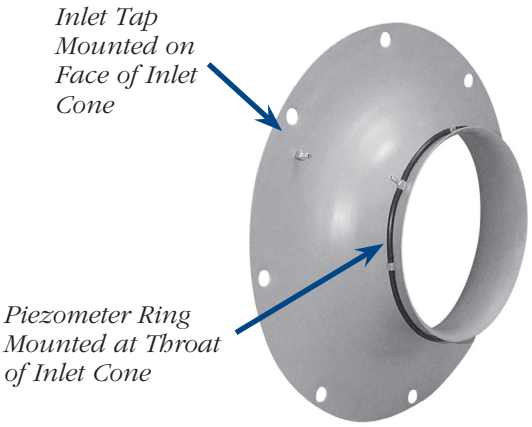
The pressure drop is measured from the tap located on the face of the inlet cone to the piezometer ring in the throat. The inlet tap is connected to the high-pressure side of the transducer and the piezometer ring is connected to the low-pressure side. See diagram on right.

Based on Twin City Fan laboratory tests, the system was determined to be accurate within +/-5%.

Refer to Twin City Fan Engineering Supplement ES-105.

NOTE: Twin City Fan does not recommend placement of flow measuring probes inside the fan inlet cone in the path of airflow. These devices create disturbances and unpredictable performance losses. Twin City Fan will not be responsible for loss of performance due to such devices.





Accessories

Variable Inlet Vanes

Variable inlet vanes provide economical, stable, and efficient air volume control for manual or motorized operation. Blades are supported with fatigue-resistant steel shafts and two needle roller bearings riding on zone-hardened surfaces to minimize wear. Bearings are lubricated for life with high grade moisture resistant grease and protected with lip seals. The vane bearing housings are welded in position and stiffened with a welded support ring. The welded structure eliminates flutter and vibration while utilizing a cantilevered design to minimize insertion loss.

NOTE: Inlet vanes are not recommended on fans smaller than size 182 due to noise and performance loss.

Inlet Screen

Heavy-gauge barbecue grille style inlet screen that nests in the inlet funnel for personnel protection on non-ducted inlets.

Inlet Collar

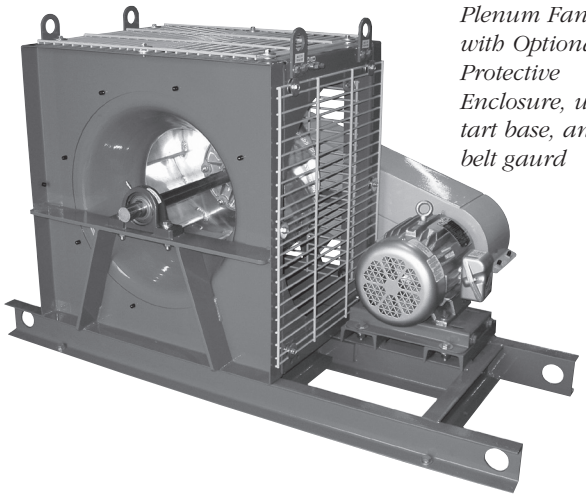
The standard, square-panel design provides the means for flex connecting on all arrangements without an inlet collar.

Belt Guard

Provides protection to personnel from the moving drive parts. Both standard and OSHA totally enclosed types are available.

Protective Enclosure

Grill style protective enclosure completely encloses all sides and the back of the fan wheel. Side panels are individually removable to provide access to the wheel.



Arrg. 3 EPQ Plenum Fan with Optional Protective Enclosure, unitart base, and belt gaurd

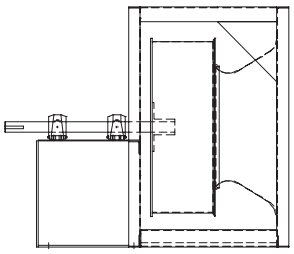
NOTE: On belt driven units, a belt guard should be used for full protection.

Arrangements

Arrangement 1

Arrangement 1 features an overhung wheel design suitable for V-belt drive and requires mounting of motor independent of the fan.

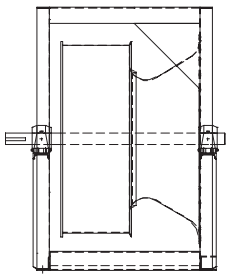
- Models EPFN and EPQN.
- Class I and II available in sizes 122 to 730. See dimensional drawing on page 28.
- Class III available in sizes 182 to 730. Contact factory for dimensional drawing.



Arrangement 3 (Horizontal)

This is the most common plenum fan arrangement for use in OEM and site-built air handlers. Arrangement 3 is suitable for V-belt drive and requires mounting of the motor independently of the fan. Twin City Fan & Blower offers common unitary bases and isolation bases for the fan and motor as accessories.

- Models EPF and EPQ.
- Class I and II available in sizes 122 to 730. See dimensional drawing on page 29.
- Class III available in sizes 182 to 730. See dimensional drawings on page 30.

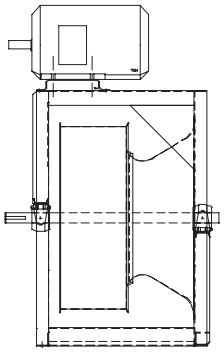


Arrangements 3HS and 3HA (Horizontal with Top Mounted Motor)

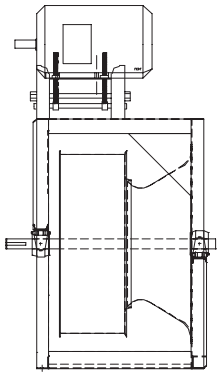
Arrangements 3HS and 3HA provide a means for mounting the motor on top of the unit. This design is often desirable when floor space is limited.

Available with two different motor mounting options: slide base type (Arrangement 3HS) and adjustable motor base (Arrangement 3HA). Due to limited belt center range, NEMA "slide base" option is available on sizes 182 and larger only. A heavy duty Twin City Fan & Blower designed "adjustable motor base" is available for all fan sizes.

- Models EPF and EPQ.
- Arrangement 3HS is available in Class I and II with motor slide base for sizes 182 to 542. See dimensional drawing on page 32.
- Arrangement 3HA with pivot motor base is available in Class I and II for sizes 122 to 542. See dimensional drawing on page 32.



Arrg. 3HS



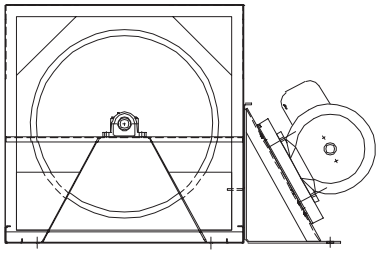
Arrg. 3HA

Arrangements

Arrangement 3SM (Horizontal With Side Mounted Motor)

Arrangement 3SM is designed to provide an economical and space-saving means to supply plenum fans with motors mounted to the side of the fan frame. A motor slide base allows for quick and easy belt adjustments.

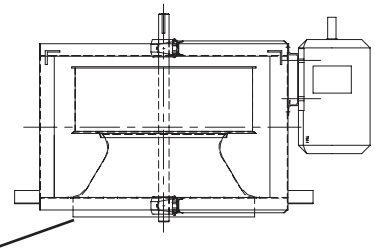
- Models EPF and EPQ.
- Class I and II available in sizes 165 to 600. Motor limited to maximum frame size shown on drawing.
- See dimensional drawing on page 31.



Arrangements 3VS and 3VA (Vertical with Side Mounted Motor)

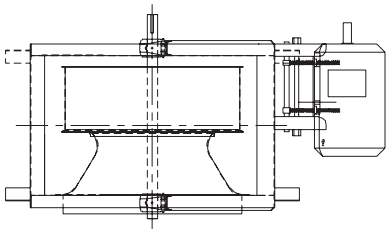
Vertical Arrangement 3 is available with two different motor mounting options: slide base type (Arrangement 3VS) and adjustable motor base (Arrangement 3VA). Due to limited belt center range, NEMA "slide base" option is available on sizes 182 and larger only. A heavy duty Twin City Fan & Blower designed "adjustable motor base" is available for all fan sizes.

- Models EPF and EPQ.
- Arrangement 3VS is available in Class I and II with motor slide base for sizes 182 to 542. See dimensional drawing on page 33.
- Arrangement 3VA with pivot motor base is available in Class I and II for sizes 122 to 542. See dimensional drawing on page 33.
- Unless specified otherwise, units will be built for vertical up airflow.



Inlet collar is now optional on 3VS, 3VA

Arrg. 3VS



Arrg. 3VA

Shown with optional Inlet collar.

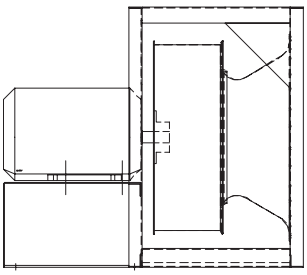
Arrangement 4 (Horizontal)

Direct drive Arrangement 4 mounts the fan wheel directly onto the motor shaft. This arrangement provides a compact fan/motor unit which eliminates belt residue and requires less maintenance than other arrangements.

For these reasons, Arrangement 4 plenum fans are widely used in cleanroom, pharmaceutical, and other critical applications.

Fans can be selected with varying wheel widths to provide desired performance at direct drive motor speeds. Performance changes in the field are usually achieved by means of variable inlet vanes or VFD.

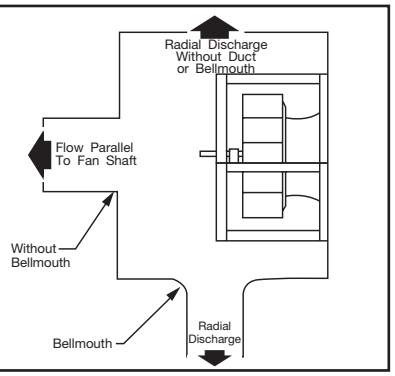
- Models EPFN and EPQN.
- Aluminum wheels using extruded aluminum blades are standard.
- Class I and II available in sizes 122 to 600.
- Class III available in sizes 182 to 600.
- See dimensional drawing on page 34.



Duct Entrance Losses From Plenum Fan Cabinet

To achieve the air velocity in the discharge duct and overcome the loss associated with the air entering the ductwork, additional resistance must be added to the external static pressure (ESP) requirements of the fan. Different types of duct entrances and locations will require varying correction factors. Therefore, prior to selecting a fan, make the following correction, depending upon the type of duct and its location.

ADDITIONAL DUCT ENTRANCE LOSS TO BE ADDED TO FAN ESP	
DISCHARGE TYPE	**CORRECTION FACTOR**
• Radial and ducted with bellmouth	1.1 x Duct Velocity Pressure
• Radial and ducted without bellmouth	1.4 x Duct Velocity Pressure
• Radial without duct or bellmouth	1.8 x Duct Velocity Pressure
• Flow parallel to shaft and ducted with bellmouth	1.6 x Duct Velocity Pressure
• Flow parallel to shaft and ducted without bellmouth	1.9 x Duct Velocity Pressure
• Flow parallel to shaft without duct or bellmouth	2.4 x Duct Velocity Pressure



Example: A system requires 30,000 CFM at 5" SP at standard air density with one 4 ft diameter duct with bell-mouth placed in a radial discharge. Determine RPM and brake horsepower:

Duct area = $(4^2 \times \pi) \div 4 = 12.57$ ft^2
Duct velocity = 30,000 ÷ 12.57 = 2387 FPM
Duct velocity pressure = $(2387 \div 4005)^2 = 0.355$ @ std. cond.

Entrance loss correction factor = 1.1 x duct velocity pressure
= 1.1 x 0.355 = 0.39
Thus, select the fan for = 5" + 0.39" = 5.39" S.P.

Application Guidelines

Fan Selection Recommendations

1. System effect losses (see AMCA 201) and plenum losses should be estimated and added to the required static pressure, prior to making selections. Refer to AMCA Publication 201 at www.amca.org and Twin City Fan Engineering Data Letter "Fan Performance Troubleshooting Guide" (ED-100) at www.tcf.com.
2. Fans should be selected so that the point of operation is approximately between 55% and 90% of the free delivery point on the fan curve.
3. Avoid selections over 4000 RPM. A narrow width, larger size impeller can be used to avoid this.
4. Arrangements 1 and 4 will offer the best efficiency and lowest noise as there are no inlet obstructions.
5. Where space is available, mount the fan and motor on a sub-base. The motor can be mounted on the fan on Arrangements 3HS, 3HA, 3SM, 3VS, and 3VA.
6. Use inertia-type isolation bases or rigid mounting for lowest fan vibration. Rigid mounting requires dynamic analysis (by others) of the support structure to avoid resonance.
7. Applications exceeding 10" SP are prone to high system effect losses. Use of housed fans (BAE-DWDI) should be considered.
8. Where static pressures over 8" wg are required, Type EPQ or EPQN are preferred because of lower operating speeds and improved stability. Select the fan so the design pressure is at least 10% below the peak pressure.
9. Where flow monitoring is required, use a piezometer ring or externally mounted flow measurement station. Fan performance may be substantially affected by flow measurement probes mounted directly in the fan inlet cone. Refer to page 5.
10. For direct drive fans without speed control (or where speed control cannot exceed 60 Hz), select fans at 3 – 5% below the nominal speed of the motor. This will normally cover the uncertainties associated with the system and air balancer's measurements. Select motors loaded no closer than 90% of the maximum loading of the motor.
11. For multiple fans in a plenum, alternate CW and CCW rotation fans to minimize losses. If fans are not counter-rotating, install walls between each fan to create cells in the outlet plenum.
12. Add losses for duct take-offs per the chart above to pressure requirements of the fan. Bellmouth entries will always reduce losses and are recommended.
13. For highest reliability, specify the required bearing life. For example, the statement "minimum L-10 bearing life = 100,000 hours" allows for the best bearing to be put on the fan without creating other problems. Some specifications state "use split roller bearings." This can cause a number of problems, such as:
    1. On smaller fans, there may not be enough radial load to prevent roller skidding. This is especially a problem for Arrangement 3 fans.
    2. Split roller bearings are not offered in sizes smaller than 1 7/16" bore. Smaller fans use shafts smaller than this.
    3. The oversized bearing in the inlet will block some air in smaller fans (above the losses that are already included in the EPF/EPQ ratings).

Application Guidelines

Location and Placement of Fans in Air Handlers

1. Center the fan inlets in both the horizontal and vertical planes.
2. For inlet clearance, see Figure 1. The flow should converge at an angle not greater than 45° when approaching the opening for the fan inlet. A minimum of one fan wheel diameter clearance is recommended.
3. In the fan outlet plenum, a minimum wall clearance of one-half fan wheel diameter to the periphery of the fan wheel is recommended.
4. Figure 1 shows that the minimum clearance between the back of the fan wheel and the nearest component downstream (Dim. E) should be one wheel diameter. Small clearances do not allow the flow to equalize behind the fan wheel and the pressure drop of the downstream component is increased.
5. When the flow enters the inlet plenum perpendicular to the fan shaft, large system effect losses can occur. See Figure 2 for a recommended flow baffle or a vortex breaker that may help preserve rated fan performance.
6. When two or more fans are installed in a plenum, divide the plenum into imaginary cells of equal area. Center the fan inlets on each cell. See Figure 3.

Installation Recommendations

1. Install the fan so the flexible connector on the inlet remains uncollapsed during operation.
2. Install thrust restraints (snubbers) to maintain the axial position of the fan when it is generating pressure.
3. Peripheral equipment, such as electrical components, inverters, control panels, etc., should be positioned away from the high velocity air entering or leaving the fan.
4. Adjust springs on the isolation base so that spring deflection is approximately equal for all isolators.
5. Follow safety, installation, start-up, and maintenance instructions supplied with each fan.

Figure 1. Recommended Location of Fan in Plenum

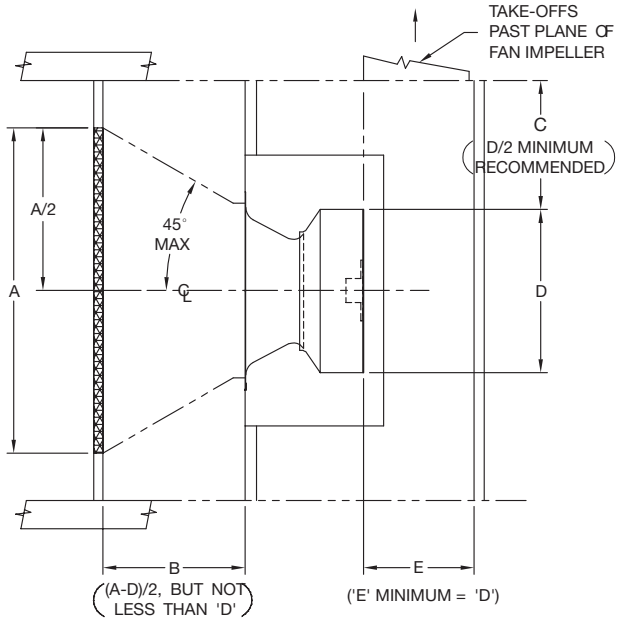


Figure 2. Flow Baffle and Vortex Spin Breaker Location

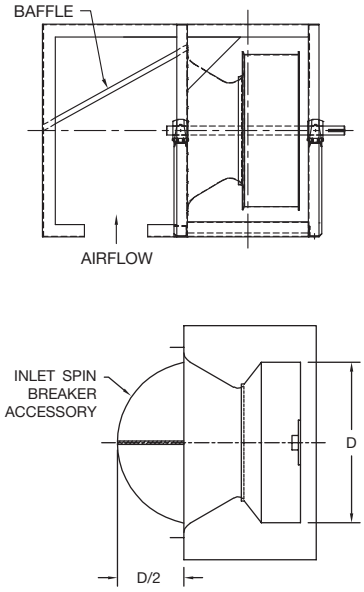
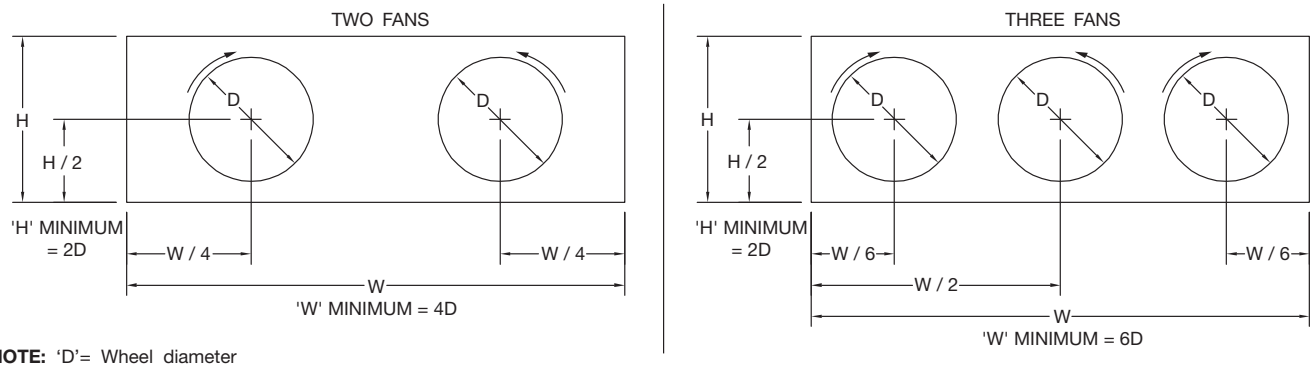


Figure 3. Location of Counter-Rotating Fans



NOTE: 'D'= Wheel diameter

Engineering Data

Maximum RPM, Wheel Weights, & WR^2 – EPF and EPFN

EPF EPFN	WHEEL DIA. (IN.)	CLASS I					CLASS II					CLASS III				
		MAX.	ALUMINUM		STEEL		MAX.	ALUMINUM		STEEL		MAX.	ALUMINUM		STEEL	
		RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)	RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)	RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)
122	12.40	3388	9	0.9	N/A	N/A	4000	9	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
150	13.98	3006	12	1.7	N/A	N/A	3909	12	1.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
165	15.75	2668	15	2.9	N/A	N/A	3468	15	2.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
182	18.25	2302	17	6.1	N/A	N/A	2930	18	6.1	N/A	N/A	3767	21	6.2	N/A	N/A
200	20.00	2101	21	6.4	N/A	N/A	2674	21	7.4	N/A	N/A	3438	24	9.3	N/A	N/A
222	22.25	1888	30	12	N/A	N/A	2403	30	12	N/A	N/A	3090	34	15	N/A	N/A
245	24.50	1715	35	21	N/A	N/A	2183	35	21	N/A	N/A	2806	38	22	N/A	N/A
270	27.00	1556	40	29	85	84	1981	40	29	97	93	2546	47	32	131	125
300	30.00	1401	49	46	103	120	1783	54	51	111	128	2291	58	52	153	178
330	33.00	1273	62	70	136	194	1620	67	76	154	215	2083	72	77	206	294
365	36.50	1151	73	103	157	273	1465	79	112	179	306	1884	84	114	237	409
402	40.25	1044	85	151	180	376	1329	93	165	209	429	1708	98	166	310	647
445	44.50	944	126	233	327	880	1202	135	253	351	932	1545	142	256	470	1255
490	49.00	857	164	391	366	1171	1091	164	391	395	1249	1403	174	535	535	1708
542	54.25	775	227	632	513	2048	986	227	632	653	2562	1267	239	673	696	2778
600	60.00	700	255	931	662	3224	891	255	931	750	3542	1146	270	991	801	3838
660	66.00	637	346	1377	953	5621	810	346	1377	1099	6510	1041	371	1478	1016	5910
730	73.00	576	412	2049	1076	7630	733	499	2671	1153	8058	942	550	2985	1318	9290

Maximum RPM, Wheel Weights, & WR^2 – EPQ and EPQN

EPQ EPQN	WHEEL DIA. (IN.)	CLASS I					CLASS II					CLASS III				
		MAX.	ALUMINUM		STEEL		MAX.	ALUMINUM		STEEL		MAX.	ALUMINUM		STEEL	
		RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)	RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)	RPM (70°F)	WT. (LB)	WR^2 (LB-FT^2)	WT. (LB)	WR^2 (LB-FT^2)
122	12.40	3388	10	2.1	N/A	N/A	4000	10	2.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
150	13.98	3006	13	3.3	N/A	N/A	3909	13	3.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
165	15.75	2668	17	5.2	N/A	N/A	3468	17	5.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
182	18.25	2302	20	7.2	N/A	N/A	2930	20	7.2	N/A	N/A	3767	23	7.4	N/A	N/A
200	20.00	2101	24	10	N/A	N/A	2674	24	8.4	N/A	N/A	3438	27	10	N/A	N/A
222	22.25	1888	34	14	N/A	N/A	2403	34	14	N/A	N/A	3090	38	17	N/A	N/A
245	24.50	1715	39	24	N/A	N/A	2183	39	24	N/A	N/A	2806	43	24	N/A	N/A
270	27.00	1556	46	35	96	94	1981	46	35	107	104	2546	53	38	142	135
300	30.00	1401	57	55	116	135	1783	61	59	124	144	2291	65	59	166	193
330	33.00	1273	72	81	151	216	1620	77	87	169	237	2083	82	88	222	316
365	36.50	1151	85	120	176	307	1465	91	129	199	340	1884	96	130	257	443
402	40.25	1044	99	176	203	425	1329	107	190	232	479	1708	112	190	345	721
445	44.50	944	141	274	356	955	1202	150	294	379	1007	1545	157	297	512	1367
490	49.00	857	183	451	400	1281	1091	183	451	429	1359	1403	200	481	586	1872
542	54.25	775	250	722	551	2213	986	250	722	716	2808	1267	262	763	759	3024
600	60.00	700	290	1058	740	3573	891	290	1058	824	3891	1146	305	1118	874	4188
660	66.00	637	380	1574	1047	6161	810	380	1574	1110	6450	1041	405	1675	1193	7050
730	73.00	576	454	2342	1191	8438	733	541	2964	1267	8865	942	592	3278	1433	10097

*Consult factory for fans over 4000 RPM.

Contact factory for belt driven fans above 150 HP.

Bare Fan Weights

SIZE	WHEEL DIA. (IN.)	ARR. 1 (EPQN)			ARR. 3 (EPQ)			ARR. 4 (EPQN)		
		CL I	CL II	CL III	CL I	CL II	CL III	CL I	CL II	CL III
122	12.40	93	94	N/A	79	79	N/A	83	83	N/A
150	13.98	115	117	N/A	99	101	N/A	102	102	N/A
165	15.75	133	135	N/A	114	116	N/A	120	120	N/A
182	18.25	165	169	188	143	147	164	149	150	166
200	20.00	192	192	213	167	167	186	172	172	190
222	22.25	242	246	272	209	209	238	221	221	243
245	24.50	283	288	317	245	251	277	254	254	279
270	27.00	395	412	478	342	359	429	362	374	436
300	30.00	498	506	587	432	448	524	452	461	538
330	33.00	607	633	732	526	561	654	559	578	673
365	36.50	764	804	923	670	714	811	709	732	845
402	40.25	876	915	1096	762	814	986	808	838	1016
445	44.50	1291	1326	1551	1132	1183	1431	1204	1229	1452
490	49.00	1485	1527	1776	1289	1347	1633	1383	1413	1674
542	54.25	1834	2031	2183	1628	1813	1987	1725	1899	2059
600	60.00	2086	2204	2365	1904	2036	2231	1942	2030	2200
660	66.00	2619	2724	2932	2433	2558	2810	2085	2135	2343
730	73.00	2996	3117	3428	2848	2924	3283	N/A	N/A	N/A

NOTES:

1. Arrangement 1 and 3 weights include an aluminum wheel on size 122 through 245, and a steel wheel on size 270 through 730.
2. Arrangement 4 weights include an aluminum wheel on all sizes.
3. Weights are for the 12-bladed wheel design (EPQ and EPQN). 9-bladed designs (EPF and EPFN) are slightly less and can be reduced by the difference between the wheel weights shown above.
4. Weights do not include motor, drive, motor base, or slide base.

Performance Data

122 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 12.38" **Max. BHP = 0.056 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1000	1660	0.25	2151	0.54																		
1100	1734	0.28	2182	0.57																		
1200	1811	0.31	2224	0.61	2630	0.98																
1400	1966	0.38	2338	0.70	2693	1.08	3039	1.51														
1600	2124	0.46	2486	0.81	2792	1.20	3103	1.65	3406	2.14												
1800	2291	0.55	2642	0.94	2924	1.35	3197	1.81	3473	2.31	3744	2.86										
2000	2466	0.65	2796	1.09	3076	1.53	3320	2.00	3568	2.51	3817	3.07										
2200	2647	0.77	2953	1.25	3232	1.73	3467	2.22	3687	2.74	3913	3.31										
2400	2831	0.90	3116	1.42	3386	1.94	3623	2.48	3831	3.02												
2800	3204	1.22	3462	1.81	3702	2.43	3931	3.03														
3200	3582	1.62	3824	2.28																		
3600	3966	2.12																				

MAXIMUM RPM: CLASS I = 3388 CLASS II = 4000 Selections above 4000 RPM not recommended. Consult factory.

122 EPF (9-Blade, Arr. 3)

Wheel Diameter: 12.38" **Max. BHP = 0.056 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1000	1699	0.27	2135	0.53																		
1100	1771	0.30	2189	0.58																		
1200	1848	0.33	2256	0.64	2605	0.97																
1400	2013	0.41	2392	0.76	2715	1.12	3013	1.50														
1600	2187	0.50	2538	0.87	2851	1.29	3125	1.71	3384	2.13												
1800	2367	0.60	2696	1.01	2991	1.46	3260	1.94	3501	2.40	3730	2.87	3968	3.39								
2000	2553	0.73	2864	1.17	3140	1.64	3397	2.16	3636	2.69	3854	3.20										
2200	2742	0.88	3038	1.34	3298	1.84	3542	2.39	3773	2.97	3990	3.55										
2400	2934	1.04	3216	1.55	3465	2.08	3696	2.64	3916	3.25												
2800	3326	1.44	3583	2.03	3814	2.62																
3200	3726	1.95	3962	2.62																		
3600																						

MAXIMUM RPM: CLASS I = 3388 CLASS II = 4000 Selections above 4000 RPM not recommended. Consult factory.

122 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 12.38" **Max. BHP = 0.062 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1000	1644	0.27	2046	0.53																		
1100	1721	0.30	2106	0.58																		
1200	1799	0.34	2173	0.63	2494	0.96																
1400	1963	0.42	2315	0.75	2614	1.11	2886	1.49														
1600	2132	0.51	2468	0.89	2752	1.27	3007	1.68	3245	2.12												
1800	2302	0.61	2627	1.04	2899	1.47	3144	1.90	3370	2.37	3581	2.86	3795	3.38								
2000	2475	0.72	2792	1.20	3054	1.68	3289	2.16	3507	2.64	3711	3.16	3902	3.69								
2200	2654	0.86	2961	1.37	3214	1.90	3441	2.43	3650	2.95	3848	3.49										
2400	2839	1.01	3131	1.56	3378	2.14	3598	2.72	3802	3.30	3991	3.86										
2800	3222	1.40	3475	2.00	3717	2.67	3925	3.34														
3200	3616	1.91	3835	2.55																		
3600																						

MAXIMUM RPM: CLASS I = 3388 CLASS II = 4000 Selections above 4000 RPM not recommended. Consult factory.

122 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 12.38" **Max. BHP = 0.061 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1000	1672	0.28	2076	0.55																		
1100	1752	0.31	2137	0.60																		
1200	1834	0.35	2206	0.66	2530	0.98																
1400	2006	0.44	2353	0.78	2654	1.14	2928	1.53														
1600	2185	0.54	2514	0.92	2795	1.32	3053	1.74	3292	2.18												
1800	2370	0.67	2681	1.08	2949	1.51	3193	1.98	3421	2.45	3634	2.94	3850	3.45								
2000	2560	0.82	2855	1.26	3112	1.73	3344	2.23	3561	2.74	3767	3.27	3960	3.80								
2200	2754	0.99	3034	1.47	3279	1.97	3504	2.50	3710	3.05	3907	3.62										
2400	2950	1.18	3216	1.70	3453	2.25	3668	2.81	3869	3.39												
2800	3347	1.66	3594	2.26	3811	2.88																
3200	3751	2.26	3981	2.96																		
3600																						

MAXIMUM RPM: CLASS I = 3388 CLASS II = 4000 Selections above 4000 RPM not recommended. Consult factory.

Class I = First white section
Class II = Blue shaded section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 10" above the base on fan size 122.

Performance Data

150 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 14.00" **Max. BHP = 0.154 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1200	1433	0.30																				
1400	1529	0.35	1928	0.73																		
1600	1637	0.42	1989	0.80	2336	1.28																
1800	1743	0.49	2072	0.90	2384	1.38	2689	1.94														
2200	1966	0.66	2281	1.14	2535	1.65	2791	2.22	3045	2.87	3293	3.56										
2600	2207	0.86	2495	1.42	2743	2.00	2956	2.60	3171	3.26	3388	3.98	3602	4.74	3812	5.55						
3000	2459	1.10	2716	1.75	2957	2.41	3166	3.07	3352	3.76	3535	4.49	3723	5.28								
3400	2716	1.40	2951	2.13	3173	2.87	3380	3.61	3565	4.37	3731	5.14	3892	5.94								
3800	2976	1.77	3198	2.57	3399	3.40	3595	4.22	3779	5.05												
4200	3239	2.20	3450	3.06	3637	3.98	3817	4.89														
4600	3505	2.71	3706	3.64	3883	4.62																
5000	3773	3.30																				

MAXIMUM RPM: CLASS I = 3006 CLASS II = 3909

150 EPF (9-Blade, Arr. 3)

Wheel Diameter: 14.00" **Max. BHP = 0.154 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1200	1464	0.32																				
1400	1563	0.38	1933	0.74																		
1600	1670	0.45	2025	0.86	2323	1.28																
1800	1786	0.52	2120	0.97	2406	1.44	2667	1.92														
2200	2029	0.71	2327	1.21	2594	1.78	2835	2.36	3051	2.93	3265	3.53										
2600	2285	0.96	2558	1.53	2799	2.14	3025	2.81	3235	3.50	3427	4.17	3608	4.84	3789	5.54						
3000	2548	1.27	2801	1.90	3024	2.57	3231	3.29	3428	4.05	3615	4.85	3792	5.65								
3400	2818	1.65	3052	2.36	3262	3.09	3455	3.86	3637	4.67	3813	5.53										
3800	3092	2.10	3311	2.90	3508	3.70	3691	4.53	3862	5.40												
4200	3370	2.65	3576	3.53	3761	4.40																
4600	3650	3.28	3844	4.25																		
5000																						

MAXIMUM RPM: CLASS I = 3006 CLASS II = 3909

150 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 14.00" **Max. BHP = 0.171 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1200	1414	0.32	1786	0.65																		
1400	1518	0.39	1859	0.74																		
1600	1627	0.46	1953	0.85	2228	1.27																
1800	1741	0.54	2052	0.97	2316	1.42	2555	1.92														
2200	1976	0.72	2266	1.25	2511	1.78	2732	2.32	2933	2.90	3128	3.51										
2600	2215	0.95	2494	1.57	2724	2.20	2930	2.82	3121	3.44	3301	4.11	3469	4.80	3634	5.52	3802	6.28				
3000	2466	1.24	2728	1.93	2948	2.65	3144	3.38	3325	4.10	3494	4.81	3657	5.55	3811	6.32						
3400	2729	1.60	2965	2.35	3180	3.16	3367	3.98	3540	4.81	3703	5.63	3856	6.43								
3800	2998	2.05	3207	2.84	3416	3.74	3598	4.64	3764	5.56												
4200	3272	2.59	3460	3.43	3652	4.38	3833	5.38														
4600			3721	4.13	3895	5.12																
5000																						

MAXIMUM RPM: CLASS I = 3006 CLASS II = 3909

150 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 14.00" **Max. BHP = 0.168 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1200	1437	0.33																				
1400	1545	0.40	1887	0.76																		
1600	1660	0.48	1983	0.88	2261	1.31																
1800	1780	0.57	2086	1.00	2351	1.47	2593	1.96														
2200	2030	0.79	2311	1.29	2553	1.83	2774	2.41	2977	2.99	3174	3.60										
2600	2292	1.08	2550	1.65	2776	2.26	2980	2.90	3170	3.57	3351	4.25	3521	4.95	3687	5.66	3858	6.42				
3000	2561	1.44	2800	2.09	3011	2.77	3204	3.48	3383	4.22	3551	4.97	3713	5.75	3869	6.55						
3400	2835	1.89	3059	2.62	3257	3.38	3438	4.15	3608	4.95	3769	5.78										
3800	3112	2.43	3324	3.25	3510	4.08	3682	4.93	3844	5.80												
4200	3393	3.08	3593	3.99	3770	4.90																
4600	3676	3.84	3866	4.84																		
5000																						

MAXIMUM RPM: CLASS I = 3006 CLASS II = 3909

Class I = First white section
Class II = Blue shaded section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 10" above the base on fan size 150.

Performance Data

165 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 15.75" **Max. BHP = 0.248 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	1268	0.37																				
1700	1333	0.43	1702	0.90																		
1900	1408	0.49	1739	0.97																		
2100	1483	0.55	1788	1.05	2087	1.66																
2500	1634	0.71	1920	1.26	2170	1.88	2422	2.60	2668	3.39												
2900	1795	0.88	2071	1.52	2293	2.18	2509	2.91	2728	3.73	2941	4.61										
3300	1966	1.09	2221	1.81	2442	2.54	2631	3.30	2821	4.13	3013	5.04	3203	6.01	3390	7.04						
3700	2142	1.33	2376	2.14	2592	2.94	2778	3.77	2945	4.62	3114	5.55	3286	6.54	3456	7.59						
4500	2504	1.95	2708	2.90	2897	3.88	3078	4.86	3243	5.86	3390	6.87										
5300	2872	2.77	3060	3.86	3226	5.01	3387	6.16														
6100	3246	3.83	3421	5.05																		
6900																						

MAXIMUM RPM: CLASS I = 2668 CLASS II = 3468

165 EPF (9-Blade, Arr. 3)

Wheel Diameter: 15.75" **Max. BHP = 0.248 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	1295	0.40																				
1700	1363	0.46	1698	0.90																		
1900	1437	0.52	1759	1.02	2041	1.54																
2100	1515	0.59	1825	1.13	2084	1.67																
2500	1681	0.76	1962	1.35	2212	2.02	2428	2.66	2642	3.35												
2900	1855	0.97	2114	1.62	2346	2.35	2558	3.12	2747	3.86	2929	4.63										
3300	2035	1.22	2278	1.94	2492	2.71	2692	3.56	2879	4.44	3050	5.30	3210	6.14	3370	7.03						
3700	2220	1.53	2448	2.31	2649	3.15	2836	4.04	3013	4.99	3181	5.98	3339	6.95								
4500	2599	2.30	2802	3.24	2984	4.20	3151	5.20	3309	6.25	3461	7.35										
5300	2988	3.33	3171	4.44	3336	5.54																
6100	3383	4.65																				
6900																						

MAXIMUM RPM: CLASS I = 2668 CLASS II = 3468

165 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 15.75" **Max. BHP = 0.275 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	1250	0.40																				
1700	1322	0.46	1630	0.90																		
1900	1398	0.54	1694	1.00	1951	1.53																
2100	1476	0.61	1761	1.11	2002	1.66																
2500	1638	0.78	1906	1.38	2133	1.98	2335	2.64	2529	3.34												
2900	1804	0.97	2060	1.67	2274	2.37	2467	3.07	2644	3.82	2811	4.60	2980	5.45								
3300	1972	1.21	2220	1.99	2425	2.79	2608	3.58	2778	4.37	2938	5.22	3087	6.09	3232	7.00	3381	7.96				
3700	2148	1.49	2385	2.35	2581	3.24	2758	4.14	2920	5.02	3072	5.90	3218	6.83	3355	7.79						
4500	2518	2.24	2718	3.21	2908	4.27	3072	5.35	3223	6.45	3366	7.54										
5300	2901	3.26	3068	4.32	3240	5.52	3401	6.78														
6100			3437	5.77																		
6900																						

MAXIMUM RPM: CLASS I = 2668 CLASS II = 3468

165 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 15.75" **Max. BHP = 0.270 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1500	1270	0.41																				
1700	1345	0.48	1654	0.92																		
1900	1425	0.55	1720	1.04	1980	1.56																
2100	1507	0.63	1789	1.15	2032	1.71																
2500	1678	0.83	1940	1.42	2165	2.05	2370	2.72	2566	3.42												
2900	1857	1.07	2102	1.73	2313	2.44	2505	3.18	2684	3.95	2852	4.73	3024	5.57								
3300	2042	1.37	2271	2.10	2471	2.87	2652	3.68	2821	4.53	2982	5.40	3133	6.28	3280	7.19	3431	8.14				
3700	2231	1.73	2446	2.54	2636	3.38	2809	4.26	2969	5.17	3121	6.11	3267	7.08	3406	8.06						
4500	2616	2.64	2810	3.61	2982	4.60	3140	5.62	3288	6.67	3428	7.75										
5300	3008	3.86	3187	5.02	3344	6.17																
6100	3407	5.46																				
6900																						

MAXIMUM RPM: CLASS I = 2668 CLASS II = 3468

Class I = First white section
Class II = Blue shaded section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 10" above the base on fan size 165.

Performance Data

182 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 18.25" **Max. BHP = 0.453 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2500	1086	0.57																				
2800	1136	0.64	1426	1.27																		
3100	1190	0.73	1467	1.40																		
3400	1246	0.82	1515	1.54	1743	2.32																
4000	1368	1.05	1614	1.85	1829	2.71	2021	3.63														
4600	1495	1.30	1723	2.20	1925	3.15	2109	4.16	2276	5.20												
5200	1627	1.61	1840	2.60	2030	3.65	2205	4.74	2367	5.88	2516	7.05	2664	8.29								
5800	1763	1.97	1964	3.07	2141	4.19	2307	5.38	2463	6.61	2610	7.89	2745	9.17	2877	10.50						
7000	2044	2.86	2222	4.17	2384	5.51	2532	6.87	2673	8.27	2807	9.71	**2937**	**11.20**	**3061**	**12.72**	**3180**	**14.27**	**3292**	**15.82**		
8200	2334	4.04	2492	5.56	2640	7.11	2777	8.68	2905	10.25	**3028**	**11.86**	**3147**	**13.52**	**3262**	**15.21**	**3374**	**16.94**	**3483**	**18.70**		
9400	2631	5.56	2772	7.28	2906	9.03	**3034**	**10.82**	**3154**	**12.62**	**3268**	**14.42**	**3377**	**16.23**	**3483**	**18.08**	**3587**	**19.98**	**3689**	**21.92**		
10600			**3059**	**9.38**	**3181**	**11.33**	**3299**	**13.33**	**3411**	**15.33**	**3519**	**17.36**	**3622**	**19.39**	**3721**	**21.42**						

MAXIMUM RPM: CLASS I = 2302 CLASS II = 2930 CLASS III = 3767

182 EPF (9-Blade, Arr. 3)

Wheel Diameter: 18.25" **Max. BHP = 0.443 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2500	1101	0.59	1420	1.20																		
2800	1157	0.68	1449	1.32	1721	2.06																
3100	1217	0.77	1487	1.45	1742	2.22																
3400	1281	0.88	1534	1.60	1772	2.40	1998	3.29														
4000	1416	1.14	1644	1.94	1852	2.81	2054	3.76	2249	4.78	2436	5.88										
4600	1551	1.43	1767	2.34	1956	3.29	2135	4.31	2312	5.39	2484	6.53	2650	7.74	2811	9.02						
5200	1689	1.78	1899	2.81	2073	3.85	2238	4.94	2396	6.09	2553	7.30	2707	8.56	2858	9.88	**3004**	**11.27**	**3147**	**12.71**		
5800	1833	2.20	2034	3.35	2200	4.48	2353	5.66	2500	6.89	2642	8.17	2783	9.51	2922	10.88	**3059**	**12.30**	**3194**	**13.79**		
7000	2135	3.28	2306	4.61	2468	6.00	2607	7.37	2735	8.75	2861	10.20	**2983**	**11.68**	**3102**	**13.21**	**3219**	**14.77**	**3335**	**16.38**		
8200	2448	4.74	2592	6.22	2739	7.83	2876	9.46	**2998**	**11.07**	**3110**	**12.67**	**3219**	**14.30**	**3327**	**16.00**	**3432**	**17.72**	**3535**	**19.48**		
9400			2892	8.28	**3019**	**10.04**	**3147**	**11.90**	**3268**	**13.78**	**3378**	**15.63**	**3479**	**17.45**	**3577**	**19.31**	**3672**	**21.18**	**3766**	**23.10**		
10600			**3201**	**10.84**	**3312**	**12.76**	**3426**	**14.78**	**3539**	**16.88**	**3648**	**19.00**	**3749**	**21.10**								

MAXIMUM RPM: CLASS I = 2302 CLASS II = 2930 CLASS III = 3767

182 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 18.25" **Max. BHP = 0.458 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2500	1093	0.59	1380	1.19																		
2800	1151	0.67	1420	1.31																		
3100	1212	0.77	1468	1.45	1694	2.21																
3400	1277	0.87	1520	1.59	1735	2.39																
4000	1412	1.11	1635	1.93	1833	2.81	2014	3.74	2187	4.75												
4600	1552	1.40	1760	2.31	1944	3.28	2113	4.30	2272	5.38	2423	6.50	2574	7.68								
5200	1697	1.74	1893	2.75	2064	3.82	2223	4.93	2372	6.08	2515	7.29	2651	8.54	2783	9.82	2917	11.17				
5800	1846	2.15	2030	3.26	2192	4.42	2342	5.63	2483	6.87	2617	8.15	2747	9.48	2871	10.85	**2991**	**12.25**	**3110**	**13.71**		
7000	2155	3.18	2314	4.50	2462	5.85	2598	7.25	2725	8.68	2847	10.14	**2964**	**11.64**	**3077**	**13.18**	**3187**	**14.75**	**3295**	**16.36**	**3500**	**19.65**
8200	2472	4.56	2610	6.06	2744	7.63	2870	9.22	**2988**	**10.84**	**3100**	**12.50**	**3207**	**14.18**	**3311**	**15.90**	**3412**	**17.64**	**3511**	**19.43**	**3701**	**23.06**
9400			2917	8.04	**3036**	**9.79**	**3152**	**11.59**	**3263**	**13.42**	**3368**	**15.27**	**3468**	**17.15**	**3564**	**19.04**	**3658**	**20.98**	**3749**	**22.93**		
10600			**3231**	**10.47**	**3338**	**12.42**	**3443**	**14.42**	**3546**	**16.45**	**3645**	**18.51**	**3740**	**20.58**								

MAXIMUM RPM: CLASS I = 2302 CLASS II = 2930 CLASS III = 3767

182 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 18.25" **Max. BHP = 0.455 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2500	1106	0.61	1388	1.19																		
2800	1167	0.71	1432	1.33																		
3100	1229	0.81	1482	1.48	1704	2.21																
3400	1295	0.92	1537	1.65	1749	2.42	1947	3.25														
4000	1436	1.18	1658	2.04	1852	2.89	2031	3.79	2200	4.75	2370	5.79										
4600	1588	1.51	1785	2.44	1969	3.45	2135	4.43	2292	5.46	2441	6.54	2587	7.68	2736	8.89						
5200	1746	1.93	1922	2.91	2094	4.04	2252	5.17	2397	6.27	2538	7.42	2672	8.62	2802	9.87	**2931**	**11.16**	**3062**	**12.52**		
5800	1905	2.42	2067	3.48	2223	4.66	2375	5.95	2515	7.21	2646	8.43	2773	9.70	2896	11.01	**3015**	**12.37**	**3131**	**13.76**	**3363**	**16.69**
7000	2228	3.67	2375	4.94	2506	6.23	2636	7.64	2764	9.17	2887	10.73	**3003**	**12.24**	**3114**	**13.73**	**3221**	**15.22**	**3326**	**16.74**	**3530**	**19.92**
8200	2557	5.33	2693	6.84	2812	8.32	2922	9.83	**3033**	**11.44**	**3144**	**13.18**	**3252**	**14.99**	**3358**	**16.82**	**3459**	**18.62**	**3556**	**20.37**	**3741**	**23.84**
9400			**3015**	**9.22**	**3127**	**10.93**	**3229**	**12.63**	**3326**	**14.36**	**3422**	**16.16**	**3519**	**18.08**	**3615**	**20.09**	**3710**	**22.17**				
10600			**3342**	**12.16**	**3448**	**14.12**	**3544**	**16.04**	**3633**	**17.94**	**3720**	**19.88**										

MAXIMUM RPM: CLASS I = 2302 CLASS II = 2930 CLASS III = 3767

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 13" above the base on fan size 182.

Performance Data

200 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 20.00" **Max. BHP = 0.716 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	991	0.68																				
3400	1042	0.79	1305	1.54																		
3800	1096	0.90	1348	1.72																		
4200	1155	1.03	1396	1.91	1601	2.86																
4600	1216	1.17	1446	2.11	1645	3.12																
5400	1344	1.51	1554	2.56	1741	3.69	1910	4.88	2065	6.12												
6200	1477	1.91	1672	3.09	1846	4.34	2006	5.65	2155	7.02	2291	8.40										
7000	1614	2.38	1798	3.72	1959	5.07	2110	6.50	2252	7.99	2385	9.51	2509	11.07	2629	12.67						
7800	1756	2.95	1927	4.42	2080	5.91	2221	7.45	2355	9.04	2483	10.70	2605	12.39	**2720**	**14.11**	**2829**	**15.85**	**2936**	**17.64**		
9400	2047	4.38	2197	6.12	2335	7.90	2463	9.70	2583	11.52	**2698**	**13.39**	**2810**	**15.32**	**2918**	**17.30**	**3022**	**19.30**	**3123**	**21.35**		
11000	2346	6.28	2478	8.29	2603	10.36	**2721**	**12.45**	**2832**	**14.55**	**2937**	**16.66**	**3038**	**18.80**	**3137**	**20.99**	**3233**	**23.23**	**3327**	**25.51**		
12600			**2767**	**11.01**	**2880**	**13.34**	**2988**	**15.71**	**3091**	**18.10**	**3190**	**20.51**	**3285**	**22.93**	**3376**	**25.36**						

MAXIMUM RPM: CLASS I = 2101 CLASS II = 2674 CLASS III = 3438

200 EPF (9-Blade, Arr. 3)

Wheel Diameter: 20.00" **Max. BHP = 0.700 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	1004	0.71	1295	1.44																		
3400	1061	0.82	1326	1.60	1572	2.50																
3800	1123	0.96	1366	1.78	1595	2.71	1810	3.76														
4200	1189	1.11	1415	1.98	1627	2.96	1829	4.03	2021	5.21												
4600	1257	1.27	1470	2.20	1667	3.23	1858	4.34	2040	5.55	2214	6.85										
5400	1394	1.66	1592	2.72	1767	3.84	1934	5.06	2098	6.34	2258	7.70	2411	9.14	2560	10.67						
6200	1533	2.11	1725	3.34	1885	4.58	2036	5.88	2181	7.26	2325	8.71	2467	10.22	2604	11.79	**2738**	**13.45**	**2869**	**15.17**		
7000	1679	2.67	1862	4.05	2013	5.42	2152	6.84	2286	8.32	2415	9.86	2543	11.47	2670	13.13	**2794**	**14.83**	**2917**	**16.62**		
7800	1831	3.34	1999	4.85	2148	6.39	2278	7.93	2402	9.51	2523	11.17	2639	12.86	**2754**	**14.61**	**2869**	**16.43**	**2982**	**18.28**		
9400	2144	5.09	2282	6.81	2422	8.68	2548	10.54	2659	12.37	**2765**	**14.23**	**2868**	**16.14**	**2970**	**18.12**	**3068**	**20.12**	**3164**	**22.15**		
11000			2583	9.40	**2703**	**11.48**	**2822**	**13.67**	**2933**	**15.86**	**3033**	**18.02**	**3126**	**20.15**	**3216**	**22.32**	**3305**	**24.55**	**3393**	**26.82**		
12600			**2895**	**12.71**	**2998**	**15.00**	**3102**	**17.40**	**3207**	**19.91**	**3307**	**22.44**	**3399**	**24.93**								

MAXIMUM RPM: CLASS I = 2101 CLASS II = 2674 CLASS III = 3438

200 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 20.00" **Max. BHP = 0.724 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	997	0.71	1259	1.43																		
3400	1056	0.82	1300	1.59																		
3800	1119	0.95	1350	1.78	1553	2.70																
4200	1185	1.09	1403	1.97	1597	2.95	1777	4.00														
4600	1253	1.24	1462	2.20	1646	3.22	1815	4.33														
5400	1394	1.61	1586	2.69	1756	3.84	1912	5.05	2059	6.32	2198	7.65										
6200	1540	2.06	1720	3.27	1876	4.54	2022	5.87	2159	7.25	2290	8.70	2414	10.19	2535	11.72						
7000	1691	2.60	1858	3.95	2006	5.34	2142	6.80	2271	8.30	2393	9.85	2511	11.45	2624	13.09	**2733**	**14.78**	2841	16.53		
7800	1847	3.25	2001	4.73	2142	6.26	2270	7.84	2391	9.46	2507	11.13	2617	12.83	**2725**	**14.59**	**2830**	**16.40**	**2931**	**18.24**	3125	22.04
9400	2165	4.91	2297	6.65	2423	8.45	2541	10.29	2651	12.17	**2755**	**14.08**	**2855**	**16.03**	**2953**	**18.03**	**3047**	**20.05**	**3139**	**22.11**	**3317**	**26.35**
11000			2605	9.14	**2716**	**11.20**	**2824**	**13.31**	**2926**	**15.45**	**3023**	**17.62**	**3116**	**19.84**	**3205**	**22.08**	**3291**	**24.33**	**3376**	**26.65**		
12600			**2922**	**12.29**	**3021**	**14.62**	**3118**	**16.99**	**3212**	**19.40**	**3303**	**21.85**	**3390**	**24.32**								

MAXIMUM RPM: CLASS I = 2101 CLASS II = 2674 CLASS III = 3438

200 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 20.00" **Max. BHP = 0.719 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	1009	0.74	1266	1.43																		
3400	1070	0.87	1311	1.61	1529	2.46																
3800	1134	1.00	1363	1.82	1563	2.70																
4200	1202	1.15	1420	2.06	1610	2.99	1786	4.00														
4600	1273	1.32	1481	2.31	1662	3.30	1829	4.36	1989	5.50												
5400	1425	1.74	1609	2.84	1778	4.02	1931	5.18	2076	6.40	2213	7.68	2350	9.04								
6200	1584	2.28	1745	3.45	1903	4.80	2048	6.15	2181	7.47	2310	8.85	2433	10.28	2552	11.77	2671	13.33	2792	14.96		
7000	1745	2.94	1893	4.21	2035	5.64	2172	7.19	2300	8.71	2419	10.19	2535	11.71	2647	13.29	**2755**	**14.92**	**2861**	**16.61**	3071	20.12
7800	1908	3.72	2047	5.13	2175	6.61	2302	8.27	2424	10.00	2540	11.71	2648	13.35	**2753**	**15.02**	**2856**	**16.74**	**2956**	**18.51**	**3148**	**22.17**
9400	2239	5.72	2367	7.45	2478	9.15	2583	10.91	**2689**	**12.82**	**2794**	**14.87**	**2896**	**16.97**	**2993**	**19.02**	**3087**	**21.05**	**3177**	**23.05**	**3351**	**27.07**
11000	2576	8.41	**2692**	**10.45**	**2796**	**12.46**	**2889**	**14.43**	**2980**	**16.48**	**3070**	**18.62**	**3161**	**20.91**	**3250**	**23.29**	**3338**	**25.74**	**3424**	**28.20**		
12600			**3022**	**14.25**	**3119**	**16.57**	**3208**	**18.87**	**3290**	**21.13**	**3369**	**23.43**										

MAXIMUM RPM: CLASS I = 2101 CLASS II = 2674 CLASS III = 3438

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 14.50" above the base on fan size 200.

Performance Data

222 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 22.25" **Max. BHP = 1.219 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3500	856	0.76																				
4000	900	0.88																				
4500	947	1.01	1172	1.93																		
5000	998	1.16	1215	2.16	1399	3.22																
6000	1106	1.48	1305	2.66	1477	3.88	1630	5.13														
7000	1221	1.88	1403	3.22	1565	4.61	1712	6.05	1843	7.47												
8000	1340	2.36	1510	3.85	1661	5.42	1800	7.02	1929	8.66	2046	10.27	2160	11.96								
9000	1464	2.93	1622	4.58	1763	6.30	1895	8.08	2018	9.89	2134	11.73	2241	13.54	2343	15.39	2444	17.31				
10000	1590	3.61	1738	5.41	1872	7.29	1995	9.23	2112	11.20	2223	13.20	2329	15.24	2429	17.28	2524	19.32	2615	21.37		
12000	1849	5.30	1980	7.43	2100	9.62	2212	11.87	2317	14.17	2418	16.51	2515	18.87	2609	21.27	2700	23.69	2788	26.14		
14000	2114	7.54	2231	10.00	2339	12.50	2441	15.05	2538	17.65	2631	20.32	2720	23.02	2807	25.77	2891	28.52	2973	31.30		
16000			2488	13.19	2587	16.03	2681	18.90	2770	21.80	2857	24.78	2940	27.79	3020	30.84						

MAXIMUM RPM: CLASS I = 1888 CLASS II = 2403 CLASS III = 3090

222 EPF (9-Blade, Arr. 3)

Wheel Diameter: 22.25" **Max. BHP = 1.212 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3500	868	0.79	1130	1.61																		
4000	912	0.92	1156	1.82																		
4500	962	1.06	1191	2.03	1393	3.09																
5000	1016	1.22	1231	2.26	1422	3.40	1600	4.61														
6000	1133	1.60	1324	2.79	1498	4.07	1657	5.43	1809	6.86	1954	8.31										
7000	1256	2.07	1429	3.40	1587	4.83	1735	6.33	1874	7.91	2006	9.53	2135	11.22	2259	12.90						
8000	1383	2.64	1544	4.13	1688	5.70	1825	7.34	1955	9.06	2078	10.83	2196	12.65	2311	14.54	2424	16.47	2533	18.38		
9000	1514	3.33	1665	4.98	1798	6.69	1924	8.48	2046	10.34	2162	12.25	2274	14.23	2381	16.25	2485	18.31	2587	20.43		
10000	1647	4.14	1788	5.95	1915	7.83	2032	9.76	2145	11.76	2254	13.81	2360	15.93	2463	18.11	2562	20.33	2657	22.56		
12000	1917	6.20	2046	8.37	2159	10.55	2266	12.81	2365	15.09	2461	17.43	2555	19.83	2648	22.30	2737	24.78	2825	27.32		
14000	2192	8.92	2310	11.46	2415	14.00	2511	16.54	2604	19.16	2692	21.82	2776	24.50	2858	27.23	2939	30.02	3019	32.85		
16000			2579	15.34	2677	18.24	2767	21.14	2852	24.06	2934	27.02	3013	30.03	3088	33.04						

MAXIMUM RPM: CLASS I = 1888 CLASS II = 2403 CLASS III = 3090

222 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 22.25" **Max. BHP = 1.287 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3500	848	0.78																				
4000	901	0.92	1122	1.79																		
4500	956	1.06	1158	2.00	1354	3.07																
5000	1015	1.23	1204	2.24	1381	3.35																
6000	1139	1.62	1312	2.80	1463	4.02	1610	5.35	1757	6.78												
7000	1270	2.11	1427	3.43	1568	4.83	1696	6.26	1822	7.78	1948	9.40	2074	11.11								
8000	1406	2.72	1549	4.18	1680	5.73	1802	7.34	1914	8.97	2023	10.66	2134	12.46	2244	14.34	2354	16.28				
9000	1545	3.44	1677	5.06	1799	6.76	1913	8.53	2020	10.33	2121	12.16	2218	14.03	2316	15.99	2415	18.04	2512	20.14	2709	24.59
10000	1686	4.29	1810	6.10	1922	7.92	2030	9.85	2131	11.81	2229	13.83	2320	15.84	2409	17.91	2496	20.01	2584	22.20	2761	26.81
12000	1972	6.43	2084	8.64	2183	10.78	2277	12.97	2369	15.25	2456	17.57	2541	19.94	2623	22.34	2702	24.75	2778	27.18	2925	32.12
14000			2364	11.87	2455	14.40	2540	16.92	2622	19.47	2701	22.07	2778	24.73	2853	27.44	2927	30.21	2998	32.98		
16000			2649	15.90	2733	18.83	2812	21.73	2887	24.62	2959	27.51	3029	30.44								

MAXIMUM RPM: CLASS I = 1888 CLASS II = 2403 CLASS III = 3090

222 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 22.25" **Max. BHP = 1.281 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3500	862	0.82	1099	1.61																		
4000	917	0.96	1131	1.83																		
4500	974	1.12	1174	2.07	1358	3.09																
5000	1034	1.30	1224	2.34	1394	3.43	1557	4.60														
6000	1162	1.74	1336	2.94	1486	4.19	1628	5.50	1765	6.86	1901	8.31										
7000	1299	2.29	1454	3.63	1596	5.06	1724	6.53	1846	8.05	1965	9.60	2082	11.21	2198	12.90						
8000	1441	2.98	1580	4.46	1712	6.05	1834	7.70	1945	9.36	2053	11.08	2159	12.84	2263	14.64	2365	16.47	2467	18.39		
9000	1585	3.81	1713	5.44	1834	7.17	1949	8.99	2056	10.83	2157	12.72	2253	14.62	2349	16.60	2442	18.57	2534	20.58	2715	24.73
10000	1729	4.79	1852	6.61	1961	8.46	2069	10.43	2172	12.46	2269	14.52	2360	16.58	2448	18.69	2534	20.82	2620	23.02	2788	27.47
12000	2022	7.27	2136	9.51	2233	11.68	2325	13.90	2415	16.20	2504	18.61	2589	21.03	2672	23.51	2750	25.96	2826	28.45	2972	33.51
14000	2318	10.56	2425	13.25	2517	15.83	2599	18.35	2677	20.90	2755	23.54	2833	26.28	2909	29.08	2982	31.88	3054	34.74		
16000			2716	17.91	2804	20.93	2882	23.85	2954	26.73	3024	29.65										

MAXIMUM RPM: CLASS I = 1888 CLASS II = 2403 CLASS III = 3090

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 16" above the base on fan size 222.

Performance Data

245 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 24.50" **Max. BHP = 1.92 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4400	790	0.93	1021	1.92																		
5000	831	1.07	1047	2.13																		
5600	877	1.23	1079	2.36	1258	3.63																
6200	926	1.41	1115	2.60	1286	3.96	1442	5.40														
7400	1031	1.83	1200	3.18	1354	4.67	1497	6.27	1632	7.96	1759	9.73										
8600	1140	2.35	1295	3.87	1435	5.49	1567	7.23	1691	9.06	1810	10.99	1924	13.00	2034	15.08						
9800	1250	2.95	1399	4.68	1526	6.44	1648	8.33	1763	10.30	1874	12.37	1981	14.52	2084	16.74	2184	19.03	2281	21.39		
11000	1364	3.67	1506	5.61	1626	7.55	1738	9.58	1845	11.69	1949	13.89	2049	16.18	2146	18.54	2240	20.97	2332	23.48		
12200	1481	4.53	1615	6.66	1731	8.81	1835	10.99	1935	13.24	2032	15.58	2126	18.00	**2218**	**20.51**	**2307**	**23.08**	**2394**	**25.73**		
14600	1720	6.71	1838	9.19	1947	11.77	2045	14.36	2134	16.93	**2219**	**19.55**	**2302**	**22.25**	**2384**	**25.03**	**2464**	**27.87**	**2543**	**30.80**		
17000	1966	9.63	2069	12.41	2168	15.36	**2261**	**18.38**	**2347**	**21.40**	**2426**	**24.38**	**2501**	**27.39**	**2574**	**30.45**	**2646**	**33.58**	**2717**	**36.78**		
19400			**2307**	**16.50**	**2396**	**19.76**	**2482**	**23.15**	**2564**	**26.61**	**2641**	**30.05**	**2713**	**33.47**	**2781**	**36.87**						

MAXIMUM RPM: CLASS I = 1715 CLASS II = 2183 CLASS III = 2806

245 EPF (9-Blade, Arr. 3)

Wheel Diameter: 24.50" **Max. BHP = 1.91 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4400	804	0.99																				
5000	849	1.15	1057	2.20																		
5600	898	1.34	1094	2.49	1270	3.71																
6200	950	1.55	1135	2.79	1299	4.10																
7400	1058	2.05	1227	3.45	1376	4.98	1515	6.55	1647	8.15												
8600	1171	2.64	1328	4.26	1466	5.94	1593	7.73	1714	9.55	1828	11.35	1942	13.28								
9800	1289	3.36	1436	5.22	1564	7.05	1683	9.00	1794	11.04	1902	13.12	2004	15.16	2104	17.25	**2204**	**19.45**				
11000	1409	4.22	1546	6.30	1668	8.36	1780	10.45	1885	12.64	1985	14.93	2081	17.23	2175	19.55	**2266**	**21.87**	**2355**	**24.21**		
12200	1533	5.27	1660	7.52	1776	9.83	1882	12.11	1981	14.43	2077	16.88	2167	19.37	**2255**	**21.93**	**2342**	**24.53**	**2426**	**27.10**		
14600	1787	7.94	1896	10.51	2001	13.28	2098	16.05	**2189**	**18.77**	**2275**	**21.49**	**2358**	**24.28**	**2439**	**27.18**	**2516**	**30.11**	**2592**	**33.15**		
17000			2142	14.43	**2234**	**17.50**	**2324**	**20.74**	**2408**	**23.96**	**2489**	**27.18**	**2565**	**30.32**	**2639**	**33.49**	**2711**	**36.72**	**2781**	**40.01**		
19400			**2394**	**19.40**	**2477**	**22.81**	**2557**	**26.35**	**2636**	**30.05**	**2711**	**33.74**	**2783**	**37.40**								

MAXIMUM RPM: CLASS I = 1715 CLASS II = 2183 CLASS III = 2806

245 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 24.50" **Max. BHP = 2.04 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4400	779	0.96																				
5000	824	1.11	1026	2.19																		
5600	875	1.29	1061	2.44	1234	3.73																
6200	929	1.49	1100	2.71	1261	4.07																
7400	1043	1.98	1192	3.33	1334	4.84	1469	6.46	1598	8.16												
8600	1157	2.53	1299	4.11	1423	5.73	1545	7.51	1662	9.37	1774	11.31	1886	13.35								
9800	1275	3.20	1412	5.03	1524	6.79	1633	8.69	1740	10.71	1844	12.81	1944	14.97	2042	17.21	2140	19.53				
11000	1395	3.99	1525	6.05	1634	8.05	1732	10.06	1829	12.20	1924	14.43	2018	16.78	2110	19.19	**2198**	**21.62**	**2285**	**24.13**	2462	29.43
12200	1519	4.95	1640	7.20	1748	9.48	1840	11.66	1928	13.91	2015	16.26	2102	18.75	**2187**	**21.30**	**2271**	**23.93**	**2353**	**26.61**	**2510**	**32.05**
14600	1770	7.35	1877	9.98	1976	12.72	2066	15.44	2147	18.08	**2222**	**20.70**	**2295**	**23.38**	**2368**	**26.17**	**2441**	**29.06**	**2514**	**32.06**	**2656**	**38.22**
17000	2026	10.54	2121	13.55	**2211**	**16.67**	**2295**	**19.85**	**2374**	**23.04**	**2447**	**26.16**	**2515**	**29.24**	**2579**	**32.28**	**2642**	**35.38**	**2704**	**38.54**		
19400			**2371**	**18.05**	**2452**	**21.52**	**2530**	**25.11**	**2604**	**28.74**	**2675**	**32.41**	**2742**	**36.03**	**2804**	**39.54**						

MAXIMUM RPM: CLASS I = 1715 CLASS II = 2183 CLASS III = 2806

245 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 24.50" **Max. BHP = 2.03 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4400	790	1.00																				
5000	838	1.17	1041	2.25																		
5600	891	1.36	1074	2.51																		
6200	947	1.59	1116	2.81	1278	4.18																
7400	1064	2.11	1213	3.51	1352	5.00	1489	6.64	1623	8.39												
8600	1185	2.76	1324	4.36	1446	6.01	1566	7.77	1683	9.63	1799	11.61										
9800	1309	3.55	1440	5.37	1552	7.19	1659	9.10	1764	11.09	1867	13.17	1970	15.38	2072	17.68	2173	20.06				
11000	1436	4.50	1558	6.52	1666	8.57	1764	10.65	1859	12.79	1952	15.00	2044	17.30	2136	19.70	**2228**	**22.22**	**2318**	**24.78**		
12200	1565	5.63	1680	7.86	1783	10.13	1876	12.40	1963	14.70	2049	17.09	2134	19.55	**2217**	**22.04**	**2300**	**24.64**	**2382**	**27.30**	**2547**	**32.96**
14600	1827	8.50	1930	11.16	2022	13.82	2109	16.55	**2189**	**19.25**	**2265**	**21.99**	**2337**	**24.73**	**2409**	**27.56**	**2481**	**30.47**	**2552**	**33.42**	**2691**	**39.46**
17000			**2186**	**15.41**	**2271**	**18.51**	**2350**	**21.63**	**2425**	**24.78**	**2496**	**27.93**	**2564**	**31.11**	**2629**	**34.29**	**2691**	**37.46**	**2753**	**40.72**		
19400			**2446**	**20.74**	**2524**	**24.26**	**2598**	**27.83**	**2667**	**31.37**	**2734**	**34.98**	**2798**	**38.58**								

MAXIMUM RPM: CLASS I = 1715 CLASS II = 2183 CLASS III = 2806

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 17" above the base on fan size 245.

Performance Data

270 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 27.00" **Max. BHP = 3.10 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	705	1.07																				
5800	743	1.24	952	2.55																		
6600	787	1.44	978	2.83																		
7400	835	1.68	1012	3.15	1174	4.84																
8200	885	1.94	1051	3.51	1202	5.27	1346	7.22														
9000	937	2.24	1095	3.92	1236	5.74	1371	7.78	1501	9.95												
10600	1045	2.92	1189	4.84	1317	6.86	1437	9.02	1553	11.36	1665	13.85	1776	16.45								
12200	1157	3.75	1291	5.93	1409	8.18	1519	10.53	1623	12.98	1725	15.61	1824	18.37	1921	21.25	2017	24.23	2114	27.32		
13800	1273	4.75	1397	7.20	1507	9.68	1610	12.26	1707	14.92	1800	17.67	1891	20.56	1980	23.59	2067	26.73	2153	29.98		
17000	1511	7.34	1618	10.32	1718	13.36	1809	16.40	1895	19.50	1977	22.66	2057	25.93	2134	29.25	2209	32.65	2284	36.21		
20200	1757	10.89	1850	14.40	1938	17.94	2022	21.54	2101	25.17	2175	28.78	2247	32.47	2317	36.23	2385	40.05	2452	43.96		
23400			2089	19.59	2168	23.69	2243	27.78	2316	31.94	2386	36.14	2453	40.36	2517	44.56						

MAXIMUM RPM: CLASS I = 1556 CLASS II = 1981 CLASS III = 2546

270 EPF (9-Blade, Arr. 3)

Wheel Diameter: 27.00" **Max. BHP = 3.08 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	716	1.13	943	2.37																		
5800	756	1.33	961	2.65																		
6600	803	1.56	991	2.98	1163	4.59																
7400	854	1.82	1028	3.34	1187	5.04	1338	6.91														
8200	909	2.12	1070	3.76	1219	5.55	1358	7.48	1495	9.60												
9000	966	2.47	1115	4.20	1256	6.10	1388	8.14	1514	10.31	1638	12.63										
10600	1082	3.28	1217	5.24	1341	7.35	1460	9.58	1574	11.95	1683	14.41	1789	16.99	1895	19.72	1999	22.55				
12200	1203	4.30	1328	6.50	1439	8.83	1547	11.29	1651	13.85	1751	16.51	1848	19.27	1942	22.12	2034	25.07	2126	28.16		
13800	1326	5.54	1443	7.99	1547	10.56	1643	13.21	1738	15.99	1831	18.87	1921	21.83	2009	24.90	2094	28.03	2177	31.24		
17000	1576	8.74	1682	11.81	1774	14.83	1861	17.98	1941	21.17	2019	24.47	2096	27.86	2173	31.36	2248	34.90	2321	38.49		
20200	1831	13.12	1928	16.84	2013	20.45	2090	24.01	2165	27.72	2235	31.46	2303	35.31	2368	39.18	2433	43.15	2499	47.26		
23400			2178	23.25	2258	27.52	2330	31.67	2397	35.79	2462	40.00	2526	44.34								

MAXIMUM RPM: CLASS I = 1556 CLASS II = 1981 CLASS III = 2546

270 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 27.00" **Max. BHP = 3.26 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	698	1.11																				
5800	741	1.30	927	2.57																		
6600	790	1.53	964	2.92	1119	4.43																
7400	842	1.78	1004	3.28	1148	4.91																
8200	897	2.07	1048	3.68	1186	5.43	1311	7.27														
9000	953	2.38	1096	4.12	1226	5.98	1347	7.95	1460	10.00												
10600	1071	3.15	1200	5.13	1317	7.23	1427	9.42	1532	11.71	1630	14.06	1725	16.48	1823	19.02						
12200	1192	4.09	1310	6.31	1417	8.64	1518	11.07	1614	13.58	1707	16.18	1796	18.86	1880	21.56	1963	24.35	2047	27.24		
13800	1316	5.23	1425	7.70	1525	10.28	1618	12.95	1707	15.70	1793	18.53	1876	21.42	1956	24.36	2034	27.39	2109	30.47	2256	36.81
17000	1569	8.21	1667	11.25	1753	14.30	1835	17.44	1913	20.66	1988	23.97	2061	27.35	2132	30.78	2201	34.25	2269	37.79	2401	45.06
20200	1828	12.31	1915	15.90	1994	19.51	2066	23.11	2136	26.81	2204	30.59	2269	34.42	2333	38.36	2395	42.33	2456	46.36		
23400			2168	21.86	2241	26.05	2308	30.22	2371	34.39	2432	38.63	2492	42.96								

MAXIMUM RPM: CLASS I = 1556 CLASS II = 1981 CLASS III = 2546

270 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 27.00" **Max. BHP = 3.23 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	706	1.14																				
5800	756	1.37	939	2.65																		
6600	807	1.62	974	2.99																		
7400	861	1.89	1018	3.39	1162	5.04																
8200	917	2.20	1068	3.86	1198	5.56	1328	7.48														
9000	977	2.57	1120	4.36	1243	6.18	1361	8.14	1479	10.30												
10600	1101	3.45	1227	5.45	1344	7.60	1448	9.75	1548	12.00	1648	14.41	1748	16.98								
12200	1230	4.57	1341	6.76	1449	9.17	1550	11.67	1641	14.13	1727	16.63	1814	19.29	1902	22.14	1988	25.06				
13800	1360	5.92	1464	8.39	1560	10.97	1654	13.73	1743	16.55	1825	19.34	1902	22.13	1979	25.05	2056	28.09	2133	31.27	2286	37.93
17000	1623	9.43	1719	12.54	1800	15.55	1878	18.68	1956	21.99	2032	25.41	2106	28.91	2175	32.35	2241	35.78	2305	39.25	2429	46.31
20200	1891	14.27	1979	18.02	2055	21.66	2123	25.24	2189	28.90	2255	32.71	2321	36.68	2385	40.71	2448	44.83	2509	48.96		
23400			2242	25.05	2314	29.35	2379	33.57	2439	37.74	2496	41.92										

MAXIMUM RPM: CLASS I = 1556 CLASS II = 1981 CLASS III = 2546

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 19" above the base on fan size 270.

Performance Data

300 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 30.00" **Max. BHP = 5.27 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	627	1.27																				
7000	662	1.49	847	3.05																		
8000	702	1.73	872	3.40	1025	5.31																
9000	746	2.01	904	3.82	1047	5.81	1179	8.03														
10000	794	2.35	940	4.26	1074	6.37	1200	8.68	1317	11.17												
11000	842	2.70	980	4.74	1106	6.99	1225	9.40	1337	11.96	1443	14.70										
13000	941	3.56	1068	5.87	1181	8.36	1287	11.01	1390	13.83	1488	16.75	1582	19.82	1672	23.02						
15000	1041	4.58	1164	7.24	1266	9.96	1363	12.85	1456	15.91	1546	19.09	1633	22.36	1718	25.77	1800	29.30	1879	32.93		
17000	1144	5.82	1262	8.82	1359	11.83	1448	14.97	1533	18.23	1616	21.67	1696	25.20	1775	28.86	1851	32.56	1926	36.40		
21000	1359	9.10	1461	12.70	1555	16.45	1636	20.16	1709	23.89	1781	27.79	1851	31.80	1919	35.93	1986	40.19	2051	44.49		
25000	1582	13.67	1668	17.79	1753	22.16	1832	26.61	1903	31.03	1968	35.45	2030	39.95	2090	44.53	2150	49.26	2208	54.03		
29000			1884	24.42	1958	29.32	2031	34.41	2100	39.56	2165	44.76	2224	49.88	2279	54.97						

MAXIMUM RPM: CLASS I = 1401 CLASS II = 1783 CLASS III = 2291

300 EPF (9-Blade, Arr. 3)

Wheel Diameter: 30.00" **Max. BHP = 5.11 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	639	1.33																				
7000	675	1.56	860	3.20																		
8000	717	1.84	888	3.58	1041	5.56																
9000	761	2.14	921	3.99	1064	6.11	1198	8.40														
10000	809	2.50	959	4.48	1094	6.69	1219	9.13	1339	11.70												
11000	858	2.89	1000	5.02	1128	7.33	1246	9.87	1358	12.57	1467	15.41										
13000	960	3.89	1090	6.26	1205	8.83	1313	11.55	1415	14.48	1512	17.58	1607	20.83	1699	24.14	1790	27.60				
15000	1066	5.15	1186	7.73	1292	10.60	1391	13.58	1485	16.69	1575	19.97	1662	23.45	1746	27.07	1828	30.78	1909	34.60		
17000	1174	6.66	1287	9.53	1386	12.63	1477	15.90	1565	19.30	1649	22.80	1730	26.44	1808	30.22	1884	34.16	1958	38.22		
21000	1399	10.60	1496	14.27	1585	17.77	1667	21.52	1744	25.50	1817	29.55	1889	33.72	1959	37.98	2026	42.26	2092	46.69		
25000	1629	15.97	1714	20.50	1794	24.77	1869	28.93	1940	33.30	2007	37.89	2071	42.62	2133	47.44	2194	52.36	2254	57.33		
29000			1938	28.38	2010	33.57	2078	38.45	2143	43.24	2206	48.20	2266	53.37								

MAXIMUM RPM: CLASS I = 1401 CLASS II = 1783 CLASS III = 2291

300 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 30.00" **Max. BHP = 5.54 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	621	1.33																				
7000	657	1.55	845	3.17																		
8000	699	1.81	865	3.55																		
9000	745	2.12	895	3.97	1042	6.05																
10000	794	2.46	933	4.44	1065	6.65	1196	9.02														
11000	845	2.86	974	4.94	1095	7.27	1216	9.80	1335	12.47												
13000	949	3.81	1067	6.17	1173	8.70	1275	11.46	1377	14.40	1478	17.40	1579	20.63								
15000	1056	4.96	1166	7.63	1262	10.42	1354	13.39	1443	16.55	1531	19.88	1619	23.29	1707	26.80	1795	30.51				
17000	1167	6.37	1269	9.38	1360	12.47	1443	15.66	1524	19.03	1603	22.58	1680	26.24	1757	30.02	1835	33.91	1913	37.89	2068	46.31
21000	1394	9.97	1482	13.78	1563	17.47	1638	21.24	1708	25.11	1775	29.08	1841	33.19	1906	37.44	1970	41.84	2033	46.35	2158	55.65
25000	1626	14.85	1704	19.50	1776	23.98	1844	28.36	1909	32.82	1971	37.41	2029	42.00	2086	46.72	2141	51.48	2196	56.38		
29000			1931	26.73	1996	32.06	2058	37.24	2117	42.32	2174	47.43	2229	52.65	2282	57.96						

MAXIMUM RPM: CLASS I = 1401 CLASS II = 1783 CLASS III = 2291

300 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 30.00" **Max. BHP = 5.52 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	626	1.35																				
7000	665	1.60																				
8000	712	1.90																				
9000	763	2.27	903	4.06																		
10000	817	2.70	945	4.57																		
11000	870	3.17	992	5.18	1105	7.44																
13000	978	4.24	1094	6.65	1192	9.06	1288	11.75	1387	14.66												
15000	1089	5.55	1201	8.43	1291	11.12	1376	13.93	1459	17.00	1542	20.25										
17000	1203	7.15	1308	10.43	1397	13.59	1474	16.63	1550	19.86	1623	23.25	1696	26.87	1770	30.61						
21000	1438	11.40	1529	15.42	1612	19.47	1687	23.44	1753	27.21	1815	30.97	1876	34.87	1937	38.95	1996	43.17	2055	47.58	2174	56.74
25000	1677	17.22	1757	21.99	1832	26.81	1902	31.63	1968	36.44	2027	41.02	2082	45.50	2135	50.00	2186	54.51	2237	59.17		
29000			1992	30.53	2059	36.06	2123	41.65	2184	47.25	2242	52.82										

MAXIMUM RPM: CLASS I = 1401 CLASS II = 1783 CLASS III = 2291

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 21" above the base on fan size 300.

Performance Data

330 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 33.00" **Max. BHP = 8.49 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000	564	1.49																				
8000	589	1.70	762	3.52																		
9000	617	1.92	779	3.86																		
11000	682	2.47	824	4.65	954	7.09	1073	9.77														
13000	754	3.15	881	5.57	998	8.27	1107	11.13	1211	14.24	1308	17.51										
15000	828	3.97	946	6.67	1052	9.59	1152	12.72	1247	15.99	1339	19.47	1426	23.11	1510	26.94						
17000	903	4.92	1016	7.93	1113	11.08	1205	14.45	1294	18.03	1379	21.71	1461	25.53	1541	29.57	1617	33.70	1692	38.06		
19000	979	6.04	1090	9.41	1180	12.81	1265	16.39	1347	20.18	1427	24.18	1504	28.25	1578	32.40	1651	36.75	1722	41.25		
23000	1137	8.86	1238	12.89	1324	16.94	1400	21.07	1471	25.28	1541	29.70	1609	34.29	1675	39.00	1740	43.84	1804	48.80		
27000	1302	12.66	1389	17.21	1472	21.99	1546	26.81	1611	31.57	1673	36.45	1734	41.49	1794	46.70	1852	51.99	1909	57.42		
31000	1470	17.56	1547	22.67	1622	28.03	1693	33.53	1758	39.05	1817	44.55	1872	50.05	1926	55.71	1979	61.48	2031	67.34		
35000			1709	29.38	1776	35.27	1843	41.45	1906	47.68	1964	53.87	2018	60.07	2069	66.30						

MAXIMUM RPM: CLASS I = 1273 CLASS II = 1620 CLASS III = 2083

330 EPF (9-Blade, Arr. 3)

Wheel Diameter: 33.00" **Max. BHP = 8.23 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000	574	1.56																				
8000	600	1.77	774	3.70																		
9000	630	2.03	792	4.06	939	6.39																
11000	696	2.63	841	4.89	969	7.44	1091	10.26														
13000	769	3.38	899	5.89	1017	8.66	1126	11.71	1230	14.96	1330	18.33										
15000	845	4.31	965	7.09	1073	10.09	1174	13.32	1269	16.80	1360	20.46	1449	24.27	1536	28.22						
17000	923	5.47	1036	8.46	1136	11.77	1230	15.23	1319	18.88	1403	22.73	1485	26.82	1565	31.06	1643	35.38	1720	39.84		
19000	1003	6.83	1110	10.07	1204	13.65	1291	17.37	1375	21.27	1455	25.33	1532	29.61	1606	34.05	1678	38.63	1749	43.35		
23000	1169	10.25	1264	14.18	1350	18.17	1428	22.46	1502	26.94	1573	31.47	1642	36.15	1709	40.97	1774	45.93	1838	51.13		
27000	1340	14.75	1424	19.53	1502	24.01	1575	28.71	1643	33.71	1707	38.84	1769	44.08	1831	49.51	1890	54.92	1948	60.46		
31000	1514	20.52	1589	26.12	1661	31.48	1728	36.61	1792	41.97	1852	47.59	1909	53.36	1965	59.34	2019	65.36	2073	71.52		
35000			1758	34.14	1823	40.36	1886	46.32	1945	52.09	2002	58.05	2057	64.35								

MAXIMUM RPM: CLASS I = 1273 CLASS II = 1620 CLASS III = 2083

330 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 33.00" **Max. BHP = 8.92 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000	559	1.55																				
8000	583	1.76																				
9000	613	2.00	775	4.03																		
11000	681	2.59	816	4.84	949	7.39																
13000	756	3.33	876	5.82	988	8.61	1100	11.60														
15000	833	4.22	943	6.97	1044	9.99	1140	13.22	1238	16.68	1334	20.26										
17000	913	5.30	1017	8.36	1108	11.58	1196	15.07	1281	18.75	1366	22.58	1452	26.58	1537	30.77						
19000	995	6.57	1093	9.95	1178	13.43	1259	17.14	1337	21.05	1413	25.14	1489	29.39	1566	33.78	1642	38.25	1718	42.96		
23000	1164	9.72	1250	13.84	1328	17.92	1399	22.13	1466	26.45	1533	31.04	1597	35.72	1660	40.58	1723	45.62	1786	50.78	1913	61.39
27000	1336	13.81	1413	18.77	1484	23.54	1550	28.32	1612	33.24	1671	38.28	1728	43.43	1784	48.71	1840	54.22	1894	59.79	2001	71.38
31000	1511	19.04	1581	24.83	1646	30.44	1706	35.83	1764	41.32	1820	47.00	1872	52.65	1923	58.46	1972	64.29	2022	70.42		
35000			1751	32.13	1811	38.60	1868	44.89	1921	50.97	1973	57.16	2023	63.45	2071	69.85						

MAXIMUM RPM: CLASS I = 1273 CLASS II = 1620 CLASS III = 2083

330 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 33.00" **Max. BHP = 8.89 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000																						
8000	590	1.81																				
9000	623	2.09																				
11000	698	2.79	824	4.96																		
13000	779	3.69	891	6.07	996	8.79																
15000	860	4.72	965	7.45	1059	10.33	1150	13.53														
17000	942	5.93	1045	9.13	1130	12.21	1212	15.55	1292	19.17												
19000	1026	7.35	1126	11.02	1207	14.45	1281	17.92	1355	21.74	1426	25.73	1500	29.97								
23000	1200	11.01	1289	15.44	1368	19.84	1436	24.00	1499	28.16	1560	32.45	1620	36.96	1679	41.71	1738	46.63	1799	51.76		
27000	1378	15.87	1457	21.02	1531	26.28	1598	31.44	1658	36.41	1712	41.18	1765	46.07	1817	51.09	1869	56.33	1920	61.78	2020	73.09
31000			1630	28.04	1697	34.01	1760	40.00	1819	45.95	1873	51.72	1923	57.33	1970	62.84	2016	68.43	2061	74.09		
35000			1807	36.73	1868	43.41	1926	50.13	1982	56.93	2035	63.67										

MAXIMUM RPM: CLASS I = 1273 CLASS II = 1620 CLASS III = 2083

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 23" above the base on fan size 330.

Performance Data

365 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 36.50" **Max. BHP = 14.55 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	491	1.66																				
9200	511	1.90																				
10400	534	2.16	682	4.34																		
11600	560	2.46	698	4.78																		
14000	615	3.12	741	5.79	852	8.67																
16400	676	3.92	791	6.92	893	10.15	987	13.51	1078	17.13												
18800	741	4.88	846	8.23	941	11.77	1029	15.53	1111	19.35	1191	23.40										
23600	880	7.40	967	11.40	1050	15.64	1128	20.01	1201	24.54	1271	29.26	1338	34.05	1403	38.93	1466	43.90	1529	49.14		
28400	1026	10.93	1099	15.45	1171	20.39	1240	25.45	1307	30.67	1371	36.04	1431	41.44	1490	47.06	1547	52.76	1603	58.58		
33200	1176	15.63	1239	20.71	1301	26.17	1363	32.00	1422	37.86	1480	43.85	1537	50.01	1592	56.30	1644	62.59	1695	69.03		
38000			1384	27.37	1439	33.38	1493	39.71	1547	46.34	1599	53.02	1651	59.88	1702	66.84	1751	73.80	1799	80.90		
42800			1532	35.59	1581	42.14	1630	49.03	1678	56.19	1726	63.62	1773	71.16	1819	78.74	1865	86.48				

MAXIMUM RPM: CLASS I = 1151 CLASS II = 1465 CLASS III = 1884

365 EPF (9-Blade, Arr. 3)

Wheel Diameter: 36.50" **Max. BHP = 14.43 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	496	1.73																				
9200	518	2.00																				
10400	541	2.28	689	4.55																		
11600	568	2.60	707	5.04																		
14000	628	3.34	751	6.11	862	9.11	968	12.42														
16400	693	4.25	803	7.35	906	10.73	999	14.21	1089	17.97												
18800	762	5.37	862	8.78	954	12.45	1043	16.36	1126	20.42	1203	24.51	1282	29.02								
23600	906	8.32	992	12.37	1070	16.67	1145	21.24	1218	25.98	1289	30.90	1357	35.95	1421	41.00	1483	46.15	1544	51.45		
28400	1053	12.27	1131	17.14	1201	22.10	1266	27.23	1329	32.63	1390	38.13	1451	43.85	1511	49.74	1569	55.72	1625	61.76		
33200	1204	17.52	1275	23.22	1339	28.93	1398	34.70	1455	40.71	1509	46.84	1562	53.14	1615	59.66	1667	66.25	1719	73.06		
38000	1357	24.22	1423	30.84	1482	37.35	1536	43.81	1588	50.43	1638	57.19	1687	64.19	1734	71.26	1780	78.45	1826	85.81		
42800			1572	40.05	1627	47.40	1678	54.70	1726	61.99	1773	69.48	1818	77.02	1862	84.75						

MAXIMUM RPM: CLASS I = 1151 CLASS II = 1465 CLASS III = 1884

365 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 36.50" **Max. BHP = 15.10 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	486	1.72																				
9200	506	1.96																				
10400	535	2.27																				
11600	566	2.61	691	4.97																		
14000	630	3.36	739	6.04	843	9.00																
16400	698	4.27	800	7.36	887	10.52	977	14.04														
18800	767	5.34	863	8.81	946	12.40	1022	16.10	1099	20.06												
23600	912	8.13	998	12.39	1073	16.77	1141	21.24	1205	25.81	1264	30.36	1325	35.24	1388	40.37						
28400	1061	11.88	1139	16.98	1208	22.15	1271	27.42	1329	32.74	1385	38.19	1438	43.67	1488	49.15	1537	54.72	1587	60.53	1692	72.93
33200	1213	16.79	1284	22.73	1348	28.73	1407	34.81	1461	40.88	1513	47.13	1562	53.39	1610	59.77	1656	66.16	1699	72.43	1784	85.42
38000	1367	23.04	1432	29.84	1492	36.72	1546	43.52	1598	50.48	1647	57.48	1693	64.49	1738	71.68	1781	78.87	1823	86.13		
42800			1583	38.54	1638	46.20	1690	53.94	1738	61.63	1784	69.39	1829	77.31	1871	85.16						

MAXIMUM RPM: CLASS I = 1151 CLASS II = 1465 CLASS III = 1884

365 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 36.50" **Max. BHP = 15.10 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	489	1.75																				
9200	513	2.02																				
10400	542	2.34																				
11600	575	2.71	696	5.05																		
14000	646	3.60	749	6.23	849	9.16																
16400	719	4.67	813	7.67	899	10.85	985	14.32														
18800	793	5.96	883	9.37	960	12.87	1035	16.56	1109	20.47	1187	24.84										
23600	946	9.32	1029	13.61	1099	17.89	1161	22.22	1222	26.73	1281	31.31	1340	36.10	1400	41.17	1462	46.61				
28400	1103	13.91	1178	19.05	1245	24.27	1304	29.43	1357	34.58	1408	39.86	1458	45.22	1508	50.74	1557	56.35	1606	62.13	1705	74.28
33200	1264	20.06	1332	26.05	1393	32.06	1450	38.16	1502	44.22	1550	50.30	1594	56.29	1637	62.39	1680	68.65	1723	75.02	1808	88.09
38000			1489	34.81	1545	41.63	1599	48.64	1649	55.63	1695	62.52	1739	69.50	1779	76.30	1818	83.23	1856	90.22		
42800			1648	45.56	1700	53.23	1750	61.04	1797	68.85	1842	76.74	1884	84.52								

MAXIMUM RPM: CLASS I = 1151 CLASS II = 1465 CLASS III = 1884

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 25.50" above the base on fan size 365.

Performance Data

402 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 40.25" **Max. BHP = 23.73 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	448	2.06																				
11500	467	2.37																				
13000	490	2.71	622	5.41																		
16000	540	3.50	657	6.59	762	9.97																
19000	595	4.44	702	7.95	797	11.74	885	15.72														
22000	654	5.56	752	9.51	840	13.71	921	18.13	998	22.72	1072	27.53										
25000	717	6.93	806	11.32	888	15.90	964	20.75	1035	25.75	1103	30.87	1169	36.19								
28000	782	8.56	863	13.35	940	18.41	1012	23.66	1078	29.01	1142	34.61	1204	40.35	1264	46.22	1322	52.19				
34000	918	12.84	985	18.27	1051	24.19	1115	30.31	1176	36.56	1234	42.96	1290	49.59	1343	56.24	1395	63.07	1446	70.02		
40000	1057	18.56	1115	24.70	1172	31.33	1228	38.30	1283	45.48	1336	52.72	1388	60.18	1437	67.63	1485	75.32	1531	83.03		
46000			1250	32.94	1300	40.21	1350	47.96	1399	56.00	1446	64.04	1493	72.30	1539	80.67	1584	89.18	1628	97.85		
52000			1389	43.27	1433	51.19	1477	59.51	1521	68.26	1564	77.22	1607	86.43	1649	95.68	1690	104.96				

MAXIMUM RPM: CLASS I = 1044 CLASS II = 1329 CLASS III = 1708

402 EPF (9-Blade, Arr. 3)

Wheel Diameter: 40.25" **Max. BHP = 23.53 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	454	2.18																				
11500	474	2.50																				
13000	497	2.87	628	5.66																		
16000	549	3.71	667	6.98	770	10.45																
19000	609	4.78	712	8.42	808	12.38	895	16.52	981	21.07												
22000	672	6.09	765	10.13	852	14.51	934	19.13	1010	23.89	1083	28.87										
25000	738	7.70	824	12.15	901	16.85	978	21.97	1050	27.21	1118	32.59	1182	38.01	1247	43.87	1314	50.25				
28000	805	9.59	885	14.45	957	19.60	1026	25.03	1094	30.75	1159	36.61	1221	42.62	1279	48.57	1337	54.86	1394	61.32		
34000	943	14.45	1014	20.26	1078	26.20	1138	32.43	1195	38.84	1251	45.45	1307	52.33	1362	59.43	1415	66.61	1466	73.87		
40000	1083	20.84	1148	27.73	1206	34.58	1260	41.56	1312	48.83	1361	56.20	1410	63.90	1458	71.71	1506	79.75	1553	87.90		
46000	1226	29.16	1285	37.08	1339	44.99	1388	52.80	1436	60.90	1481	69.04	1525	77.44	1568	86.05	1610	94.77	1652	103.72		
52000			1425	48.66	1475	57.61	1521	66.45	1564	75.24	1607	84.39	1648	93.58	1688	103.00						

MAXIMUM RPM: CLASS I = 1044 CLASS II = 1329 CLASS III = 1708

402 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 40.25" **Max. BHP = 24.62 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	443	2.14																				
11500	464	2.46																				
13000	492	2.86																				
16000	550	3.73	652	6.83																		
19000	613	4.82	707	8.40	790	12.17																
22000	677	6.09	765	10.16	842	14.39	913	18.79	988	23.62												
25000	743	7.61	827	12.20	899	16.91	965	21.75	1027	26.71	1092	32.08										
28000	811	9.42	890	14.49	959	19.72	1022	25.07	1079	30.39	1135	35.96	1192	41.83	1251	48.01						
34000	949	13.95	1021	20.08	1084	26.27	1141	32.55	1195	39.03	1246	45.55	1294	52.10	1339	58.58	1385	65.42	1432	72.55	1529	87.50
40000	1091	19.98	1156	27.16	1214	34.37	1268	41.71	1317	49.02	1364	56.51	1409	64.11	1453	71.84	1494	79.41	1534	87.12	1611	102.71
46000	1235	27.75	1294	35.97	1348	44.24	1398	52.58	1445	60.98	1489	69.39	1531	77.92	1571	86.48	1610	95.17	1649	104.10		
52000			1435	46.83	1485	56.15	1531	65.42	1575	74.82	1617	84.29	1657	93.78	1696	103.47						

MAXIMUM RPM: CLASS I = 1044 CLASS II = 1329 CLASS III = 1708

402 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 40.25" **Max. BHP = 24.62 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	447	2.18																				
11500	470	2.53																				
13000	499	2.96	620	5.75																		
16000	563	3.97	661	7.04	760	10.61																
19000	631	5.25	718	8.74	799	12.47	882	16.67														
22000	699	6.75	782	10.76	854	14.91	924	19.29	995	24.04												
25000	769	8.57	850	13.17	915	17.70	978	22.47	1039	27.38	1101	32.66	1166	38.48								
28000	841	10.76	918	15.91	981	20.95	1038	26.10	1094	31.44	1149	36.96	1204	42.73	1260	48.86	1318	55.46				
34000	987	16.33	1056	22.51	1117	28.75	1171	34.96	1219	41.11	1265	47.36	1312	53.93	1358	60.59	1403	67.34	1448	74.31	1540	89.13
40000	1137	23.86	1199	31.08	1255	38.36	1307	45.73	1354	53.01	1397	60.26	1437	67.48	1477	74.95	1516	82.46	1556	90.27	1633	105.96
46000			1345	41.90	1396	50.16	1445	58.64	1490	67.04	1533	75.55	1572	83.85	1609	92.21	1644	100.53	1678	108.89		
52000			1493	55.26	1541	64.67	1586	74.11	1629	83.67	1669	93.11	1708	102.73								

MAXIMUM RPM: CLASS I = 1044 CLASS II = 1329 CLASS III = 1708

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 28.12" above the base on fan size 402.

Performance Data

445 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 44.50" **Max. BHP = 39.19 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	403	2.47																				
13800	420	2.84																				
15600	440	3.25	560	6.49																		
17400	461	3.68	574	7.17																		
21000	507	4.69	610	8.70	700	12.97																
24600	558	5.92	652	10.42	735	15.24	812	20.30	886	25.69												
28200	612	7.37	697	12.37	775	17.69	846	23.24	914	29.07	978	34.98										
35400	727	11.20	798	17.20	865	23.49	929	30.06	989	36.88	1046	43.92	1101	51.13	1154	58.44	1205	65.81	1256	73.55		
42600	848	16.57	907	23.31	966	30.73	1022	38.28	1077	46.14	1129	54.12	1179	62.36	1226	70.57	1273	79.18	1318	87.76		
49800	972	23.71	1024	31.37	1074	39.50	1124	48.16	1173	57.06	1220	65.99	1266	75.14	1311	84.56	1354	94.06	1396	103.78		
57000			1144	41.50	1188	50.39	1233	60.00	1276	69.79	1319	79.90	1361	90.09	1402	100.39	1443	111.03	1482	121.61		
64200			1267	54.06	1307	63.90	1346	74.08	1386	84.95	1424	95.87	1463	107.31	1500	118.56	1537	130.03				

MAXIMUM RPM: CLASS I = 944 CLASS II = 1202 CLASS III = 1545

445 EPF (9-Blade, Arr. 3)

Wheel Diameter: 44.50" **Max. BHP = 38.87 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	408	2.60																				
13800	426	3.00																				
15600	446	3.44	566	6.82																		
17400	468	3.91	581	7.54																		
21000	518	5.03	618	9.17	709	13.67	794	18.53														
24600	572	6.41	661	11.02	745	16.07	822	21.35	894	26.84												
28200	629	8.11	710	13.18	786	18.73	859	24.63	926	30.63	989	36.75	1053	43.45								
35400	748	12.57	819	18.69	883	25.16	943	31.90	1003	39.04	1061	46.42	1116	53.90	1168	61.40	1219	69.16	1269	77.13		
42600	871	18.66	934	25.91	991	33.33	1044	41.01	1095	49.03	1145	57.30	1195	65.91	1244	74.74	1291	83.61	1337	92.71		
49800	996	26.65	1054	35.22	1105	43.65	1154	52.40	1200	61.32	1244	70.47	1287	79.88	1330	89.59	1373	99.58	1415	109.67		
57000	1122	36.80	1176	46.74	1224	56.49	1268	66.17	1310	76.00	1352	86.34	1391	96.62	1429	107.13	1467	117.99	1505	129.14		
64200			1300	60.84	1345	71.91	1386	82.76	1425	93.66	1463	104.8	1500	116.15	1536	127.73						

MAXIMUM RPM: CLASS I = 944 CLASS II = 1202 CLASS III = 1545

445 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 44.50" **Max. BHP = 40.67 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	399	2.57																				
13800	417	2.95																				
15600	441	3.41																				
17400	466	3.91	568	7.44																		
21000	520	5.07	609	9.09	693	13.49																
24600	576	6.44	659	11.05	731	15.84	803	21.03														
28200	634	8.09	712	13.28	780	18.67	841	24.14	904	30.09												
35400	753	12.28	824	18.72	885	25.26	941	32.00	993	38.81	1041	45.61	1090	52.82	1141	60.47	1194	68.57				
42600	877	18.01	941	25.69	997	33.41	1048	41.25	1096	49.30	1142	57.51	1185	65.67	1225	73.72	1266	82.26	1306	90.82	1391	109.31
49800	1003	25.49	1061	34.42	1113	43.39	1161	52.47	1206	61.69	1248	70.99	1288	80.36	1327	89.89	1364	99.33	1400	108.91	1469	128.27
57000	1131	35.06	1184	45.27	1232	55.46	1277	65.79	1319	76.16	1359	86.64	1397	97.24	1433	107.84	1468	118.58	1502	129.37		
64200			1309	58.50	1354	70.02	1396	81.57	1435	93.06	1473	104.79	1509	116.50	1544	128.42						

MAXIMUM RPM: CLASS I = 944 CLASS II = 1202 CLASS III = 1545

445 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 44.50" **Max. BHP = 40.67 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	402	2.62																				
13800	422	3.03																				
15600	447	3.53																				
17400	474	4.08	573	7.60																		
21000	533	5.42	617	9.37	698	13.72																
24600	594	7.07	670	11.53	740	16.28	810	21.47														
28200	655	9.01	729	14.15	791	19.35	852	24.86	912	30.68	975	37.15										
35400	781	14.08	850	20.59	907	27.00	957	33.42	1007	40.21	1055	47.05	1103	54.20	1151	61.65	1201	69.69	1253	78.39		
42600	912	21.13	973	28.83	1028	36.67	1076	44.38	1120	52.19	1161	60.02	1202	68.11	1242	76.23	1282	84.63	1322	93.29	1403	111.56
49800	1045	30.46	1100	39.40	1151	48.54	1197	57.63	1240	66.79	1279	75.86	1315	84.85	1350	93.97	1385	103.35	1420	112.88	1489	132.37
57000			1230	52.71	1277	63.11	1320	73.46	1361	83.96	1399	94.37	1435	104.82	1468	115.09	1500	125.51	1530	135.71		
64200			1363	69.26	1405	80.69	1446	92.45	1484	104.1	1521	115.98										

MAXIMUM RPM: CLASS I = 944 CLASS II = 1202 CLASS III = 1545

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 31.09" above the base on fan size 445.

Performance Data

490 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 49.00" **Max. BHP = 63.44 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	376	3.29																				
18000	392	3.74																				
20000	409	4.20	514	8.25																		
24000	446	5.26	542	9.89	627	14.89																
28000	487	6.53	576	11.75	654	17.34	726	23.18														
32000	531	8.02	612	13.77	685	19.91	752	26.34	816	33.08												
36000	577	9.77	651	16.09	720	22.78	783	29.79	843	37.13	899	44.48	955	52.38								
44000	673	14.24	736	21.62	797	29.53	854	37.62	908	46.06	958	54.56	1007	63.42	1055	72.53	1101	81.67	1146	91.03		
52000	774	20.34	828	28.62	881	37.63	932	46.90	981	56.35	1028	66.06	1073	76.03	1116	86.13	1158	96.48	1200	107.26		
60000	878	28.34	925	37.53	971	47.38	1017	57.90	1061	68.50	1104	79.29	1147	90.58	1187	101.71	1226	113.14	1264	124.79		
68000			1025	48.61	1066	59.34	1107	70.79	1147	82.60	1186	94.57	1225	106.87	1263	119.30	1300	131.89	1336	144.66		
76000			1127	62.09	1164	73.77	1201	86.08	1237	98.79	1273	111.99	1309	125.58	1343	138.87	1378	152.77				

MAXIMUM RPM: CLASS I = 857 CLASS II = 1091 CLASS III = 1403

490 EPF (9-Blade, Arr. 3)

Wheel Diameter: 49.00" **Max. BHP = 62.92 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	381	3.47																				
18000	397	3.93	510	7.95																		
20000	414	4.42	520	8.67																		
24000	454	5.59	550	10.46	634	15.65																
28000	499	7.05	583	12.37	663	18.29	734	24.33	805	31.07												
32000	545	8.75	622	14.63	695	21.09	763	27.86	825	34.71	887	42.18										
36000	593	10.79	665	17.24	730	24.10	794	31.48	855	39.21	910	46.79	965	54.94	1020	63.59						
44000	693	16.04	756	23.59	813	31.53	867	39.90	920	48.64	972	57.75	1022	67.09	1069	76.42	1114	85.81	1159	95.68		
52000	795	22.92	853	31.88	904	40.86	952	50.22	998	59.97	1043	70.02	1088	80.46	1132	91.14	1175	102.05	1217	113.23		
60000	899	31.77	952	42.11	999	52.33	1043	62.77	1086	73.74	1126	84.77	1165	96.07	1204	107.73	1243	119.72	1282	132.10		
68000	1005	42.97	1054	54.77	1098	66.40	1138	77.89	1177	89.76	1215	102.02	1251	114.41	1286	127.04	1321	140.08	1355	153.12		
76000			1156	69.75	1198	82.94	1236	95.83	1272	108.78	1307	122.01	1341	135.50	1374	149.26						

MAXIMUM RPM: CLASS I = 857 CLASS II = 1091 CLASS III = 1403

490 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 49.00" **Max. BHP = 65.84 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	372	3.40																				
18000	391	3.89																				
20000	412	4.44																				
24000	455	5.63	539	10.30																		
28000	501	7.05	579	12.35	647	17.89																
32000	549	8.76	622	14.70	685	20.81	745	27.31	808	34.40												
36000	598	10.74	667	17.32	727	24.12	782	31.14	834	38.31	890	46.24										
44000	698	15.66	761	23.61	816	31.73	866	40.05	913	48.52	956	56.92	999	65.71	1044	75.13	1090	84.90				
52000	801	22.16	858	31.43	910	41.00	956	50.54	999	60.28	1040	70.17	1080	80.33	1116	90.10	1153	100.49	1189	110.89	1266	133.53
60000	906	30.48	959	41.25	1006	52.01	1050	63.00	1091	74.13	1129	85.29	1165	96.48	1201	108.09	1235	119.56	1268	131.19	1331	154.60
68000	1012	40.85	1061	53.07	1105	65.24	1146	77.53	1185	90.03	1221	102.42	1256	115.16	1289	127.86	1321	140.69	1352	153.55		
76000			1164	67.17	1206	80.89	1245	94.65	1281	108.30	1316	122.24	1349	136.12	1381	150.26						

MAXIMUM RPM: CLASS I = 857 CLASS II = 1091 CLASS III = 1403

490 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 49.00" **Max. BHP = 65.84 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	377	3.51																				
18000	396	4.01																				
20000	418	4.61	513	8.78																		
24000	466	6.00	546	10.60	625	15.82																
28000	516	7.69	588	12.86	655	18.38	724	24.63														
32000	567	9.70	635	15.51	695	21.57	753	27.94	813	35.00												
36000	618	12.02	685	18.64	739	25.17	792	32.08	844	39.33	897	47.14	952	55.69								
44000	724	18.00	785	26.02	837	34.03	882	41.99	926	50.31	969	58.78	1012	67.64	1054	76.67	1098	86.45	1143	96.82		
52000	833	26.01	888	35.38	938	44.98	982	54.47	1021	63.85	1058	73.36	1095	83.21	1132	93.31	1168	103.51	1204	114.02	1276	135.90
60000	944	36.40	994	47.16	1040	58.11	1082	69.06	1121	80.07	1156	90.89	1189	101.76	1221	112.78	1253	124.09	1285	135.60	1348	159.13
68000			1102	61.67	1145	74.07	1185	86.56	1222	98.98	1257	111.47	1289	123.74	1319	135.97	1348	148.32	1376	160.69		
76000			1212	79.36	1251	92.95	1289	106.93	1324	120.74	1358	134.82	1389	148.50								

MAXIMUM RPM: CLASS I = 857 CLASS II = 1091 CLASS III = 1403

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 34.23" above the base on fan size 490.

Performance Data

542 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 54.25" **Max. BHP = 105.5 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	342	4.13																				
22500	356	4.65																				
25000	372	5.24	467	10.33																		
30000	407	6.61	493	12.38	569	18.60																
35000	445	8.23	524	14.67	594	21.64	659	28.97														
40000	486	10.15	558	17.28	624	24.99	684	33.03	740	41.21	796	50.15										
45000	528	12.35	595	20.31	656	28.56	713	37.37	766	46.40	817	55.73	866	65.30								
55000	618	18.20	674	27.39	727	37.07	779	47.31	827	57.74	872	68.37	916	79.44	959	90.82	1000	102.15	1040	113.71		
65000	711	26.05	759	36.35	806	47.55	851	59.03	895	70.86	937	82.91	978	95.51	1016	107.93	1054	120.96	1091	134.19		
75000	807	36.39	849	47.88	890	60.17	930	73.07	970	86.50	1008	99.87	1046	113.78	1082	127.69	1117	141.92	1151	156.41		
85000			941	62.11	977	75.36	1014	89.73	1049	104.26	1084	119.28	1119	134.70	1152	149.83	1185	165.46	1218	181.67		
95000			1035	79.47	1068	94.04	1101	109.38	1133	125.19	1165	141.62	1197	158.53	1227	175.00	1258	192.24				

MAXIMUM RPM: CLASS I = 775 CLASS II = 986 CLASS III = 1267

542 EPF (9-Blade, Arr. 3)

Wheel Diameter: 54.25" **Max. BHP = 104.7 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	347	4.36																				
22500	361	4.92	462	9.90																		
25000	378	5.58	472	10.83																		
30000	415	7.06	500	13.08	575	19.50																
35000	456	8.88	532	15.59	603	22.91	666	30.36	729	38.66												
40000	499	11.09	568	18.43	632	26.34	693	34.76	749	43.35	803	52.36	860	62.62								
45000	544	13.76	608	21.77	666	30.34	723	39.50	777	49.01	827	58.59	875	68.44	924	79.16						
55000	636	20.49	692	29.88	743	39.77	791	50.16	838	61.00	884	72.21	929	83.87	972	95.73	1012	107.34	1052	119.51		
65000	730	29.34	782	40.57	827	51.67	871	63.55	911	75.44	951	87.93	991	100.89	1031	114.40	1069	127.83	1106	141.48		
75000	826	40.78	874	53.83	915	66.41	955	79.58	993	93.12	1029	106.94	1064	121.08	1098	135.36	1133	150.38	1167	165.46		
85000	923	55.12	967	69.91	1006	84.36	1043	99.04	1077	113.58	1111	128.85	1144	144.57	1175	160.19	1206	176.35	1236	192.48		
95000			1062	89.44	1099	105.80	1133	121.92	1166	138.39	1197	154.80	1227	171.45	1257	188.80						

MAXIMUM RPM: CLASS I = 775 CLASS II = 986 CLASS III = 1267

542 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 54.25" **Max. BHP = 109.5 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	339	4.28																				
22500	356	4.87																				
25000	376	5.58	462	10.72																		
30000	416	7.10	490	12.83																		
35000	459	8.94	528	15.50	589	22.42	652	30.05														
40000	503	11.11	568	18.48	625	26.18	677	34.07	733	42.91												
45000	548	13.63	610	21.86	664	30.39	713	39.10	759	47.99	808	57.73										
55000	640	19.92	697	29.92	746	40.01	791	50.43	833	60.97	872	71.56	910	82.44	949	93.92	989	105.84	1030	118.28		
65000	735	28.27	787	40.00	833	51.87	874	63.72	913	75.98	950	88.42	985	100.84	1018	113.26	1050	125.83	1082	138.76	1149	166.41
75000	832	39.01	879	52.41	922	66.03	961	79.67	997	93.33	1032	107.51	1064	121.40	1096	135.81	1127	150.30	1156	164.55	1212	193.54
85000	930	52.44	974	67.77	1013	82.90	1050	98.34	1084	113.67	1117	129.36	1148	145.09	1178	161.10	1207	177.26	1235	193.44		
95000			1069	85.94	1107	103.22	1141	120.16	1174	137.48	1205	154.77	1234	171.88	1263	189.62						

MAXIMUM RPM: CLASS I = 775 CLASS II = 986 CLASS III = 1267

542 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 54.25" **Max. BHP = 109.5 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
20000	343	4.39																				
22500	361	5.04																				
25000	381	5.77	465	10.90																		
30000	426	7.57	497	13.27	567	19.71																
35000	472	9.72	536	16.12	596	23.00	657	30.71														
40000	519	12.28	580	19.53	634	27.13	686	35.10	738	43.64												
45000	567	15.33	626	23.49	675	31.71	722	40.29	768	49.23	815	58.90	863	69.29								
55000	665	23.05	719	33.01	766	43.07	807	53.13	845	63.25	884	73.97	922	84.92	959	96.03	997	107.82	1037	120.67		
65000	765	33.32	815	45.18	859	57.05	899	69.01	934	80.72	967	92.56	999	104.56	1032	117.15	1064	129.79	1096	142.82	1160	169.98
75000	868	46.84	912	60.19	953	73.83	991	87.62	1026	101.38	1058	115.05	1087	128.43	1116	142.32	1144	156.22	1173	170.81	1229	200.04
85000			1012	78.97	1050	94.36	1086	110.02	1119	125.50	1150	140.96	1180	156.74	1207	172.04	1233	187.47	1258	202.90		
95000			1113	101.67	1148	118.70	1182	136.18	1213	153.33	1243	170.73										

MAXIMUM RPM: CLASS I = 775 CLASS II = 986 CLASS III = 1267

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 37.90" above the base on fan size 542.

Performance Data

600 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 60.00" **Max. BHP = 174.6 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
25000	311	5.14																				
28000	324	5.79																				
31000	339	6.55	423	12.74																		
37000	370	8.20	447	15.27	515	22.87																
43000	403	10.09	475	18.08	538	26.62	596	35.50														
49000	440	12.45	505	21.19	564	30.53	618	40.32	670	50.63	720	61.44										
55000	477	15.08	537	24.71	593	34.92	644	45.57	692	56.61	738	67.96	783	79.86								
67000	557	22.09	608	33.33	656	45.13	703	57.59	746	70.17	787	83.19	827	96.73	866	110.62	903	124.38	939	138.37		
79000	640	31.51	683	43.96	726	57.66	767	71.67	807	86.09	845	100.75	882	116.03	917	131.39	951	147.06	984	162.89		
91000	724	43.59	762	57.48	800	72.58	837	88.44	872	104.29	908	121.07	942	137.78	975	154.85	1007	172.30	1037	189.46		
103000			844	74.42	877	90.57	910	107.77	943	125.84	975	144.12	1006	162.44	1037	181.31	1067	200.30	1096	219.44		
115000			928	95.13	958	112.79	987	130.99	1017	150.52	1046	170.38	1075	190.80	1103	211.12	1131	231.90				

MAXIMUM RPM: CLASS I = 700 CLASS II = 891 CLASS III = 1146

600 EPF (9-Blade, Arr. 3)

Wheel Diameter: 60.00" **Max. BHP = 173.2 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
25000	316	5.46																				
28000	329	6.15	419	12.28																		
31000	344	6.95	429	13.48																		
37000	377	8.74	453	16.10	521	24.04	588	33.13														
43000	414	10.98	482	19.18	546	28.16	603	37.32	659	47.34												
49000	452	13.63	514	22.59	572	32.31	627	42.61	678	53.23	727	64.33	777	76.48								
55000	491	16.75	549	26.54	602	37.08	653	48.16	702	59.82	747	71.45	791	83.66	835	96.65						
67000	573	24.83	624	36.31	670	48.32	714	61.12	756	74.15	798	87.92	839	102.23	877	116.32	914	130.78	950	145.52		
79000	657	35.46	703	48.89	745	62.65	784	76.86	821	91.55	858	107.01	894	122.68	929	138.56	964	155.13	998	171.99		
91000	742	49.02	785	64.73	823	80.21	859	96.12	893	112.40	926	129.31	957	146.13	989	163.98	1020	181.81	1052	200.74		
103000	828	65.99	868	83.92	903	101.30	936	118.86	968	136.94	999	155.55	1028	174.16	1057	193.56	1085	213.07	1112	232.45		
115000			952	106.95	986	126.89	1017	146.47	1046	165.96	1074	185.75	1102	206.32	1129	227.22						

MAXIMUM RPM: CLASS I = 700 CLASS II = 891 CLASS III = 1146

600 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 60.00" **Max. BHP = 181.2 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
25000	309	5.35																				
28000	325	6.10																				
31000	342	6.92	419	13.27																		
37000	378	8.79	445	15.89	511	23.93																
43000	416	11.00	479	19.13	533	27.48	590	36.89														
49000	455	13.59	514	22.66	565	31.99	613	41.85	663	52.56												
55000	495	16.63	551	26.66	600	37.12	644	47.69	686	58.64	730	70.45										
67000	577	24.20	628	36.28	673	48.69	713	61.21	751	74.02	787	87.13	821	100.23	857	114.45	893	128.86				
79000	661	34.11	708	48.33	749	62.57	787	77.19	822	91.99	856	107.27	888	122.49	918	137.64	947	152.94	976	168.65	1037	202.33
91000	747	46.85	790	63.17	829	79.72	864	96.15	897	112.87	928	129.79	958	147.08	987	164.56	1015	182.12	1041	199.27	1092	234.59
103000	834	62.76	874	81.33	910	99.86	943	118.38	974	137.01	1004	156.08	1032	175.11	1059	194.41	1085	213.81	1111	233.78		
115000			958	102.74	992	123.45	1024	144.39	1053	164.92	1081	185.76	1108	206.82	1134	228.14						

MAXIMUM RPM: CLASS I = 700 CLASS II = 891 CLASS III = 1146

600 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 60.00" **Max. BHP = 181.2 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
25000	313	5.51																				
28000	329	6.29																				
31000	347	7.18	422	13.51																		
37000	387	9.36	451	16.39	514	24.33																
43000	428	11.97	486	19.85	540	28.30	594	37.58														
49000	470	15.09	525	23.95	573	33.14	620	42.88	668	53.57												
55000	512	18.69	566	28.74	610	38.73	653	49.33	694	60.12	736	71.78	780	84.65								
67000	599	27.92	648	40.05	691	52.40	728	64.65	763	77.15	798	90.12	832	103.31	866	117.03	901	131.65	936	146.75		
79000	688	40.19	733	54.52	773	68.96	809	83.43	841	97.75	871	112.18	901	127.16	930	142.06	960	157.91	988	173.24	1047	206.80
91000	779	56.15	819	72.33	857	89.12	891	105.71	923	122.52	951	138.70	978	155.25	1004	171.96	1030	189.13	1056	206.63	1107	242.21
103000			908	94.67	942	113.13	975	132.22	1005	150.99	1033	169.67	1060	188.70	1084	206.97	1108	225.90	1131	244.79		
115000			998	121.65	1030	142.37	1060	163.15	1089	184.32	1116	205.28	1142	226.42								

MAXIMUM RPM: CLASS I = 700 CLASS II = 891 CLASS III = 1146

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 41.92" above the base on fan size 600.

Performance Data

660 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 66.00" **Max. BHP = 281 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	282	6.17																				
35000	299	7.31	379	14.52																		
40000	317	8.53	392	16.50																		
45000	337	9.97	407	18.57	469	27.85																
53000	371	12.59	435	22.29	492	32.80	544	43.64														
61000	408	15.79	466	26.64	519	38.20	567	50.20	613	62.77	657	75.78										
69000	446	19.54	499	31.57	549	44.33	594	57.40	637	71.20	678	85.32	717	99.59	756	114.81						
77000	486	24.13	534	37.15	580	50.97	623	65.19	664	80.20	702	95.29	740	111.32	775	126.80	810	143.08	845	160.24		
93000	568	35.82	608	50.55	648	66.76	686	83.28	723	100.34	759	118.17	792	135.79	824	153.85	856	172.78	887	191.87		
109000	653	51.66	687	68.12	722	86.31	756	105.39	788	124.36	821	144.53	852	164.54	882	184.95	911	205.76	939	226.79		
125000			769	90.56	799	110.16	829	131.05	859	153.00	888	175.16	916	197.31	944	220.10	971	242.96	998	266.68		
141000			853	118.46	880	140.06	907	162.78	933	186.09	959	210.28	985	235.18	1011	260.66	1036	285.91				

MAXIMUM RPM: CLASS I = 637 CLASS II = 810 CLASS III = 1041

660 EPF (9-Blade, Arr. 3)

Wheel Diameter: 66.00" **Max. BHP = 279 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	286	6.52																				
35000	303	7.72	383	15.24																		
40000	322	9.06	397	17.36	464	26.54																
45000	344	10.67	413	19.65	475	29.37	534	40.05														
53000	381	13.69	441	23.58	499	34.64	551	46.01	601	58.17												
61000	419	17.31	474	28.30	526	40.37	576	53.27	621	66.15	664	79.52	708	94.23								
69000	459	21.75	510	33.83	557	46.93	602	60.63	646	75.17	687	89.90	726	104.94	764	120.50	803	137.36				
77000	500	27.04	548	40.35	591	54.34	632	69.07	673	84.73	712	100.67	750	117.31	785	133.58	819	150.20	854	168.21		
93000	583	40.25	626	56.15	665	72.48	701	89.33	735	106.64	769	124.76	803	143.65	836	162.84	868	182.36	899	202.19		
109000	668	57.77	708	76.75	743	95.40	775	114.11	807	134.08	837	154.30	866	174.88	895	196.12	924	217.98	952	239.80		
125000	755	80.52	791	102.19	823	123.38	853	144.72	882	166.65	910	189.14	936	211.50	962	234.79	988	258.88	1013	282.83		
141000			875	133.21	905	157.30	934	181.86	960	205.63	986	230.36	1011	255.36	1035	280.62						

MAXIMUM RPM: CLASS I = 637 CLASS II = 810 CLASS III = 1041

660 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 66.00" **Max. BHP = 292 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	280	6.42																				
35000	300	7.67																				
40000	322	9.12	388	17.10																		
45000	345	10.74	406	19.41	465	29.07																
53000	383	13.71	440	23.75	488	33.91	539	45.48														
61000	422	17.25	475	28.49	521	40.11	563	52.08	607	65.26												
69000	462	21.43	513	34.14	556	47.02	596	60.37	633	73.92	671	88.42	710	103.59								
77000	503	26.38	551	40.36	593	54.78	631	69.49	666	84.27	699	99.27	732	114.86	767	131.64						
93000	587	38.87	631	55.78	669	72.67	704	90.01	736	107.44	767	125.33	796	143.13	823	160.70	851	179.51	878	198.13	936	238.73
109000	673	55.36	712	74.80	748	94.74	780	114.44	810	134.42	839	155.09	866	175.62	892	196.25	918	217.61	942	238.40	988	280.28
125000	760	76.42	796	98.84	829	121.44	859	143.92	887	166.44	914	189.40	940	212.86	964	235.90	988	259.72	1011	283.43		
141000			881	128.07	912	153.65	940	178.84	967	204.50	992	229.85	1016	255.36	1040	281.83						

MAXIMUM RPM: CLASS I = 637 CLASS II = 810 CLASS III = 1041

660 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 66.00" **Max. BHP = 292 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
30000	283	6.56																				
35000	304	7.93	378	15.46																		
40000	328	9.57	392	17.49																		
45000	353	11.42	411	19.96	468	29.60																
53000	394	14.93	447	24.74	495	35.05	543	46.34														
61000	436	19.19	486	30.28	529	41.72	570	53.53	612	66.48	656	80.93										
69000	479	24.32	527	36.85	567	49.49	604	62.40	641	76.03	677	90.07	715	105.60								
77000	522	30.28	568	44.29	607	58.33	641	72.34	675	87.13	708	102.21	740	117.54	774	134.47	808	152.07				
93000	611	45.70	652	62.42	689	79.46	722	96.50	751	113.24	779	130.42	807	148.19	835	166.48	862	184.80	889	203.68	944	243.74
109000	702	66.34	739	85.88	773	105.73	804	125.56	833	145.59	859	165.25	884	185.33	907	204.86	931	225.59	955	246.70	1002	289.69
125000			827	115.08	859	138.01	888	160.69	916	183.92	941	206.32	965	229.04	988	252.09	1009	274.45	1030	297.47		
141000			917	151.42	946	176.86	973	202.25	999	228.04	1024	254.13										

MAXIMUM RPM: CLASS I = 637 CLASS II = 810 CLASS III = 1041

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 46.11" above the base on fan size 660.

Performance Data

730 EPFN (9-Blade, Arr. 1 and 4)

Wheel Diameter: 73.00" **Max. BHP = 466 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
40000	263	8.28																				
45000	276	9.45	346	18.52																		
50000	290	10.76	357	20.68																		
55000	305	12.23	368	22.72	424	34.06																
60000	320	13.76	381	25.06	434	37.07	484	49.94														
70000	353	17.40	408	30.02	457	43.43	503	57.78	546	72.49												
80000	387	21.63	437	35.69	484	50.77	526	66.27	566	82.49	604	99.02	641	116.27								
90000	424	27.03	469	42.42	512	58.71	552	75.63	589	93.01	625	111.25	660	130.06	693	148.77	726	168.56				
110000	499	40.70	537	58.52	574	77.82	609	97.38	643	117.67	676	138.96	706	159.78	**736**	**181.75**	**765**	**203.99**	**794**	**227.10**		
130000	577	59.46	609	79.38	641	101.11	672	123.77	702	146.75	732	170.68	**761**	**195.11**	788	219.30	815	244.70	**840**	**269.38**		
150000			684	106.25	712	130.12	**740**	**155.62**	**767**	**181.73**	**793**	**207.92**	819	234.82	845	262.60	870	290.49	894	318.48		
170000			**761**	**139.92**	**786**	**166.17**	**811**	**193.85**	**835**	**222.24**	**859**	**251.71**	**883**	**282.04**	**906**	**312.07**	**929**	**342.76**				

MAXIMUM RPM: CLASS I = 576 CLASS II = 733 CLASS III = 942

730 EPF (9-Blade, Arr. 3)

Wheel Diameter: 73.00" **Max. BHP = 462 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
40000	267	8.78	342	17.60																		
45000	280	10.02	350	19.46																		
50000	295	11.47	362	21.82	421	33.06																
55000	311	13.06	373	23.96	429	35.81	483	49.04														
60000	327	14.73	386	26.45	440	39.12	489	52.37														
70000	362	18.91	414	31.78	464	46.08	510	60.98	552	76.08	594	92.54										
80000	399	24.12	447	38.41	491	53.81	533	69.87	574	87.08	611	103.97	648	122.12	685	141.41						
90000	436	30.16	481	45.92	521	62.50	560	80.18	598	98.66	634	117.52	668	136.62	701	156.31	733	176.40	**766**	**198.18**		
110000	513	45.89	552	64.52	588	83.95	621	103.97	653	124.90	685	146.80	716	169.06	**747**	**192.44**	**776**	**215.47**	**804**	**238.77**		
130000	591	66.70	627	89.03	659	111.22	689	133.94	718	157.71	**745**	**181.57**	**772**	**206.44**	799	232.09	826	258.60	852	285.05		
150000	671	94.01	704	120.01	733	145.30	**761**	**171.32**	**787**	**197.36**	**812**	**223.99**	**837**	**252.01**	**860**	**279.36**	**884**	**308.58**	**907**	**337.47**		
170000			**781**	**157.49**	**809**	**186.94**	**835**	**216.23**	**859**	**245.17**	**882**	**274.40**	**905**	**304.80**	**927**	**335.49**						

MAXIMUM RPM: CLASS I = 576 CLASS II = 733 CLASS III = 942

730 EPQN (12-Blade, Arr. 1 and 4)

Wheel Diameter: 73.00" **Max. BHP = 483 x (RPM / 1000)³**

CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
40000	262	8.59																				
45000	278	9.97	343	19.32																		
50000	295	11.52	353	21.33																		
55000	311	13.02	366	23.55	420	35.46																
60000	329	14.87	382	26.28	429	38.26																
70000	365	19.00	414	31.96	457	45.50	498	59.87														
80000	401	23.76	448	38.49	489	53.85	525	69.13	560	85.12	598	102.96										
90000	439	29.61	483	45.89	522	62.96	557	80.19	589	97.50	620	115.33	653	134.78	686	154.57						
110000	516	44.27	556	64.11	591	84.14	623	104.69	653	125.70	681	146.64	707	167.41	733	189.15	**759**	**211.62**	**785**	**234.46**	840	283.65
130000	595	63.87	631	87.12	664	110.94	693	134.32	721	158.62	**747**	**183.02**	**772**	**207.79**	796	232.62	819	257.56	841	282.52	**884**	**333.53**
150000	676	89.52	708	116.01	**738**	**143.01**	**766**	**170.38**	**792**	**197.79**	**816**	**224.95**	**840**	**253.46**	**862**	**281.30**	**884**	**310.09**	**905**	**338.63**		
170000			**787**	**151.93**	**815**	**182.62**	**840**	**212.61**	**865**	**243.87**	**888**	**274.68**	**910**	**305.64**	**931**	**336.76**						

MAXIMUM RPM: CLASS I = 576 CLASS II = 733 CLASS III = 942

730 EPQ (12-Blade, Arr. 3)

Wheel Diameter: 73.00" **Max. BHP = 483 x (RPM / 1000)³**

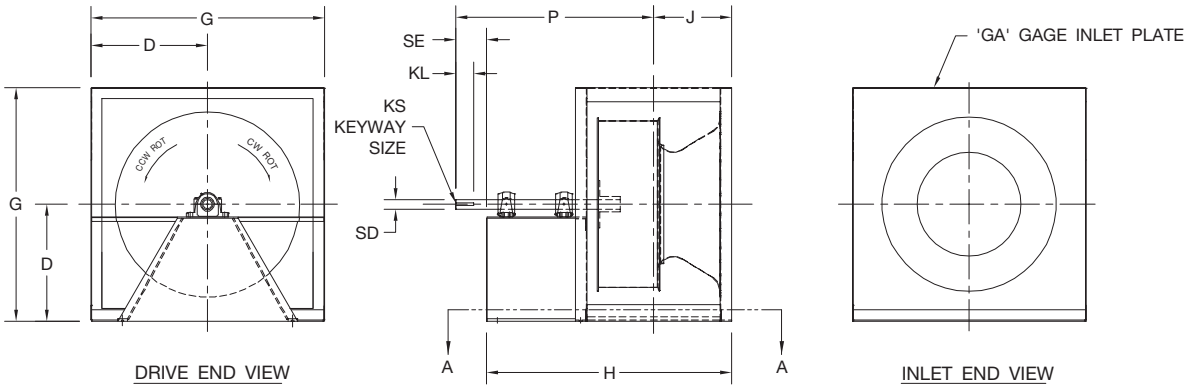
CFM	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP		12" SP	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
40000	266	8.92																				
45000	283	10.45	345	19.63																		
50000	300	12.03	357	21.85																		
55000	319	13.96	371	24.31	423	36.17																
60000	338	16.06	387	27.14	434	39.28	483	53.29														
70000	376	20.87	422	33.59	463	46.94	503	61.14	544	76.79												
80000	415	26.70	460	41.40	497	56.17	532	71.35	567	87.50	602	104.59	639	123.62								
90000	455	33.72	498	50.26	533	66.50	565	83.17	597	100.71	628	118.68	659	137.50	691	157.74	724	179.48				
110000	537	51.88	575	71.76	609	91.99	639	112.17	665	131.73	691	152.24	717	173.36	**743**	**195.24**	**768**	**217.09**	**793**	**239.61**	**846**	**289.40**
130000	620	76.15	654	99.40	686	123.49	714	146.97	**741**	**171.28**	**764**	**194.31**	**787**	**218.44**	809	242.62	831	267.35	853	292.58	895	342.82
150000			**736**	**135.10**	**765**	**162.48**	**791**	**189.37**	**817**	**217.60**	**840**	**244.70**	**862**	**272.21**	**882**	**299.04**	**901**	**325.76**	**921**	**354.36**		
170000			**819**	**179.31**	**845**	**209.67**	**870**	**240.60**	**894**	**272.01**	**916**	**302.77**	**938**	**334.67**								

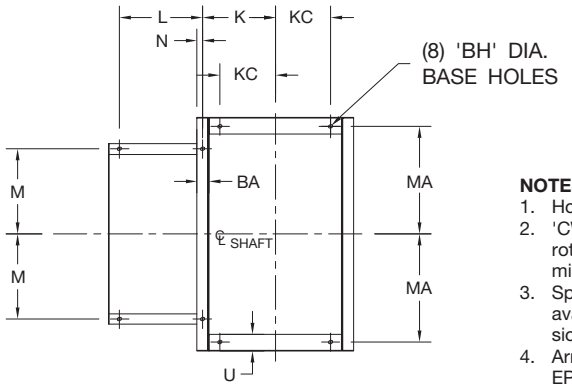
MAXIMUM RPM: CLASS I = 576 CLASS II = 733 CLASS III = 942

Class I = First white section
Class II = Blue shaded section
Class III = Bolded section after blue section
Underlined figures indicate Maximum Static Efficiency

Performance certified is for installation Type A; Free inlet, Free outlet.
Power rating (BHP) does not include transmission losses.
Performance ratings do not include the effects of appurtenances (accessories).
Performance based on a shaft height of 51" above the base on fan size 730.

Dimensional Data – Horizontal, Arr. 1 - Class I and II





NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Split roller bearing upgrades are not available on fans with 'SD' dimensions less than 1.44".
4. Arrangement 1 is available on models EPFN and EPQN.

SIZE	BA	BH	D	G	GA	H	J	K	KC	KL	KS		L	M	MA	N	P	SD		SE	U
											CL I	CL II						CL I	CL II		
122	1.50	0.31	10.00	20.00	12	22.88	6.88	6.25	4.00	3.25	.25 x .13	.25 x .13	7.88	6.75	9.13	0.63	20.38	1.00	1.19	4.38	1.50
150	1.50	0.44	11.00	22.00	12	26.88	7.88	7.25	5.00	3.25	.25 x .13	.25 x .13	9.88	8.25	10.13	0.63	23.38	1.00	1.19	4.38	1.50
165	1.50	0.44	12.00	24.00	12	28.13	8.50	7.88	5.50	3.25	.25 x .13	.25 x .13	9.88	8.75	11.13	0.63	24.00	1.00	1.19	4.38	1.50
182	1.75	0.44	13.00	26.00	12	30.88	9.50	8.75	5.25	3.88	.25 x .13	.38 x .19	10.75	9.63	11.50	0.75	26.38	1.19	1.44	5.00	4.00
200	2.25	0.56	14.50	29.00	12	33.75	10.69	9.69	7.50	3.63	.38 x .19	.38 x .19	11.50	10.63	13.00	1.00	28.06	1.44	1.44	5.00	4.00
222	2.25	0.56	16.00	32.00	10	37.88	11.50	10.50	8.00	4.25	.38 x .19	.38 x .19	14.00	11.75	14.50	1.00	32.00	1.44	1.69	5.63	4.00
245	2.50	0.56	17.00	34.00	10	41.38	12.63	11.50	7.50	4.25	.38 x .19	.38 x .19	15.38	12.88	14.50	1.13	34.38	1.44	1.69	5.63	4.00
270	2.50	0.56	19.00	38.00	10	45.38	13.63	12.50	8.00	5.63	.38 x .19	.50 x .25	17.38	14.13	16.50	1.13	38.75	1.69	1.94	7.00	4.00
300	3.00	0.56	21.00	42.00	10	50.13	15.25	13.88	9.00	5.50	.50 x .25	.50 x .25	19.13	15.88	17.50	1.38	41.88	1.94	1.94	7.00	4.75
330	3.50	0.56	23.00	46.00	10	54.88	16.88	15.25	10.75	6.75	.50 x .25	.50 x .25	20.88	17.38	19.50	1.63	46.25	1.94	2.19	8.25	4.75
365	3.50	0.56	25.50	51.00	7	59.31	18.31	16.69	12.00	6.75	.50 x .25	.63 x .31	22.44	18.88	22.00	1.63	49.25	1.94	2.44	8.25	4.75
402	3.50	0.81	28.00	56.00	7	64.19	19.75	18.13	13.50	6.75	.50 x .25	.63 x .31	24.44	20.88	24.50	1.63	52.69	2.19	2.44	8.25	4.75
445	4.00	0.81	31.00	62.00	7	70.81	21.81	19.94	15.81	6.50	.63 x .31	.63 x .31	27.19	22.88	26.50	1.88	57.25	2.44	2.69	8.25	6.00
490	4.00	0.81	34.00	68.00	7	76.31	23.56	21.69	17.56	6.50	.63 x .31	.75 x .38	29.19	25.38	29.50	1.88	61.00	2.69	2.94	8.25	6.00
542	4.00	0.81	38.00	76.00	7	81.31	25.56	23.69	19.56	6.38	.75 x .38	.88 x .44	30.19	27.63	33.50	1.88	64.00	2.94	3.44	8.25	6.00
600	5.00	0.81	38.00	76.00	.25	89.88	28.81	26.44	21.81	6.63	.75 x .38	.88 x .44	32.75	30.63	33.50	2.38	69.56	2.94	3.44	8.50	6.00
660	5.00	0.81	40.75	81.50	.25	97.50	31.13	28.75	24.13	6.63	.88 x .44	1.00 x .50	35.75	33.13	36.25	2.38	75.00	3.44	3.94	8.63	6.00
730	5.00	0.81	46.00	92.00	.25	105.75	33.75	31.38	26.75	6.63	.88 x .44	1.00 x .50	38.75	37.13	41.50	2.38	80.63	3.44	3.94	8.63	6.00

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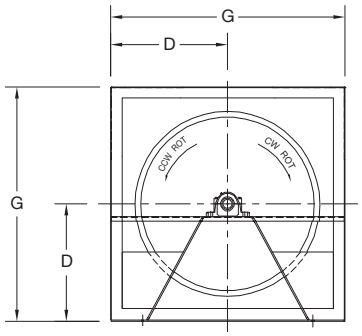
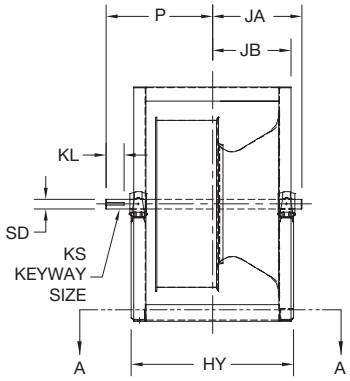
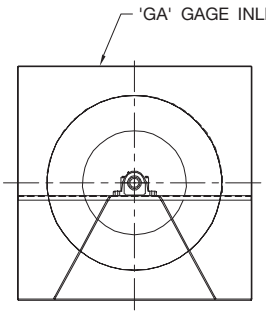
DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

Dimensional Data – Horizontal, Arr. 3 - Class I, II, and III

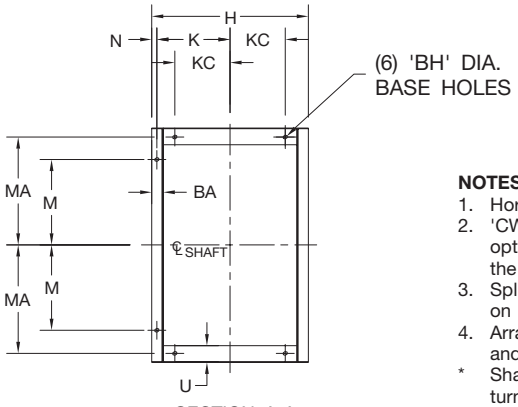


DRIVE END VIEW





INLET END VIEW



SECTION A-A

NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Split roller bearing upgrades are not available on fans with 'SD' dimensions less than 1.44".
4. Arrangement 3 is available on models EPF and EPQ.

* Shaft diameter ('SD') on Size 730, Class III is turned down from $4^{7}/_{16}$"

Class I and II

SIZE	BA	BH	D	G	GA	H	HY		JA		JB	K	KC	KL	KS		M	MA	N	P		SD		U
							CL I	CL II	CL I	CL II					CL I	CL II				CL I	CL II	CL I	CL II	
122	1.50	0.31	10.00	20.00	12	13.75	16.00	16.00	7.75	7.88	6.88	6.25	4.00	2.38	.25 x .13	.25 x .13	6.75	9.13	0.63	11.13	11.13	1.00	1.19	1.50
150	1.50	0.44	11.00	22.00	12	15.75	18.00	18.00	8.75	8.88	7.88	7.25	5.00	3.38	.25 x .13	.25 x .13	8.25	10.13	0.63	13.13	13.13	1.00	1.19	1.50
165	1.50	0.44	12.00	24.00	12	17.00	19.25	19.25	9.38	9.50	8.50	7.88	5.50	3.38	.25 x .13	.25 x .13	8.75	11.13	0.63	13.75	13.75	1.00	1.19	1.50
182	1.75	0.44	13.00	26.00	12	19.00	20.75	20.75	10.25	10.31	9.50	8.75	5.25	3.00	.25 x .13	.38 x .19	9.63	11.50	0.75	14.13	15.06	1.19	1.44	4.00
200	2.25	0.56	14.50	29.00	12	21.38	22.13	23.13	10.94	11.25	10.69	9.69	7.50	3.00	.25 x .13	.38 x .19	10.63	13.00	1.00	14.81	15.75	1.19	1.44	4.00
222	2.25	0.56	16.00	32.00	10	23.00	23.75	24.75	11.88	12.19	11.50	10.50	8.00	4.00	.38 x .19	.38 x .19	11.75	14.50	1.00	17.56	17.69	1.44	1.69	4.00
245	2.50	0.56	17.00	34.00	10	25.25	25.50	26.50	12.75	13.06	12.63	11.50	7.50	3.50	.38 x .19	.50 x .25	12.88	14.50	1.13	17.94	18.06	1.44	1.94	4.00
270	2.50	0.56	19.00	38.00	10	27.25	27.50	28.50	13.75	14.06	13.63	12.50	8.00	3.50	.38 x .19	.50 x .25	14.13	16.50	1.13	18.94	19.06	1.44	1.94	4.00
300	3.00	0.56	21.00	42.00	10	30.50	30.75	30.75	15.19	15.31	15.25	13.88	9.00	4.50	.38 x .19	.50 x .25	15.88	17.50	1.38	21.19	21.50	1.69	1.94	4.75
330	3.50	0.56	23.00	46.00	10	33.75	34.00	34.00	16.56	16.69	16.88	15.25	10.75	4.50	.38 x .19	.50 x .25	17.38	19.50	1.63	22.44	22.63	1.69	1.94	4.75
365	3.50	0.56	25.50	51.00	7	36.63	37.00	38.00	18.06	18.56	18.31	16.69	12.00	4.75	.50 x .25	.50 x .25	18.88	22.00	1.63	24.13	24.75	1.94	2.19	4.75
402	3.50	0.81	28.00	56.00	7	39.50	39.88	40.88	19.56	20.00	19.75	18.13	13.50	5.50	.50 x .25	.50 x .25	20.88	24.50	1.63	26.56	26.94	1.94	2.19	4.75
445	4.00	0.81	31.00	62.00	7	43.63	44.00	44.00	21.56	21.75	21.81	19.94	15.81	5.50	.50 x .25	.63 x .31	22.88	26.50	1.88	28.50	28.81	2.19	2.44	6.00
490	4.00	0.81	34.00	68.00	7	47.13	47.50	47.50	23.31	23.56	23.56	21.69	17.56	5.50	.50 x .25	.63 x .31	25.38	29.50	1.88	30.25	30.88	2.19	2.69	6.00
542	4.00	0.81	38.00	76.00	7	51.13	51.50	53.50	25.31	26.06	25.56	23.69	19.56	6.63	.63 x .31	.75 x .38	27.63	33.50	1.88	33.69	34.63	2.44	2.94	6.00
600	5.00	0.81	38.00	76.00	.25	57.63	58.13	58.13	28.44	28.56	28.81	26.44	21.81	6.81	.63 x .31	.88 x .44	30.63	33.50	2.38	37.00	38.19	2.69	3.44	6.00
660	5.00	0.81	40.75	81.50	.25	62.25	62.75	64.75	30.75	31.38	31.13	28.75	24.13	7.38	.75 x .38	.88 x .44	33.13	36.25	2.38	40.00	42.06	2.94	3.44	6.00
730	5.00	0.81	46.00	92.00	.25	67.50	68.00	70.00	33.50	34.00	33.75	31.38	26.75	7.38	.88 x .44	.88 x .44	37.13	41.50	2.38	43.69	44.69	3.44	3.44	6.00

AC1001285B

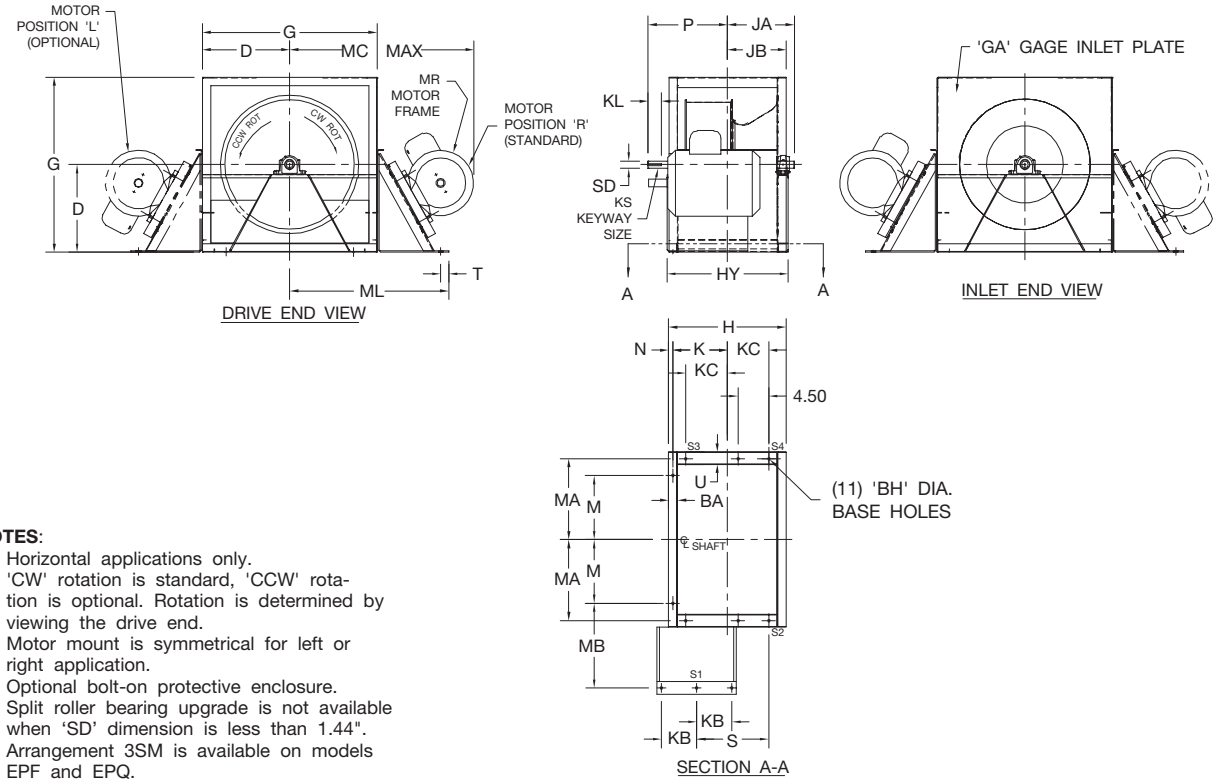
Class III

SIZE	BA	BH	D	G	GA	H	HY	JA	JB	K	KC	KL	KS	M	MA	N	P	SD	U
182	1.75	0.44	13.00	26.00	10	19.00	21.75	10.69	9.50	8.75	5.25	2.94	.38 x .19	9.63	11.50	0.75	15.19	1.69	4.00
200	2.25	0.56	14.50	29.00	10	21.38	23.13	11.38	10.69	9.69	7.50	2.94	.38 x .19	10.63	13.00	1.00	15.88	1.69	4.00
222	2.25	0.56	16.00	32.00	7	23.00	24.88	12.31	11.50	10.50	8.00	3.94	.50 x .25	11.75	14.50	1.00	18.06	1.94	4.00
245	2.50	0.56	17.00	34.00	7	25.25	26.63	13.19	12.63	11.50	7.50	3.50	.50 x .25	12.88	14.50	1.13	18.50	1.94	4.00
270	2.50	0.56	19.00	38.00	7	27.25	28.63	14.38	13.63	12.50	8.00	3.44	.50 x .25	14.13	16.50	1.13	19.56	2.19	4.00
300	3.00	0.56	21.00	42.00	7	30.50	30.88	15.38	15.25	13.88	9.00	4.44	.50 x .25	15.88	17.50	1.38	21.69	2.19	4.75
330	3.50	0.56	23.00	46.00	7	33.75	35.13	17.13	16.88	15.25	10.75	4.56	.63 x .31	17.38	19.50	1.63	23.63	2.44	4.75
365	3.50	0.56	25.50	51.00	.25	36.63	38.13	18.69	18.31	16.69	12.00	4.56	.63 x .31	18.88	22.00	1.63	24.94	2.44	4.75
402	3.50	0.81	28.00	56.00	.25	39.50	43.00	20.88	19.75	18.13	13.50	5.50	.63 x .31	20.88	24.50	1.63	28.13	2.69	4.75
445	4.00	0.81	31.00	62.00	.25	43.63	46.13	22.44	21.81	19.94	15.81	6.63	.75 x .38	22.88	26.50	1.88	31.06	2.94	6.00
490	4.00	0.81	34.00	68.00	.25	47.13	51.63	24.69	23.56	21.69	17.56	6.63	.75 x .38	25.38	29.50	1.88	33.75	2.94	6.00
542	4.00	0.81	38.00	76.00	.5	51.13	55.63	26.81	25.56	23.69	19.56	6.38	.88 x .44	27.63	33.50	1.88	36.56	3.44	6.00
600	5.00	0.81	38.00	76.00	.31	57.63	60.25	29.31	28.81	26.44	21.81	6.88	1.00 x .50	30.63	33.50	2.38	39.56	3.94	6.00
660	5.00	0.81	40.75	81.50	.31	62.25	66.88	32.13	31.13	28.75	24.13	8.25	1.00 x .50	33.13	36.25	2.38	44.19	3.94	6.00
730	5.00	0.81	46.00	92.00	.31	67.50	72.13	34.56	33.75	31.38	26.75	8.69	.88 x .44	37.13	41.50	2.38	47.06	3.44*	6.00

AC1001320A

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

Dimensional Data – Horizontal, Arr. 3SM - Class I and II



NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Motor mount is symmetrical for left or right application.
4. Optional bolt-on protective enclosure.
5. Split roller bearing upgrade is not available when 'SD' dimension is less than 1.44".
6. Arrangement 3SM is available on models EPF and EPQ.

SIZE	BA	BH	D	G	GA	H	HY		JA		JB	K	KB	KC	KL	KS	
							CL I	CL II	CL I	CL II						CL I	CL II
165	1.50	0.44	12.00	24.00	12	17.00	19.25	20.25	9.63	11.06	8.50	7.88	5.00	5.50	3.38	.25 x .13	.25 x .13
182	1.75	0.44	13.00	26.00	12	19.00	21.75	22.75	10.81	12.06	9.50	8.75	5.63	5.25	3.00	.25 x .13	.38 x .19
200	2.25	0.56	14.50	29.00	12	21.38	23.13	24.13	11.50	12.75	10.69	9.69	5.63	7.50	3.00	.25 x .13	.38 x .19
222	2.25	0.56	16.00	32.00	10	23.00	25.75	25.75	13.56	1356	11.50	10.50	5.63	8.00	4.00	.38 x .19	.38 x .19
245	2.50	0.56	17.00	34.00	10	25.25	27.50	27.50	14.44	14.44	12.63	11.50	6.50	7.50	3.50	.38 x .19	.50 x .25
270	2.50	0.56	19.00	38.00	10	27.25	29.50	29.50	15.44	15.44	13.63	12.50	6.50	8.00	3.50	.38 x .19	.50 x .25
300	3.00	0.56	21.00	42.00	10	30.50	31.75	32.75	16.56	16.75	15.25	13.88	8.75	9.00	4.50	.38 x .19	.50 x .25
330	3.50	0.56	23.00	46.00	10	33.75	34.00	35.00	17.69	17.88	16.88	15.25	8.75	10.75	4.50	.38 x .19	.50 x .25
365	3.50	0.56	25.50	51.00	7	36.63	37.00	38.00	19.19	20.00	18.31	16.69	10.44	12.00	4.75	.50 x .25	.50 x .25
402	3.50	0.81	28.00	56.00	7	39.50	40.88	40.88	20.81	21.44	19.75	18.13	9.69	13.50	5.50	.50 x .25	.50 x .25
445	4.00	0.81	31.00	62.00	7	43.63	44.00	44.00	23.00	23.25	21.81	19.94	9.69	15.81	5.50	.50 x .25	.63 x .31
490	4.00	0.81	34.00	68.00	7	47.13	47.50	49.50	24.75	25.56	23.56	21.69	9.69	17.56	5.50	.50 x .25	.63 x .31
542	4.00	0.81	38.00	76.00	7	51.13	51.50	53.50	27.00	27.25	25.56	23.69	10.19	19.56	6.63	.63 x .31	.75 x .38
600	5.00	0.81	38.00	76.00	.25	57.63	58.00	60.00	29.88	30.69	28.81	26.44	9.19	21.81	6.81	.63 x .31	.88 x .44

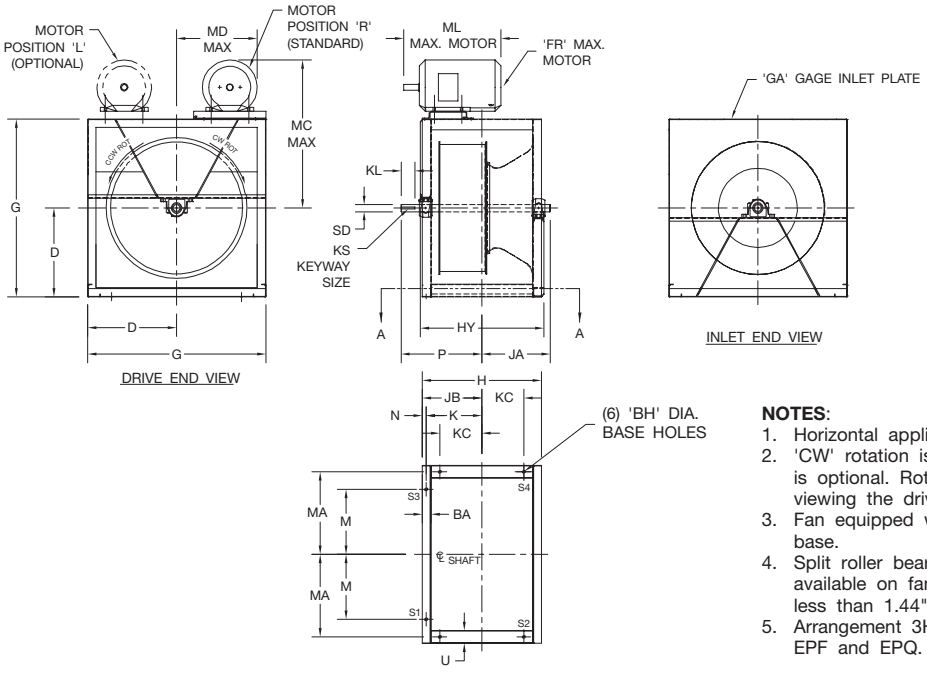
SIZE	M	MA	MB	MC	ML	MR	N	P		S		SD		T	U
								CL I	CL II	CL I	CL II	CL I	CL II		
165	8.75	11.13	13.50	26.75	23.25	56 - 215T	0.63	13.63	13.94	8.38	8.69	1.00	1.19	1.00	1.50
182	9.63	11.50	13.69	27.50	24.31	143T - 215T	0.75	14.69	15.69	8.75	8.94	1.19	1.44	1.00	4.00
200	10.63	13.00	14.19	31.00	25.81	143T - 254T	1.00	16.38	16.38	12.50	12.50	1.19	1.44	1.00	4.00
222	11.75	14.50	14.94	37.50	27.69	143T - 254T	1.00	18.25	18.25	14.75	14.75	1.44	1.69	1.00	4.00
245	12.88	14.50	15.69	32.00	29.56	143T - 256T	1.13	18.63	18.63	13.25	13.25	1.44	1.94	1.00	4.00
270	14.13	16.50	17.75	37.75	32.88	145T - 256T	1.13	19.63	19.63	14.81	14.81	1.44	1.94	1.00	4.00
300	15.88	17.50	18.88	42.00	36.00	145T - 284T	1.38	21.75	22.00	15.44	15.69	1.69	1.94	1.25	4.75
330	17.38	19.50	21.13	48.25	39.75	145T - 286T	1.63	22.88	23.75	17.81	18.06	1.69	1.94	1.25	4.75
365	18.88	22.00	23.38	53.25	43.50	182T - 324T	1.63	24.63	25.75	18.88	19.13	1.94	2.19	1.25	4.75
402	20.88	24.50	25.63	49.50	48.00	182T - 326T	1.63	27.06	28.19	23.31	23.56	1.94	2.19	1.50	4.75
445	22.88	26.50	27.63	53.25	52.00	184T - 326T	1.88	29.25	30.31	27.69	26.50	2.19	2.44	1.50	6.00
490	25.38	29.50	30.31	62.50	57.19	213T - 326T	1.88	31.00	32.06	30.25	31.31	2.19	2.69	1.50	6.00
542	27.63	33.50	33.75	66.50	62.88	213T - 364T	1.88	35.06	34.88	34.94	34.75	2.44	2.94	1.50	6.00
600	30.63	33.50	33.06	70.75	65.19	213T - 365T	2.38	37.63	38.69	40.94	40.63	2.69	3.44	1.50	6.00

AC1001294C

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

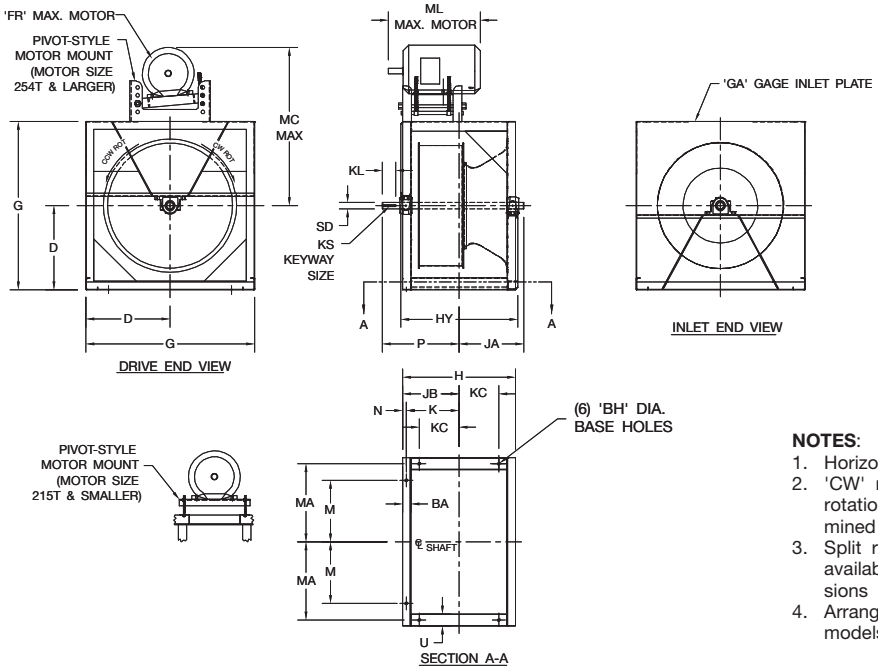
Dimensional Data – Horizontal, Arr. 3HS/3HA - Class I and II

Arr. 3HS



NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Fan equipped with standard NEMA slide base.
4. Split roller bearing upgrades are not available on fans with 'SD' dimensions less than 1.44".
5. Arrangement 3HS is available on models EPF and EPQ.

Arr. 3HA



NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Split roller bearing upgrades are not available on fans with 'SD' dimensions less than 1.44".
4. Arrangement 3HA is available on models EPF and EPQ.

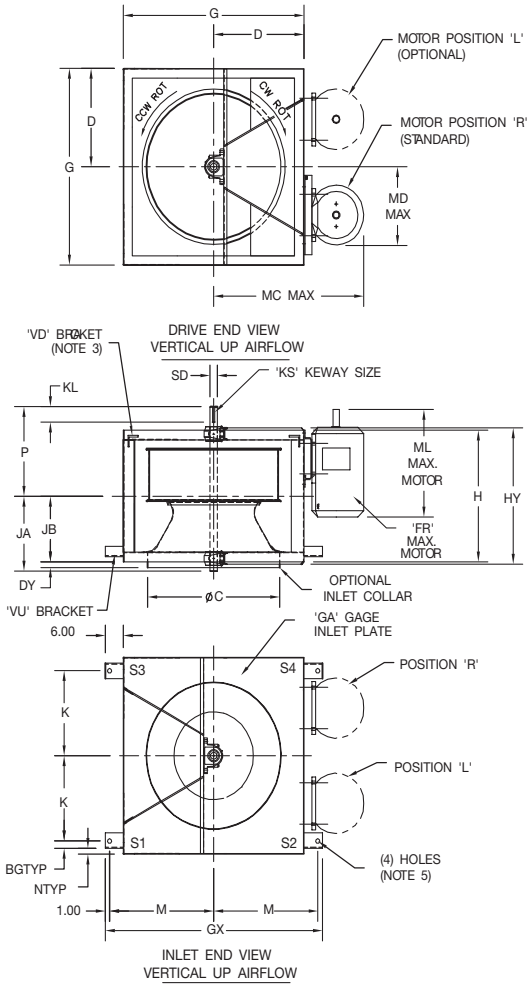
SIZE		BA	BH	D	FR	G	GA	H	HY		JA		JB	K	KC	KL	KS		M	MA	MC		MD	ML	N	P		SD		U
3HA	3HS								CL I	CL II	CL I	CL II					CL I	CL II			3HA	3HS				CL I	CL II	CL I	CL II	
122	---	1.50	0.31	10.00	215T	20.00	12	13.75	16.00	16.00	7.75	7.88	6.88	6.25	4.00	2.38	.25x.13	.25x.13	6.75	9.13	26.81	---	---	20.25	0.63	11.13	11.13	1.00	1.19	1.50
150	---	1.50	0.44	11.00	215T	22.00	12	15.75	18.00	18.00	8.75	8.88	7.88	7.25	5.00	3.38	.25x.13	.25x.13	8.25	10.13	27.81	---	---	20.25	0.63	13.13	13.31	1.00	1.19	1.50
165	---	1.50	0.44	12.00	215T	24.00	12	17.00	19.25	19.25	9.38	9.50	8.50	7.88	5.50	3.38	.25x.13	.25x.13	8.75	11.13	28.81	---	---	20.25	0.63	13.75	13.75	1.00	1.19	1.50
182	182	1.75	0.44	13.00	215T	26.00	12	19.00	20.75	20.75	10.25	10.31	9.50	8.75	5.25	3.00	.25x.13	.38x.19	9.63	11.50	29.88	27.5	13.00	20.25	0.75	14.13	15.06	1.19	1.44	4.00
200	200	2.25	0.56	14.50	215T	29.00	12	21.38	22.13	23.13	10.94	11.25	10.69	9.69	7.50	3.00	.25x.13	.38x.19	10.63	13.00	31.38	29.0	14.50	20.25	1.00	14.81	15.75	1.19	1.44	4.00
222	222	2.25	0.56	16.00	256T	32.00	10	23.00	23.75	24.75	11.88	12.19	11.50	10.50	8.00	4.00	.38x.19	.38x.19	11.75	14.50	39.38	33.25	16.13	25.75	1.00	17.56	17.69	1.44	1.69	4.00
245	245	2.50	0.56	17.00	256T	34.00	10	25.25	25.50	26.50	12.75	13.06	12.63	11.50	7.50	3.50	.38x.19	.50x.25	12.88	14.50	40.38	34.25	17.13	25.75	1.13	17.94	18.06	1.44	1.94	4.00
270	270	2.50	0.56	19.00	286T	38.00	10	27.25	27.50	28.50	13.75	14.06	13.63	12.50	8.00	3.50	.38x.19	.50x.25	14.13	16.50	43.88	37.75	19.13	28.88	1.13	18.94	19.06	1.44	1.94	4.00
300	300	3.00	0.56	21.00	286T	42.00	10	30.50	30.75	30.75	15.19	15.31	15.25	13.88	9.00	4.50	.38x.19	.50x.25	15.88	17.50	45.88	39.75	21.13	28.88	1.38	21.19	21.50	1.69	1.94	4.75
330	330	3.50	0.56	23.00	326T	46.00	10	33.75	34.00	35.00	16.69	16.88	16.88	15.25	10.75	4.50	.38x.19	.50x.25	17.38	19.50	52.38	44.25	23.00	32.00	1.63	22.44	22.63	1.69	1.94	4.75
365	365	3.50	0.56	25.50	326T	51.00	7	36.63	37.00	38.00	18.06	18.56	18.31	16.69	12.00	4.75	.50x.25	.50x.25	18.88	22.00	54.88	46.75	25.50	32.00	1.63	24.13	24.75	1.94	2.19	4.75
402	402	3.50	0.81	28.00	326T	56.00	7	39.50	39.88	40.88	19.56	20.00	19.75	18.13	13.50	5.50	.50x.25	.50x.25	20.88	24.50	57.50	49.25	28.00	32.00	1.63	26.56	26.94	1.94	2.19	4.75
445	445	4.00	0.81	31.00	365T	62.00	7	43.63	44.00	44.00	21.56	21.75	21.81	19.94	15.81	5.50	.50x.25	.63x.31	22.88	26.50	62.38	54.25	31.25	34.38	1.88	28.50	28.81	2.19	2.44	6.00
490	490	4.00	0.81	34.00	365T	68.00	7	47.13	47.50	47.50	23.31	23.56	23.56	21.69	17.56	5.50	.50x.25	.63x.31	25.38	29.50	65.38	57.25	34.25	34.38	1.88	30.25	30.88	2.19	2.69	6.00
542	542	4.00	0.81	38.00	365T	76.00	7	51.13	51.50	53.50	25.31	26.06	25.56	23.69	19.56	6.63	.63x.31	.75x.38	27.63	33.50	69.38	61.25	38.25	34.38	1.88	33.69	34.63	2.44	2.94	6.00

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

AC1001288C
AC1001289B

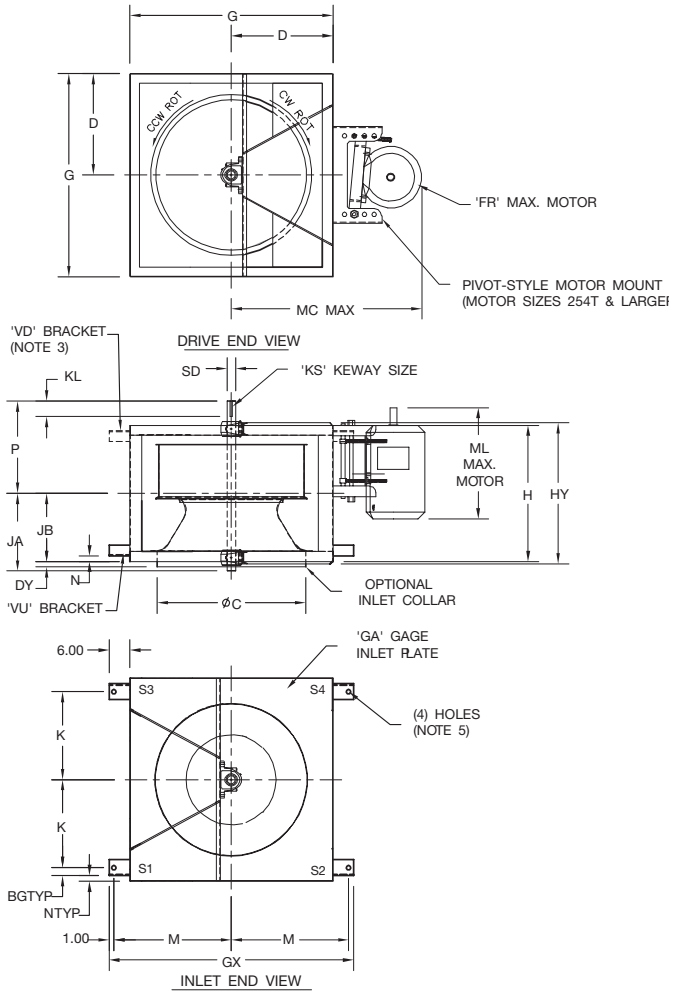
Dimensional Data – Vertical, Arr. 3VS/3VA - Class I and II

Arr. 3VS



NOTES:
1. Vertical applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Vertical up (VU) airflow is standard. Vertical down (VD) airflow requires brackets mounted on drive end.
4. Split roller bearing upgrades are not available on vertical fans.
5. Spring bracket holes are sized per spring type. Hole diameters when bracket is used as a mounting foot are as follows:
   Size 182–365: 0.56 Size 402–542: 0.81
6. Fans equipped with standard NEMA motor slide base.
7. Arrangement 3VS is available on models EPF and EPQ.

Arr. 3VA



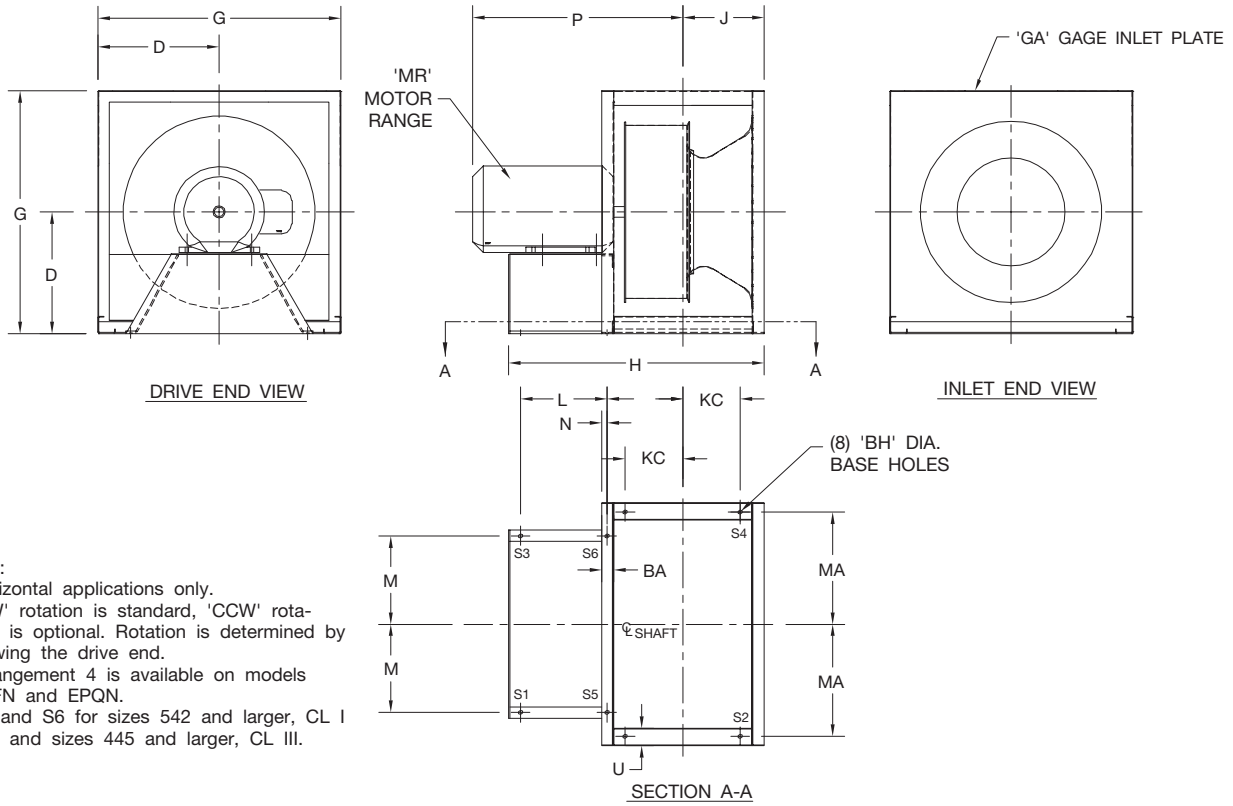
NOTES:
1. Vertical applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Vertical up (VU) airflow is standard. Vertical down (VD) airflow requires brackets mounted on drive end.
4. Split roller bearing upgrades are not available on vertical fans.
5. Spring bracket holes are sized per spring type. Hole diameters when bracket is used as a mounting foot are as follows:
   Size 122–365: 0.56 Size 402–542: 0.81
6. Arrangement 3VA is available on models EPF and EPQ.

Size		BG	C	D	DY	FR	G	GA	GX	H	HY		JA		JB	K	KL	KS		M	MC		MD	ML		N	P		SD	
3VA	3VS										CL I	CL II	CL I	CL II				CL I	CL II		3VA	3VS	3VS	3VA	3VS		CL I	CL II	CL I	CL II
122	—	1.13	13.25	10.00	2.13	215T	20.00	12	32.00	13.75	16.00	16.00	7.75	7.88	6.88	7.88	2.38	0.25x0.13	0.25x0.13	15.00	28.75	—	—	20.25	—	1.00	11.13	11.13	1.00	1.19
150	—	1.13	16.19	11.00	2.13	215T	22.00	12	34.00	15.75	18.00	18.00	8.75	8.88	7.88	8.88	3.38	0.25x0.13	0.25x0.13	16.00	29.75	—	—	20.25	—	1.00	13.13	13.13	1.00	1.19
165	—	1.13	17.75	12.00	2.13	215T	24.00	12	36.00	17.00	19.25	19.25	9.38	9.50	8.50	9.88	3.38	0.25x0.13	0.25x0.13	17.00	30.75	—	—	20.25	—	1.00	13.75	13.75	1.00	1.19
182	182	1.63	19.50	13.00	1.88	215T	26.00	12	38.00	19.00	20.75	20.75	10.25	10.38	9.50	10.38	3.38	0.25x0.13	0.38x0.19	18.00	31.75	19.00	13.13	20.25	16.25	1.00	14.50	15.38	1.19	1.44
200	200	1.63	21.38	14.50	1.88	215T	29.00	12	41.00	21.38	22.13	23.13	10.94	11.31	10.69	11.38	3.69	0.25x0.13	0.38x0.19	19.50	33.25	21.50	14.50	20.25	20.25	1.50	15.50	16.38	1.19	1.44
222	222	1.63	23.75	16.00	1.88	256T	32.00	10	44.00	23.00	23.75	24.75	11.88	12.19	11.50	12.88	4.56	0.38x0.19	0.38x0.19	21.00	38.31	23.00	16.00	25.75	20.25	1.50	18.13	18.25	1.44	1.69
245	245	1.63	26.06	17.00	1.63	256T	34.00	10	46.00	25.25	25.50	26.50	12.75	13.06	12.63	13.88	4.06	0.38x0.19	0.50x0.25	22.00	39.31	24.00	17.00	25.75	20.25	1.50	18.50	18.63	1.44	1.94
270	270	1.63	28.50	19.00	1.63	286T	38.00	10	50.00	27.25	27.50	28.50	13.75	14.06	13.63	15.88	4.06	0.38x0.19	0.50x0.25	24.00	42.81	26.00	19.00	28.88	20.25	1.50	19.50	19.63	1.44	1.94
300	300	1.63	31.63	21.00	1.13	286T	42.00	10	54.00	30.50	30.75	30.75	15.19	15.31	15.25	17.88	5.06	0.38x0.19	0.50x0.25	26.00	44.81	29.25	21.13	28.88	25.75	1.50	21.75	22.06	1.69	1.94
330	330	1.63	34.75	23.00	1.13	326T	46.00	10	58.00	33.75	34.00	34.00	16.63	16.69	16.88	19.88	5.06	0.38x0.19	0.50x0.25	28.00	51.00	31.25	23.13	32.00	25.75	1.50	22.94	23.19	1.69	1.94
365	365	2.13	38.50	25.50	1.69	326T	51.00	7	63.00	36.63	37.00	38.00	18.06	18.44	18.31	21.88	5.31	0.50x0.25	0.50x0.25	30.50	53.50	33.75	25.63	32.00	25.75	1.50	24.69	25.31	1.94	2.19
402	402	2.13	42.44	28.00	1.69	326T	56.00	7	68.00	39.50	39.88	40.88	19.63	19.88	19.75	24.38	5.94	0.50x0.25	0.50x0.25	33.00	56.00	36.25	28.13	32.00	25.75	1.50	26.94	27.38	1.94	2.19
445	445	2.13	46.88	31.00	1.19	365T	62.00	7	74.00	43.63	44.00	44.00	21.56	21.56	21.81	27.38	6.38	0.50x0.25	0.63x0.31	36.00	61.00	40.00	31.13	34.38	28.88	1.50	29.38	29.69	2.19	2.44
490	490	2.13	51.63	34.00	1.19	365T	68.00	7	80.00	47.13	47.50	47.50	23.19	23.56	23.56	30.38	6.50	0.50x0.25	0.63x0.31	39.00	64.00	43.00	34.13	34.38	28.88	1.50	31.25	31.88	2.19	2.69
542	542	2.13	57.13	38.00	2.19	365T	76.00	7	88.00	51.13	51.50	53.50	25.31	26.06	25.56	34.38	7.50	0.63x0.31	0.75x0.38	43.00	68.00	48.50	38.00	34.38	32.00	1.50	34.56	35.50	2.44	2.94

AC1001292E
AC1001293D

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

Dimensional Data – Horizontal, Arr. 4 - Class I, II, and III



NOTES:
1. Horizontal applications only.
2. 'CW' rotation is standard, 'CCW' rotation is optional. Rotation is determined by viewing the drive end.
3. Arrangement 4 is available on models EPFN and EPQN.
4. S5 and S6 for sizes 542 and larger, CL I & II and sizes 445 and larger, CL III.

Class I and II

Size	BA	BH	D	FR	G	GA	H		J		K		KC		L	M	MA	N	P Max.		U
							50-77% Width	78-105% Width	50-77% Width	78-105% Width	50-77% Width	78-105% Width	50-77% Width	78-105% Width					50-77% Width	78-105% Width	
122	1.50	0.31	10.00	56-184T	20.00	12	23.25	24.25	6.38	6.88	5.75	6.25	3.50	4.00	9.25	6.75	9.13	0.63	18.31	19.19	1.50
150	1.50	0.44	11.00	56-184T	22.00	12	25.13	26.25	7.31	7.88	6.69	7.25	4.44	5.00	9.25	8.25	10.13	0.63	18.00	20.25	1.50
165	1.50	0.44	12.00	56-184T	24.00	12	26.25	27.50	7.88	8.50	7.25	7.88	4.88	5.50	9.25	8.75	11.13	0.63	18.63	20.75	1.50
182	1.75	0.44	13.00	143T-215T	26.00	12	30.00	31.50	8.75	9.50	8.00	8.75	4.50	5.25	10.88	9.63	11.50	0.75	25.13	26.00	4.00
200	2.25	0.56	14.50	143T-215T	29.00	12	31.75	33.38	9.88	10.69	8.88	9.69	6.69	7.50	10.63	10.63	13.00	1.00	25.63	26.75	4.00
222	2.25	0.56	16.00	182T-256T	32.00	10	37.75	39.63	10.56	11.50	9.56	10.50	7.06	8.00	14.63	11.75	14.50	1.00	31.88	33.00	4.00
245	2.50	0.56	17.00	182T-256T	34.00	10	39.63	41.63	11.63	12.63	10.50	11.50	6.50	7.50	14.50	12.88	14.50	1.13	32.63	33.75	4.00
270	2.50	0.56	19.00	213T-286T	38.00	10	42.75	45.00	12.50	13.63	11.38	12.50	6.88	8.00	16.25	14.13	16.50	1.13	35.88	37.00	4.00
300	3.00	0.56	21.00	213T-286T	42.00	10	45.25	47.75	14.00	15.25	12.63	13.88	7.75	9.00	16.00	15.88	17.50	1.38	36.88	38.00	4.75
330	3.50	0.56	23.00	254T-326T	46.00	10	49.50	52.25	15.50	16.88	13.88	15.25	9.38	10.75	17.56	17.38	19.50	1.63	40.25	42.13	4.75
365	3.50	0.56	25.50	284T-405T	51.00	7	56.81	59.81	16.81	18.31	15.19	16.69	10.50	12.00	21.06	18.88	22.00	1.63	48.50	51.25	4.75
402	3.50	0.81	28.00	284T-405T	56.00	7	59.44	62.69	18.13	19.75	16.50	18.13	11.88	13.50	21.06	20.88	24.50	1.63	49.88	52.63	4.75
445	4.00	0.81	31.00	324T-405T	62.00	7	62.69	66.31	20.00	21.81	18.13	19.94	14.00	15.81	20.81	22.88	26.50	1.88	52.88	54.88	6.00
490	4.00	0.81	34.00	324T-405T	68.00	7	65.81	69.81	21.56	23.56	19.69	21.69	15.56	17.56	20.81	25.38	29.50	1.88	54.19	56.50	6.00
542	4.00	0.81	38.00	364T-445T	76.00	7	72.81	77.31	23.31	25.56	21.44	23.69	17.31	19.56	24.44	27.63	33.50	1.88	62.44	65.50	6.00
600	5.00	0.81	38.00	364T-445T	76.00	.25	78.00	82.88	26.38	28.81	24.00	26.44	19.38	21.81	24.00	30.63	33.50	2.38	64.13	67.69	6.00
660	5.00	0.81	40.75	364T-445T	81.50	.25	82.00	87.50	28.38	31.13	26.00	28.75	21.44	24.13	24.00	33.13	36.25	2.38	66.63	69.88	6.00

AC1001290D

Class III

Size	BA	BH	D	FR	G	GA	H		J		K		KC		L	M	MA	N	P Max.		U
							50-77% Width	78-105% Width	50-77% Width	78-105% Width	50-77% Width	78-105% Width	50-77% Width	78-105% Width					50-77% Width	78-105% Width	
182	1.75	0.44	13.00	143T-256T	26.00	10	35.63	37.13	8.75	9.50	8.00	8.75	4.50	5.25	14.94	9.63	11.50	0.75	30.69	32.00	4.00
200	2.25	0.56	14.50	143T-256T	29.00	10	37.13	38.75	9.88	10.69	8.88	9.69	6.69	7.50	14.75	10.63	13.00	1.00	31.19	33.00	4.00
222	2.25	0.56	16.00	182T-256T	32.00	7	36.75	38.63	10.56	11.50	9.56	10.50	7.06	8.00	14.81	11.75	14.50	1.00	30.13	31.50	4.00
245	2.50	0.56	17.00	182T-256T	34.00	7	38.63	40.63	11.63	12.63	10.50	11.50	6.50	7.50	14.69	12.88	14.50	1.13	30.88	32.00	4.00
270	2.50	0.56	19.00	213T-286T	38.00	7	42.50	44.75	12.50	13.63	11.38	12.50	6.88	8.00	16.44	14.13	16.50	1.13	34.69	36.00	4.00
300	3.00	0.56	21.00	213T-324T	42.00	7	47.13	49.63	14.00	15.25	12.63	13.88	7.75	9.00	16.44	15.88	17.50	1.38	38.75	41.00	4.75
330	3.50	0.56	23.00	254T-326T	46.00	7	48.88	51.63	15.50	16.88	13.88	15.25	9.38	10.75	17.69	17.38	19.50	1.63	38.63	41.00	4.75
365	3.50	0.56	25.50	284T-405T	51.00	.25	56.38	59.38	16.81	18.31	15.19	16.69	10.50	12.00	21.13	18.88	22.00	1.63	48.88	51.00	4.75
402	3.50	0.81	28.00	284T-405T	56.00	.25	58.88	62.13	18.13	19.75	16.50	18.13	11.88	13.50	21.13	20.88	24.50	1.63	50.00	52.00	4.75
445	4.00	0.81	31.00	324T-445T	62.00	.25	67.00	70.63	20.00	21.81	18.13	19.94	14.00	15.81	24.50	22.88	26.50	1.88	59.25	62.00	6.00
490	4.00	0.81	34.00	324T-445T	68.00	.25	69.88	73.88	21.56	23.56	19.69	21.69	15.56	17.56	24.50	25.38	29.50	1.88	60.56	63.00	6.00
542	4.00	0.81	38.00	364T-445T	76.00	.25	73.25	77.75	23.31	25.56	21.44	23.69	17.31	19.56	24.50	27.63	33.50	1.88	62.19	64.50	6.00
600	5.00	0.81	38.00	364T-445T	76.00	.31	78.13	83.00	26.38	28.81	24.00	26.44	19.38	21.81	24.06	30.63	33.50	2.38	63.88	66.50	6.00
660	5.00	0.81	40.75	365T-445T	81.50	.31	80.63	86.13	28.38	31.13	26.00	28.75	21.44	24.13	24.06	33.13	36.25	2.38	64.38	67.50	6.00

AC1001322C

DIMENSIONS ARE SUBJECT TO CHANGE. CERTIFIED DRAWINGS AVAILABLE UPON REQUEST.

Typical Specifications

Fans shall be Type EPF, EPFN, EPQ or EPQN centrifugal plenum (plug) type, as manufactured by Twin City Fan & Blower, Minneapolis, Minnesota.

Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA's Standard 2408-69.

PERFORMANCE — Fans shall be tested in accordance with AMCA 210 and AMCA 300 test standards for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for fan inlet sound, fan outlet sound, and air performance.

Arrangement 3 fans shall be tested and rated with shaft, bearings, and bearing bar in the inlet and shall be licensed to bear the AMCA certified ratings seal for both sound and air.

CONSTRUCTION — Fans shall be designed without a scroll type housing and shall incorporate a non-overloading type backward inclined airfoil blade wheel, heavy-gauge reinforced steel inlet plate, structural steel frame, and shaft and bearings.

FRAME AND INLET PANEL — Inlet panels shall be of heavy-gauge reinforced steel construction. The inlet panel incorporates a removable spun inlet cone designed for smooth airflow into the accompanying inlet retaining ring of the fan wheel. A square, formed lip suitable for attachment of a boot connector shall surround the unit.

WHEEL — Wheels shall have a spun non-tapered style blade retaining ring on the inlet side to allow higher efficiencies over the performance range of the fan. Sizes 245 and smaller shall have airfoil-shaped extruded aluminum blades. Sizes 270 and larger shall have die-formed airfoil steel blades with the option of extruded aluminum blades. All wheels on direct drive arrangement 4 fans shall have airfoil-shaped extruded aluminum blades. Wheels shall be of welded constuction. EPF and EPFN wheels shall have nine blades for high efficiencies. EPQ and EPQN wheels shall have twelve blades for better sound quality. All wheels shall be statically and dynamically balanced on precision electronic balancers to a Balance Quality Grade G6.3 per ANSI/AMCA 204 or better.

SHAFT — Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for verification. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed. All shafts must be dial indicated for straightness after the keyways are cut and straightened as required.

FAN BEARINGS — Bearings shall be heavy duty, grease lubricated, anti-friction ball (adapter mount) or roller, self-aligning, pillow block type and selected for a minimum bearing life (AFBMA L-10) in excess of 80,000 hours at the maximum fan RPM. All bearings shall be equipped with greasable zerk fittings and, where necessary, extended lube lines for easy access for lubrication.

DRIVE — Motor sheaves shall be cast iron, variable pitch on applications 10 HP and smaller, and fixed pitch on 15 HP and larger. Drives and belts shall be rated for 150% of the required motor HP.

FINISH AND COATING — The entire fan assembly, excluding the shaft, shall be thoroughly degreased and deburred before application of a rust-preventative primer. After the fan is completely assembled, a finish coat of paint shall be applied to the entire assembly. The fan shaft shall be coated with a petroleum-based rust protectant. Aluminum components shall be unpainted.

ACCESSORIES — When specified, accessories shall be provided by Twin City Fan & Blower to maintain one source responsibility.

VARIABLE INLET VANES — When specified, the variable inlet vanes shall be internal "nested" type. Each assembly is to have eleven vanes on sizes 245 and larger, and eight vanes on sizes 182 through 222. Each vane assembly shall be complete with quadrant and handle, suitable for manual or automatic operation. Construction shall be heavy-gauge and shall be of the cantilever design. Vanes are lubricated for life with a high quality moisture-resistant lubricant.

FACTORY RUN TEST — All fans prior to shipment shall be completely assembled and test run as a unit at the specified operating speed or maximum RPM allowed for the particular construction type. Maximum vibration shall be within the limits of ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

GUARANTEE — The manufacturer shall guarantee the workmanship and materials for its EPF, EPFN, EPQ and EPQN fans for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first.

Unlimited Options...

Commercial Fans

Centrifugal Fans • Utility Sets • Inline Centrifugal Fans • Plenum Fans
Radial Bladed Fans • Centrifugal Roof & Wall Exhausters • Filtered Supply Fans
Gravity Relief Ventilators • Ceiling & Cabinet Ventilators • Propeller Wall Fans
Tubeaxial Fans • Vaneaxial Fans • Propeller Roof Ventilators
Fume Hood/Smoke & Heat Exhaust Fans • Mancoolers • Fiberglass Fans

Industrial Fans

Centrifugal Fans • Forward Curved & Air Kit Components • Inline Centrifugal Fans
Plug Fans • Radial Bladed Fans • Radial Tip & High Efficiency Fans
Pressure Blowers • Tubeaxial Fans • Vaneaxial Fans

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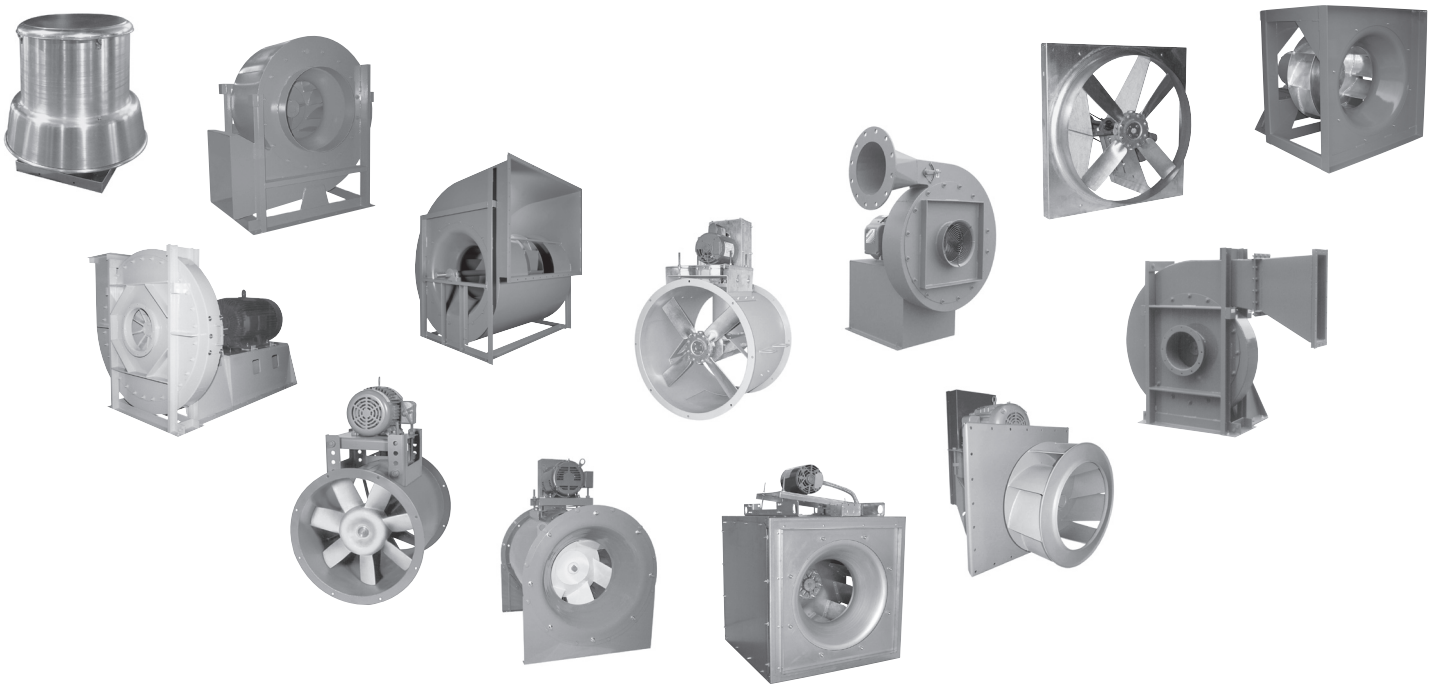
Inlet Box Dampers • Independent Bearing Pedestals • Split Housings • Bolted Housings
Spark Resistant Construction • Ultra Fine Balancing • Modified Widths and Diameters
Variable Frequency Drives • API Specifications • Special Materials • Anti-Rotation Devices
Sleeve Oil Bearings • Volume Control Dampers • Inlet Vane Control with External Mechanisms



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Twin City

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RUSKIN®

AMCA LICENSED
See Page 2

3900 Dr. Greaves Rd. • Kansas City, MO 64030 • (816) 761-7476 • FAX (816) 765-8955

CD60 LOW LEAKAGE CONTROL DAMPER

High Performance Airfoil
Class 1A Leakage Rated

APPLICATION

The CD60 is a low leak, galvanized steel damper designed with airfoil blades for higher velocity and pressure HVAC stystems. It meets the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and is AMCA licensed as a Class 1A damper.

STANDARD CONSTRUCTION

FRAME
5" x 1" x 16 gage (127 x 25 x 1.6) galvanized steel hat channel reinforced with corner braces for structural strength equal to 11 gage (3.05) channel frames. Low profile 3½" x ⅜" x 16 gage (89 x 10 x 1.6) galvanized steel channel top and bottom frame on dampers under 12" (305) high.

BLADES
Galvanized steel airfoil shaped, double skin construction of 14 gage (2.0) equivalent thickness, 6" (152) wide. Parallel or opposed action.

SEALS
Ruskiprene blade edge seals and flexible metal compressible jamb seals.

BEARINGS
Stainless steel sleeve.

LINKAGE
Concealed in frame.

AXLES
½" (13) plated steel hex. Removable control shaft extends 6" (152) beyond frame.

MAXIMUM SIZE
Single section – 60"w x 72"h (1524 x 1829).
Multiple section assembly – Unlimited size.

MINIMUM SIZE
Single blade – 8"w x 6"h (203 x 152).
Two blades, parallel or opposed action: 8"w x 10"h (203 x 254).

TEMPERATURE LIMITS
-72°F (-60°C) minimum and +275°F (+135°C) maximum.

FEATURES

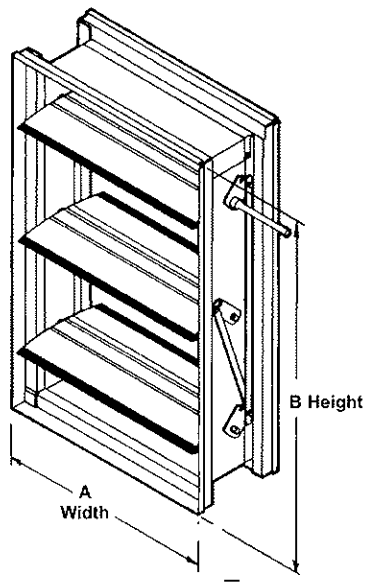
- Airfoil blade design for low pressure drop and less noise generation.
- One piece interlocking frame design to reduce racking.
- Positive lock axles, noncorrosive bearings and shake proof linkage for low maintenance operation.
- Blade edge seals mechanically lock into the blade for superior sealing.

OPTIONS

- Factory-installed, pneumatic and electric actuators.
- Enamel and epoxy finishes.
- SP100 Switch Package to remotely indicate damper blade position.
- Heavier frame construction with U-channel frame.
- Front, rear or double flange frame with or without bolt holes.
- Face and bypass configurations.

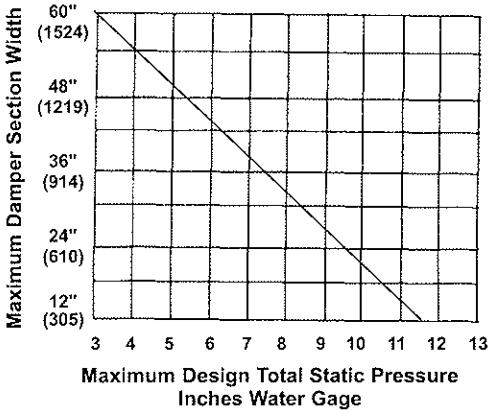
NOTE: Dimensions shown in parenthesis ( ) indicate millimeters.

*Units furnished approximately ¼" (6) smaller than given opening dimensions.



CD60 AMCA LICENSED PERFORMANCE DATA

CD60 PRESSURE LIMITATIONS



The CD60 may be used in systems with total pressures exceeding 3.5" by reducing damper section width as indicated. Example: Maximum design total pressure of 8.5" w.g. would require CD60 damper with maximum section width of 36" (914).
Pressure limitations shown above allow maximum blade deflection of 1/180 of span on 60" (1524) damper widths. Deflections in other damper widths (less than 48" [1219]) at higher pressures shown will result in blade deflection substantially less than 1/180 of span.

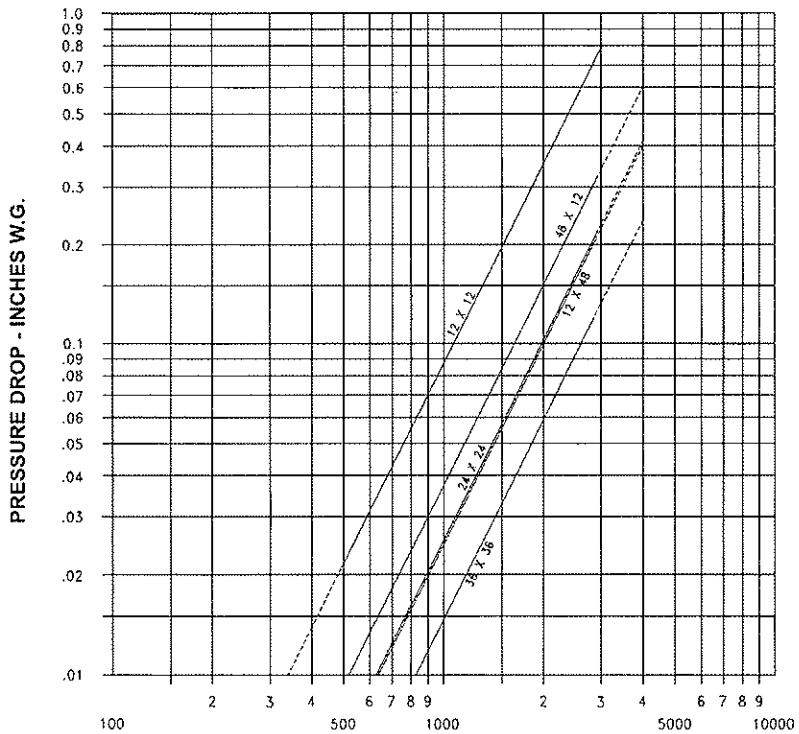
Ruskin Company certifies that the CD60 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program.The AMCA International Certified Ratings Seal applies to Air Performance and Air Leakage.

Pressure/ Class	Leakage, L/s/m² (ft³/min/ft²)			
	Required Rating		Extended Ranges (Opt.)	
	1" (0.25 kPa)	4" (1.0 kPa)	8" (2.0 kPa)	12" (3.0 kPa)
1A	3 (15.2)	N/A	N/A	N/A
1	4 (20.3)	8 (40.6)	11 (55.9)	14 (71.1)
2	10 (50.8)	20 (102)	28 (142)	35 (178)
3	40 (203)	80 (406)	112 (569)	140 (711)

Leakage testing conducted in accordance with AMCA Standard 500-D-98. Torque applied holding damper closed, 5 in. lbs./sq. ft. on opposed blade dampers and 7 in. lbs./sq. ft. on parallel blade dampers. Air leakage is based on operation between 50°F to 104°F. All data corrected to represent standard air density 0.075 lbs/ft³.

DAMPER WIDTH (INCHES)	1 IN. W.G.	4 IN. W.G.	8 IN. W.G.
12" (305)	IA	I	II
24" (610)	IA	I	II
36" (914)	IA	I	NA
48" (1219)	IA	I	NA
60"(1524)	IA	I	NA

VELOCITY VS. PRESSURE DROP



FACE VELOCITY - FEET/MINUTE
AMCA FIG. 5.3

CD60 sizes 12 x 12, 24 x 24, 48 x 12, 12 x 48, 36 x 36 (305 x 305, 610 x 610, 1219 x 305, 305 x 1219, 914 x 914)

All data corrected to represent standard air at a density of 0.075 lbs/ft³.

CD60 SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans, or in accordance with schedules, control dampers that meet the following minimum construction standards. Frame shall be 16 gage (1.6) galvanized steel structural hat channel with tabbed corners for reinforcement for 11 gage (3.05) structural equivalence. Blades shall be 14 gage (2.0) equivalent thickness galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation. Blade edge seals shall be Ruskiprene type or equivalent suitable for -72°F (-60°C) to +275°F (+135°C) mechanically locked into the blade edge. Adhesive or clip-on type seals are unacceptable. Jamb seals shall be flexible metal, compression type to prevent leakage between blade end and damper frame. Blade end overlapping frame is unacceptable.

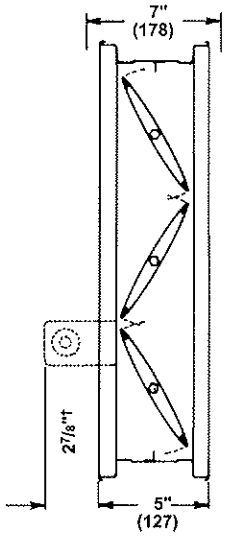
Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame. Axles shall be hexagonal positively locked into the damper blade. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure drop and noise. Submittal must include leakage, maximum air flow and maximum pressure ratings based on AMCA Publication 500. Damper shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as a class 1A damper. Dampers shall be Ruskin CD60 model.

Specifier Select Options.

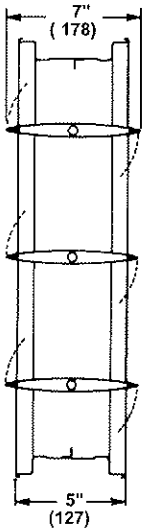
SP100: Dampers shall be equipped with factory installed damper position indication switch package. The switch package shall include two position indication switches linked directly to the damper blade to provide full open and full closed damper blade position. The switch package shall be capable of interfacing with the HVAC control system and provide remote damper blade position status. Switch package shall be Ruskin Model SP-100.

Factory Mounted Damper Actuators: If control damper actuators are required, they shall be furnished and mounted by the damper manufacturer in their factory. Each damper shall be cycle tested at the factory prior to shipment.

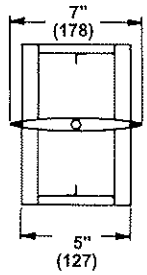
DIMENSIONAL INFORMATION



OPPOSED BLADE



PARALLEL BLADE



Low profile frame illustrated is typical for units under 12" (305) high.

RUSKIN®

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COMMERCIAL CONTROL DAMPER OPERATION & MAINTENANCE

MODELS: COMMERCIAL CONTROL DAMPERS

Regular maintenance is essential to ensure that a building's air control system will perform as intended under normal conditions. Regular maintenance should include periodic testing of all equipment associated with the air control system such as initiating devices, fans, dampers, controls, etc. Ruskin recommends each damper be cycled and tested every 6 months and in accordance with actuator manufacture recommendations (if damper has actuator) and local codes.

MAINTENANCE

- Clean damper blades and other working parts if necessary.
- Lubricate linkage, bearings and other moveable parts with a silicone lubricant. **Do not use petroleum-based products as they could cause excessive dust collection.**
- Operate (open and close) the damper via the actuator or extended shaft.
- Check the blades to make sure they completely close and re-open.
- Consult Ruskin if problems are encountered.

CLOSURE CONCERNS

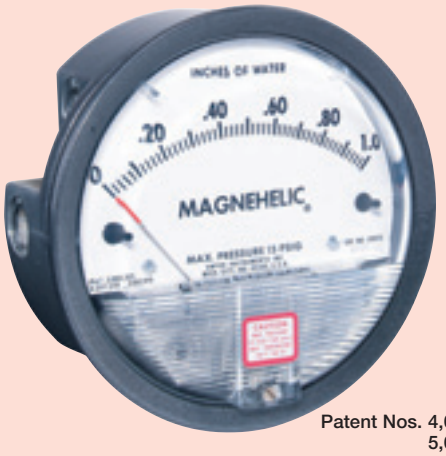
- Remove any foreign material from the blade operating path.
- Verify that hardware used to install damper does not contact moving parts of the damper.

OPERATION

• Operate damper through full cycle, verify that all blades open and close completely. Check for loose linkage from actuator (if used) through jackshafting (if multi-section) and damper side linkage. Tighten linkage where required or Call Ruskin.

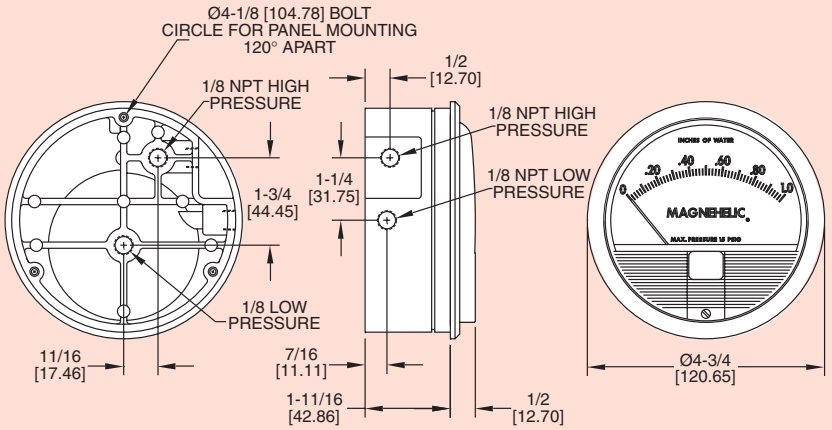
Series 2000 Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Patent Nos. 4,030,365
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

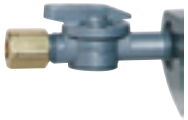
Select the Dwyer Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

MOUNTING. A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼″ - 2″ pipe. Although calibrated for vertical position, many ranges above 1″ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4¾₁₆″ hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush ...Surface...or Pipe Mounted

VENT VALVES



In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4¹³⁄₁₆″ hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100PA, -125PA, 10MM and ±4% on - 00, -60PA, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20″ Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 kPa), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4″ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapters and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays

Furnished in red, green or yellow to highlight and emphasize critical pressures.

Adjustable Signal Flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

Portable Units

Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of ⅜″ I.D. rubber tubing, standhang bracket and terminal tube with holder. **A-432,** Portable Kit

Air Filter Gage Accessory Package

Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves. **A-605,** Air Filter Kit

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

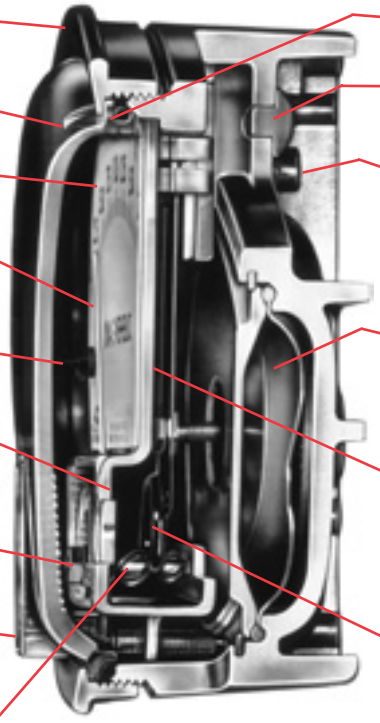
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

STOCKED MODELS

Dual Scale English/Metric Models		
Model Number	**Range, In. W.C.**	**Range, Pa or kPa**
2000-0D	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

SERIES 2000 MAGNEHELIC® — MODELS AND RANGES
STOCKED MODELS in bold

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range Inches of Water
2000-00†• •	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2150	0-150

Model Number	Range Zero Center Inches of Water
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model Number	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range in W.C. Velocity, F.P.M.
2000-00AV†• •	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2010AV	0-10/2000-12500

For use with pitot tube.

Model Number	Range MM of Water
2000-6MM†• •	0-6
2000-10MM†•	0-10
2000-25MM	0-25
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
Zero Center Ranges	
2300-20MM†	10-0-10

Model Number	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

Model Number	Range, Pascals
2000-60PA†• •	0-60
2000-100PA†• •	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
Zero Center Ranges	
2300-250PA	125-0-125
2300-500PA	250-0-250

Model Number	Range, Kilopascals
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-3KPA	1.5-0-1.5

Accessories

A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket.....
A-310A, 3-Way Vent Valve.....
A-321, Safety Relief Valve.....
A-432, Portable Kit .....
A-605, Air Filter Kit .....
A-610, Pipe Mount Kit .....

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator)

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

Special Purpose Ranges

Scale No. 2401	Scale No. 2402
Square Root	Blank Scale
Specify Range	Specify Range

Model 2000-00N. range -.05 to +.20" W.C. For room pressure monitoring

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%. • • Accuracy +/-4%

1011R01-0298P

BALDOR®
MOTORS AND DRIVES

Integral Horsepower
AC Induction Motors
ODP Enclosure
TEFC Enclosure
Explosion Proof

Installation & Operating Manual

12/98 **MN400**

Table of Contents

Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Baldor Electric motors are warranted for a period of one (1) year, from date of shipment from the factory or factory warehouse against defects in material and workmanship. To allow for stocking and/or fabrication period and to provide one year of actual service, the warranty period is extended for an additional period of six (6) months for a total of eighteen (18) months from the original date of shipment from the factory or factory warehouse stock. In no case will the warranty period be extended for a longer period. Baldor extends this limited warranty to each buyer of the electric motor for the purpose of resale and to the original purchaser for use.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
   a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
   b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

   Note that **Baldor Super–E® Premium Efficiency** electric motors are warranted for a period of three (3) years. All other terms and conditions of the Limited Warranty statement apply.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.

WARNING: Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

WARNING: Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

WARNING: Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Do not use these motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.

Safety Notice Continued

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate.**

Specific service conditions for these motors are defined in NEC 70-599.

WARNING: **UL rated motors must only be serviced by authorized Baldor Service Centers if these motors are to be returned to a flammable and/or explosive atmosphere.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG-1 and MG-2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors’ space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft.
2. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

   If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2
Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

The motor should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. Exposure to these can reduce the operating life and degrade performance. Be sure to allow clearance for ventilation and access for cleaning, repair, service and inspections. Ventilation is extremely important. Be sure the area for ventilation is not obstructed. Obstructions will limit the free passage of air. Motors get warm and the heat must be dissipated to prevent damage.

These motors are not designed for atmospheric conditions that require explosion proof operation. They must NOT be used in the presence of flammable or combustible vapors or dust.

1. ODP motors are suitable only for indoor applications.
2. TEFC motors are suitable for indoor or outdoor standard service applications.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.
4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Caution: Do not over tension belts.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

Conduit Box

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

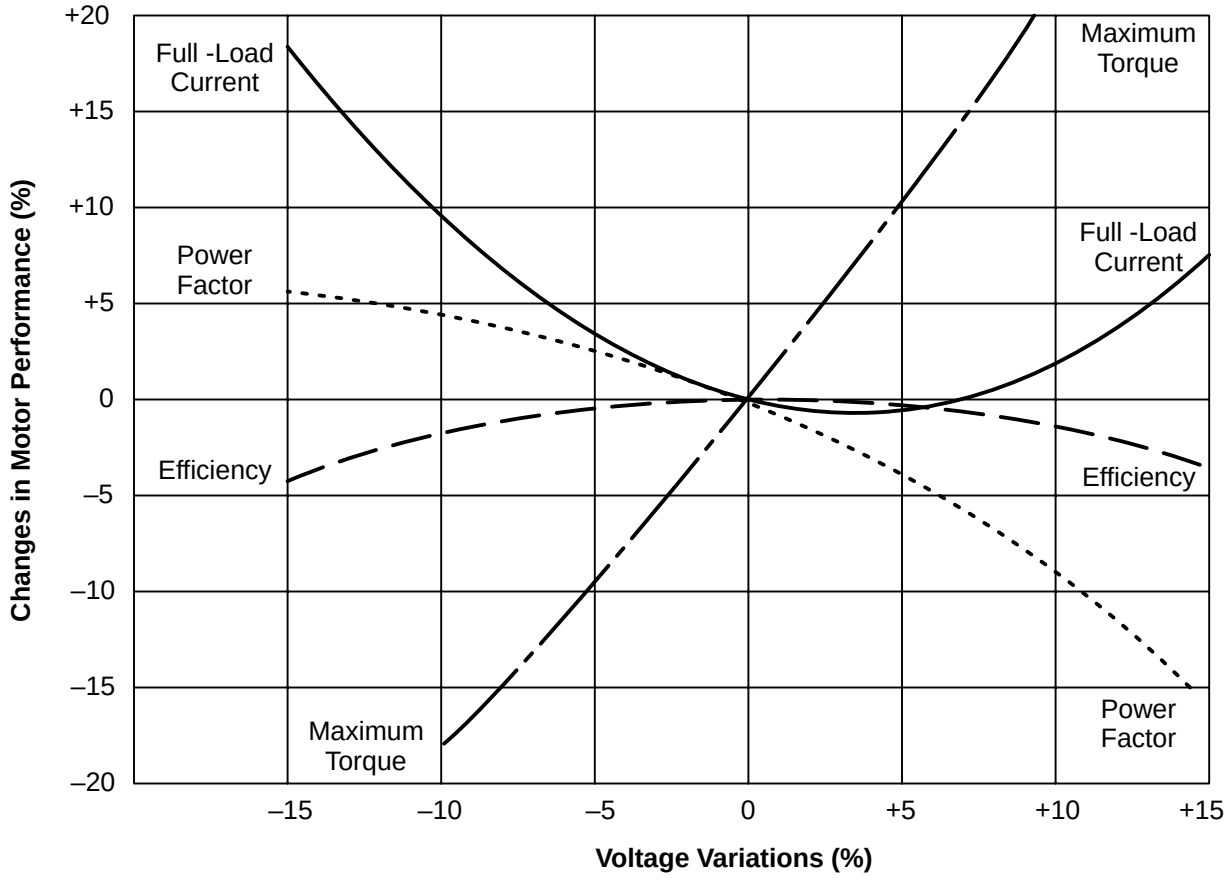
AC Power

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-1.

Figure 2-1 Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the to load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than than by the same motor under full load. If it is necessary to to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3
Maintenance & Troubleshooting

WARNING: UL rated motors must only be serviced by authorized Baldor Service Centers if these motors are to be returned to a flammable and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Lubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended greases for standard service conditions are:

Chevron SRI (Factory Installed) – Polyurea Base

Equivalent Greases

Name of Grease	Manufacturer	Type of Base
Rykon Premium #2	American Oil Co.	Polyurea
Shell Dolium R	Shell Oil Co.	Polyurea
Texaco Premium RB	Texaco	Lithium
Texaco Polystar	Texaco	Polyurea

Lubrication Intervals

Recommended lubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2 and 3-3.

Table 3-1 Lubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)			3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)			* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)			*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Lubrication intervals are for ball bearings. For roller bearings, divide the listed lubrication interval by 2.

** For 6205 and 6806 bearings. For 6807 bearings, consult oil mist lubrication (MN401).
Relubrication interval for 6205 bearing bearing is 1550Hrs. (using grease lubrication).
Relubrication interval for 6806 bearing bearing is 720Hrs. (using grease lubrication).

Table 3-2 Service Conditions

Severity of Service	Ambient Temperature Maximum	Atmospheric Contamination	Type of Bearing
Standard	40° C	Clean, Little Corrosion	Deep Groove Ball Bearing
Severe	50° C	Moderate dirt, Corrosion	Ball Thrust, Roller
Extreme	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion	All Bearings
Low Temperature	<–30° C **		

* Special high temperature grease is recommended (Darmex 707). Note that Darmex 707 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)					
	Bearing	OD D mm	Width B mm	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
					in^3	tea-spoon
Up to 210 incl. (132)	6307	80	21	0.30 (8.4)	0.6	2.0
Over 210 to 280 incl. (180)	6311	120	29	0.61 (17)	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	0.81 (23)	1.5	5.2
Over 360 to 449 incl. (280)	NU319	200	45	2.12 (60)	4.1	13.4
Over 5000 to 5800 incl. (355)	NU328	300	62	4.70 (130)	9.2	30.0
Spindle Motors						
76 Frame	6207	72	17	0.22 (6.1)	0.44	1.4
77 Frame	6210	90	20	0.32 (9.0)	0.64	2.1
80 Frame	6213	120	23	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB

Lubrication Procedure

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

With Grease Outlet Plug

1. Clean all grease fittings.
2. Remove grease outlet plug.
3. If motor is stopped, add the recommended amount of grease.

   If motor is to be greased while running, a slightly greater quantity of grease will have to be added. Add grease slowly until new grease appears at shaft hole in the endplate or purge outlet plug.
4. Re-install grease outlet plug.

Without Grease Outlet Plug

1. Disassemble motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)

Note: Bearing is 1/3 full when only one side of bearing is completely full of grease.

3. Assemble motor.

Sample Lubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as “Severe”.
3. Table 3-3 lists a multiplier value of 0.5 for Severe conditions.
4. Table 3-4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Accessories

The following is a partial list of accessories available from Baldor.
Contact your Baldor distributor for availability and pricing information.

Note: Space heaters and RTD's are standard on some motors.

Bearing RTD
RTD (Resistance Temperature Detector) devices are used to measure or monitor the temperature of the motor bearing during operation.

Bearing Thermocouples
Used to measure or monitor bearing temperatures.

Bearing Thermostat
Temperature device that activates when bearing temperatures are excessive. Used with an external circuit to warn of excessive bearing temperature or to shut down a motor.

Conduit Boxes
Optional conduit boxes are available in various sizes to accommodate accessory devices.

Cord & Plug Assembly
Adds a line cord and plug for portable applications.

Drains and Breathers
Stainless steel drains with separate breathers are available.

Drip Covers
Designed for use when motor is mounted in a vertical position. Contact your Baldor distributor to confirm that the motor is designed for vertical mounting.

Fan Cover & Lint Screen
To prevent build-up of debris on the cooling fan.

Nameplate
Additional stainless steel nameplates are available.

Roller Bearings
Recommended for belt drive applications with a speed of 1800 RPM or less.

Rotation Arrow Labels
Rotation arrows are supplied on motors designed to operate in one direction only. Additional rotation arrows are available.

Space Heater
Added to prevent condensation of moisture within the motor enclosure during periods of shut down or storage.

Stainless Hardware
Stainless steel hardware is available. Standard hardware is corrosion resistant zinc plated steel.

Winding RTD
RTD (Resistance Temperature Detector) devices are used to measure or monitor the temperature of the motor winding during operation.

Winding Thermocouples
Used to measure or monitor winding temperatures.

Winding Thermostat
Temperature device that activates when winding temperatures are excessive. Used with an external circuit to warn of excessive winding temperature or to shut down a motor.

Note: On some motors, leads for accessory devices are brought out to a separate conduit box located on the side of the motor housing (unless otherwise specified).

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

OVERLY HAUTZ COMPANY
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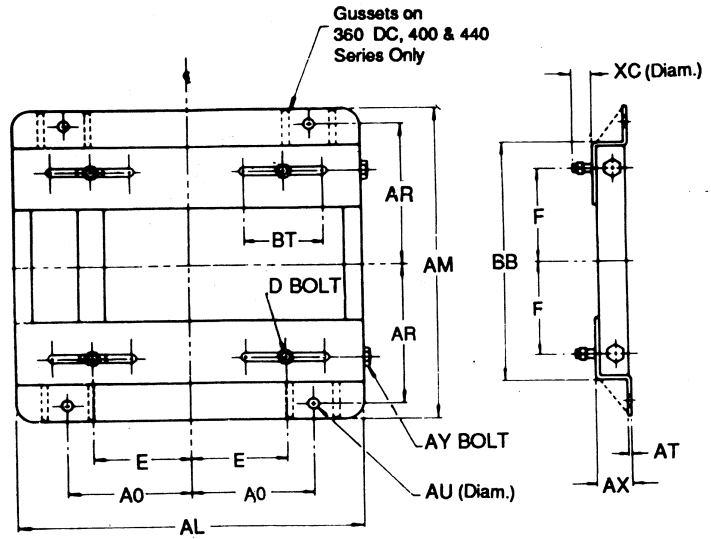
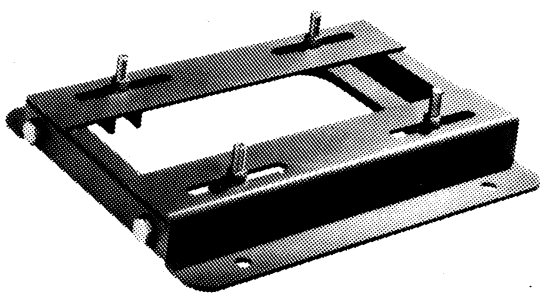
NEMA

STEEL ADJUSTABLE MOTOR BASES

DOUBLE ADJUSTING BOLT





STYLE B2

STOCK BASES

FRAME & PART NO.	AL	AM	AX	BB	E	F	A0	AR	AU	BT	AT	XC	D BOLT	AY BOLT	APPROX. WT. (LBS)
254B2	17-3/4	15-1/8	2	10-3/4	5	4-1/8	6-1/4	6-5/8	5/8	4	3/16	1-3/8	1/2x1-3/4	5/8x9	17
256B2	17-3/4	16-7/8	2	12-1/2	5	5	6-1/4	7-1/2	5/8	4	3/16	1-3/8	1/2x1-3/4	5/8x9	18
284B2	19-3/4	16-7/8	2	12-1/2	5-1/2	4-3/4	7	7-1/2	5/8	4-1/2	3/16	1-5/8	1/2x2	5/8x9	21
286B2	19-3/4	18-3/8	2	14	5-1/2	5-1/2	7	8-1/4	5/8	4-1/2	3/16	1-5/8	1/2x2	5/8x9	22
*324B2	22-3/4	19-1/4	2-1/2	14	6-1/4	5-1/4	8	8-1/2	3/4	5-1/4	3/16	2-1/8	5/8x2-1/2	3/4x9	30
*326B2	22-3/4	20-3/4	2-1/2	15-1/2	6-1/4	6	8	9-1/4	3/4	5-1/4	3/16	2-1/8	5/8x2-1/2	3/4x9	31
*364B2	25-1/2	20-1/2	2-1/2	15-1/2	7	5-5/8	9	9-1/8	3/4	6	1/4	2	5/8x2-1/2	3/4x11	45
*365B2	25-1/2	21-1/2	2-1/2	16-1/2	7	6-1/8	9	9-5/8	3/4	6	1/4	2	5/8x2-1/2	3/4x11	46
404B2	28-3/4	22-3/8	3	16-1/2	8	6-1/8	10	9-7/8	7/8	7	1/4	2-9/16	3/4x3	3/4x14	55
405B2	28-3/4	23-7/8	3	18	8	6-7/8	10	10-5/8	7/8	7	1/4	2-9/16	3/4x3	3/4x14	56
444B2	31-1/4	24-5/8	3	19-1/4	9	7-1/4	11	11	7/8	7-1/2	5/16	2-1/2	3/4x3	3/4x14	74
445B2	31-1/4	26-5/8	3	21-1/4	9	8-1/4	11	12	7/8	7-1/2	5/16	2-1/2	3/4x3	3/4x14	75
447B2	31-1/4	30-1/8	3	24-3/4	9	10	11	13-3/4	7/8	7-1/2	5/16	2-1/2	3/4x3	3/4x14	89
449B2	31-1/4	35-1/8	3	29-3/4	9	12-1/2	11	16-1/4	7/8	7-1/2	5/16	2-1/2	3/4x3	3/4x14	95

Bases noted (*) also available with gussets for additional strength; add the letter "G" after the part number. Example: 326-B2-G

NON STOCK BASES

FRAME & PART NO.	AL	AM	AX	BB	E	F	A0	AR	AU	BT	AT	XC	D BOLT	AY BOLT	APPROX. WT. (LBS)
364DCB2	25-1/2	20-1/2	2-1/2	15-1/2	7	5-5/8	9	9-1/8	7/8	6	1/4	2-9/16	3/4x3	3/4x11	47
365DCB2	25-1/2	21-1/2	2-1/2	16-1/2	7	6-1/8	9	9-5/8	7/8	6	1/4	2-9/16	3/4x3	3/4x11	48
366DCB2	25-1/2	23-1/4	2-1/2	18-1/4	7	7	9	10-1/2	7/8	6	1/4	2-9/16	3/4x3	3/4x11	49
404DCB2	28-3/4	22-3/8	3	16-1/2	8	6-1/8	10	9-7/8	1	7	1/4	3-1/16	7/8x3-1/2	3/4x14	56
405DCB2	28-3/4	23-7/8	3	18	8	6-7/8	10	10-5/8	1	7	1/4	3-1/16	7/8x3-1/2	3/4x14	57

AC & DC Bases Are Identical For Frames 254 Thru 326

DIMENSIONS ARE IN INCHES: Bases are furnished with one coat of corrosion-resistant gray primer and zinc plated nuts and bolts.

Bases listed may also be used if the motor frame is succeeded by S, T, TS, U, US or any letter combination as long as the motor complies with N.E.M.A.

The liability of the Overly-Hautz Company to the purchaser is limited to replacement of defective materials supplied. One year from the date of our shipment all liability shall terminate. There are no warranties which extend beyond the description on the face hereof.

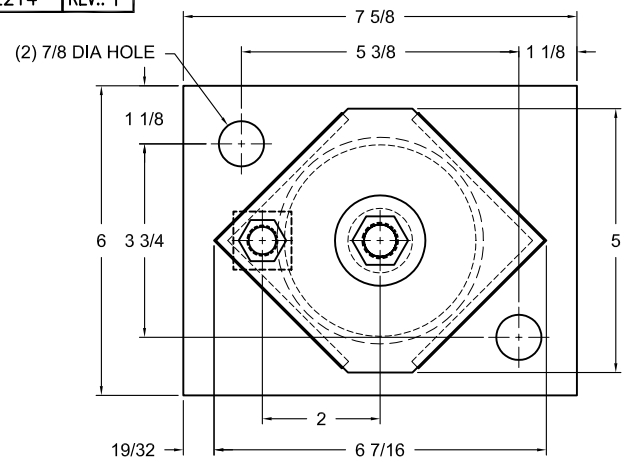
DIMENSION SHEET MB-200-B2

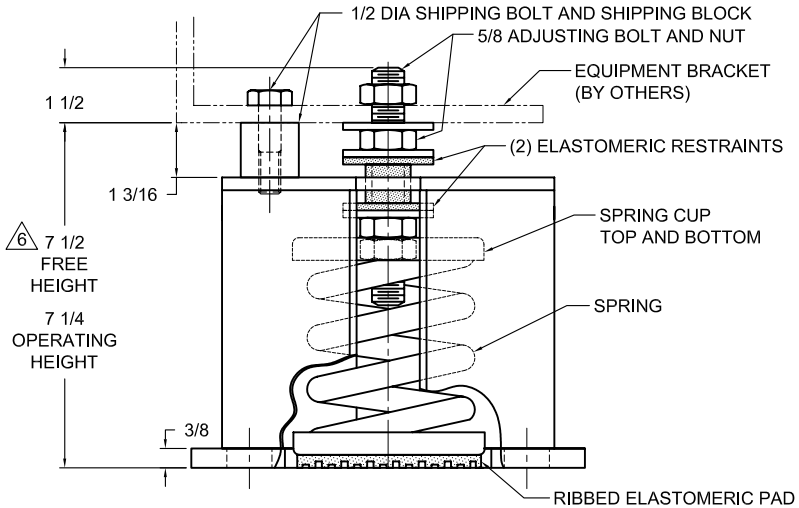
CERTIFIED FOR: _____

FRAME _____ BY _____ DATE _____

180R–102214 | REV.: 1

REV.	DESCRIPTION	DATE	BY

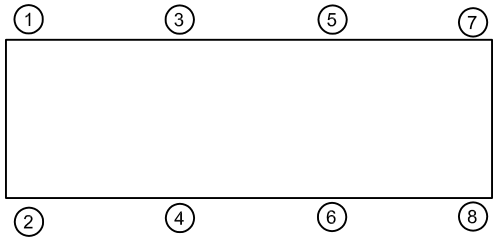




TYPE AMSR-2D-SB SEISMICALLY RESTRAINED SPRING VIBRATION ISOLATORS WITH SHIPPING BLOCK

MODEL	RATED LOAD (LBS)	RATED DEFLECTION (IN)	SPRING RATE (LB/IN)	SPRING COLOR CODE	ALLOWABLE G RATING[2]	
					HORIZONTAL	VERTICAL
AMSR-2D-75-SB	75	2.42	31	WHITE	18.7	24.7
AMSR-2D-160-SB	160	2.29	70	YELLOW	8.8	11.6
AMSR-2D-230-SB	230	2.30	100	GREEN	6.1	8.0
AMSR-2D-355-SB	355	2.15	165	DK BROWN	3.9	5.2
AMSR-2D-435-SB	435	1.89	230	RED	3.2	4.3
AMSR-2D-600N[1]-SB	600	1.88	319	RED/ BLACK	2.3	3.1
AMSR-2D-725-SB	725	1.61	450	TAN	1.9	2.6
AMSR-2D-845-SB	845	1.69	570	PINK	1.7	2.2
AMSR-2D-1000N[1]-SB	1000	1.52	659	PINK/ BLACK	1.4	1.9
AMSR-2D-1320N[1]-SB	1320	1.42	927	PINK/GRAY	1.1	1.4
AMSR-2D-1435N[3]-SB	1435	1.54	1002	PINK/GRAY/ ORANGE	1.0	1.3
AMSR-2D-1640N[3]-SB	1640	1.54	1067	PINK/GRAY/ DK BROWN	0.88	1.1

TABLE NOTES:
1. TWO NESTED SPRINGS YIELD THIS LOAD. THE COLOR CODE INDICATED IS FOR OUTER SPRING/ INNER SPRING.
2. ALL ALLOWABLE G RATINGS ARE BASED ON HILTI KWIKBOLT TZ WEDGE ANCHORS (OR EQUAL) IN STONE AND AGGREGATE CONCRETE (Fc=3000 PSI).
3. THREE NESTED SPRINGS YIELD THIS LOAD.



ISOLATOR SELECTIONS	
LOC 1:	LOC 2:
LOC 3:	LOC 4:
LOC 5:	LOC 6:
LOC 7:	LOC 8:
CUSTOMER EQP'T. TAG:	

NOTE: MATERIAL SHOWN IS FOR (1) SET.

NOTES
1. ALL DIMENSIONS ARE IN INCHES. INTERPRET PER ANSI Y-14.
2. FINISH: HOUSING- ONE COAT BLACK PAINT, SPRING- POWDER COAT, HARDWARE- ZINC ELECTROPLATE.
3. INNER NESTED SPRING, WHEN USED, NOT SHOWN. SEE TABLE NOTES 1 AND 3.
4. ALL SPRINGS DESIGNED WITH 50% OVER-TRAVEL.
5. REFER TO TABLE ABOVE FOR ALLOWABLE HORIZONTAL AND VERTICAL G RATINGS. SEE TABLE NOTE 2.
6. PRIOR TO MOUNTING EQUIPMENT, THE INTERNAL VERTICAL RESTRAINT WILL BE AGAINST THE HOUSING TOP PLATE AND THE ADJUSTING NUT WILL BE 1/4" ABOVE THE BLOCK AT THE "FREE HEIGHT." WHEN THE EQUIPMENT IS MOUNTED, THE SPRING WILL DEPRESS AND REST ON THE SHIM AT THE "OPERATING HEIGHT."

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: _____

CUSTOMER : _____

CUSTOMER P.O.: _____

SALES ORDER: _____

TYPE AMSR-2D-( )-SB SEISMIC ISOLATORS 2" DEFLECTION WITH SHIPPING BLOCK

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

SCALE : NONE

SHEET: 1 OF 2

DRAWING NO.:

REVISION

Member VISCMA

180R-102214	REV.: 1

REV.	DESCRIPTION	DATE	BY

READ INSTRUCTIONS IN THEIR ENTIRETY BEFORE BEGINNING.

FACTORY INSTRUCTIONS

1. ISOLATORS ARE SHIPPED FULLY ASSEMBLED AND ARE TO BE SPACED AND ARRANGED IN ACCORDANCE WITH INSTALLATION DRAWINGS OR AS OTHERWISE RECOMMENDED.

2. SET ISOLATORS ON FLOOR OR SUB-BASE, ENSURING THAT ALL ISOLATOR CENTERLINES MATCH THE EQUIPMENT MOUNTING HOLES OR SPACE AND ARRANGE ISOLATORS IN ACCORDANCE WITH THE INSTALLATION DRAWING. SHIM OR GROUT AS REQUIRED LEVELING ALL ISOLATOR BASE PLATES AT THE SAME ELEVATION (1/4" MAXIMUM DIFFERENCE IN ELEVATION CAN BE TOLERATED). ISOLATOR BASE MUST REST ON A FLAT SURFACE.

3. PRIOR TO ANCHORING THE BASEPLATE, THE ISOLATOR HOUSING MAY BE ELEVATED SLIGHTLY ABOVE THE FINISHED FLOOR. ANCHOR DOWN ISOLATORS USING BASE PLATE THRU HOLES **"H"**. PULL DOWN ISOLATOR HOUSING USING ANCHOR BOLTS UNTIL ISOLATOR BASE PLATE **"E"** IS FIRMLY AGAINST THE FLOOR. THIS WILL PRELOAD THE SPRING WITHIN THE HOUSING AND PUSH THE INTERNAL STOP **"A"** AGAINST THE HOUSING TOP PLATE.

4. PRIOR TO MOUNTING EQUIPMENT, INTERNAL STOP **"A"** WILL BE AGAINST THE TOP PLATE AND WASHER **"F"** WILL BE APPROXIMATELY 1/4" ABOVE THE SHIPPING BLOCK AT THE "FREE HEIGHT."

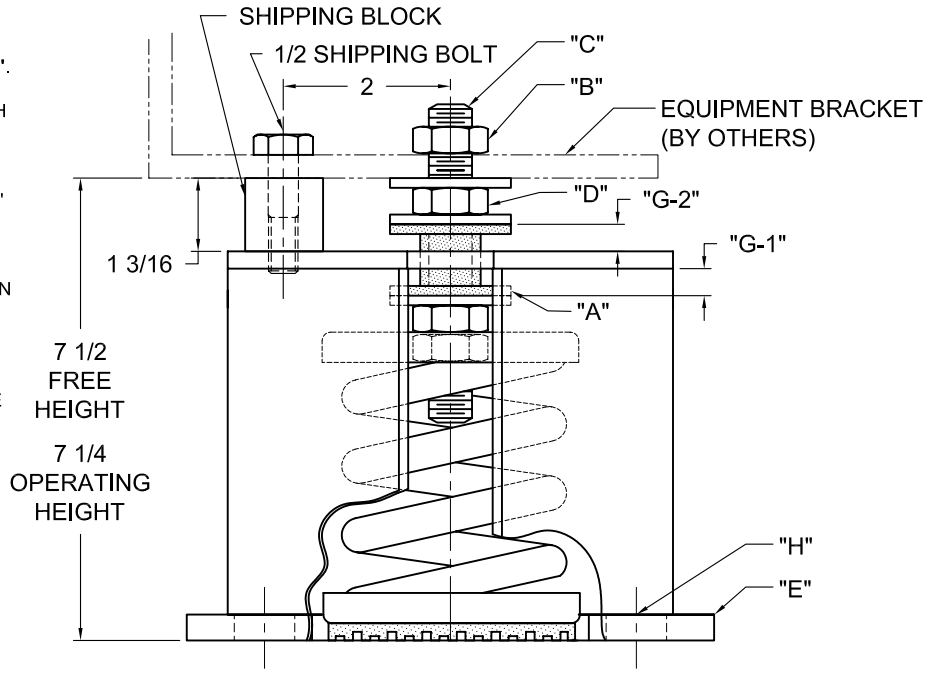
5. REMOVE SHIPPING BOLT, BUT LEAVE THE SHIPPING BLOCK IN PLACE.

6. REMOVE EQUIPMENT ATTACHMENT NUT **"B"** ON ISOLATOR STUD **"C"** AND PLACE EQUIPMENT ON ISOLATOR WASHER **"F"**. THE EQUIPMENT WEIGHT WILL COMPRESS THE SPRING INSIDE THE HOUSING AND EQUIPMENT BRACKET WILL REST ON THE SHIPPING BLOCK AT THE "OPERATING HEIGHT."

7. TURN THE ADJUSTING NUT **"D"** UNDER THE WASHER COUNTER-CLOCKWISE TO COMPRESS THE SPRING. WHEN THE LOAD IS EQUALIZED, TURNING THE NUT WILL RAISE THE EQUIPMENT UNTIL THE INTERNAL GAP **"G-1"** IS APPROXIMATELY EQUAL TO THE EXTERNAL GAP **"G-2"**. (I.E. THE EQUIPMENT CAN MOVE UP OR DOWN, THE SAME DISTANCE IN A SEISMIC EVENT).

8. THE ADJUSTING PROCESS SHOULD BE DONE GRADUALLY ON ALL ISOLATORS UNTIL THE EQUIPMENT WEIGHT IS NO LONGER RESTING ON THE SHIPPING BLOCKS.

9. REPLACE ISOLATOR ATTACHMENT NUTS **"B"** ON ADJUSTING BOLTS **"C"** TO SECURE MACHINE LEGS TO ISOLATORS. HAND TIGHTEN WHERE THERE IS FIRM CONTACT BETWEEN THE NUT AND EQUIPMENT. (HAND TOOLS MAY BE USED.) THEN TIGHTEN THE NUT AN ADDITIONAL 1/3 TURN. REPLACE SHIPPING BOLT AND HAND-TIGHTEN WHERE THERE IS FIRM CONTACT BETWEEN THE BOLT AND EQUIPMENT BRACKET. TOOLS MAY BE USED TO BRING THE BOLT AND METAL COMPONENTS INTO CONTACT. FOLLOWING CONTACT, TIGHTEN THE BOLT ANOTHER 1/3 TURN.



FIELD INSTRUCTIONS

1. SHIPPING BLOCK FIXES THE EQUIPMENT AT THE OPERATING HEIGHT. AFTER EQUIPMENT IS INSTALLED AT ITS FINAL LOCATION, REMOVE SHIPPING BOLT. iF THE BLOCK WILL NOT SLIDE OUT, TURN ADJUSTING NUT COUNTER-CLOCKWISE UNTIL EQUIPMENT DEAD LOAD IS NO LONGER RESTING ON SHIPPING BLOCK. REMOVE SHIPPING BLOCK AND DISCARD.

2. THRUST RESTRAINTS MUST BE ADDED TO THE FAN IF THE TOTAL FAN STATIC PRESSURE IS 2" W.G. OR GREATER.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: _____

CUSTOMER : _____

CUSTOMER P.O.: _____

SALES ORDER: _____

TYPE AMSR-2D-( )-SB SEISMIC ISOLATORS 2" DEFLECTION WITH SHIPPING BLOCK

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

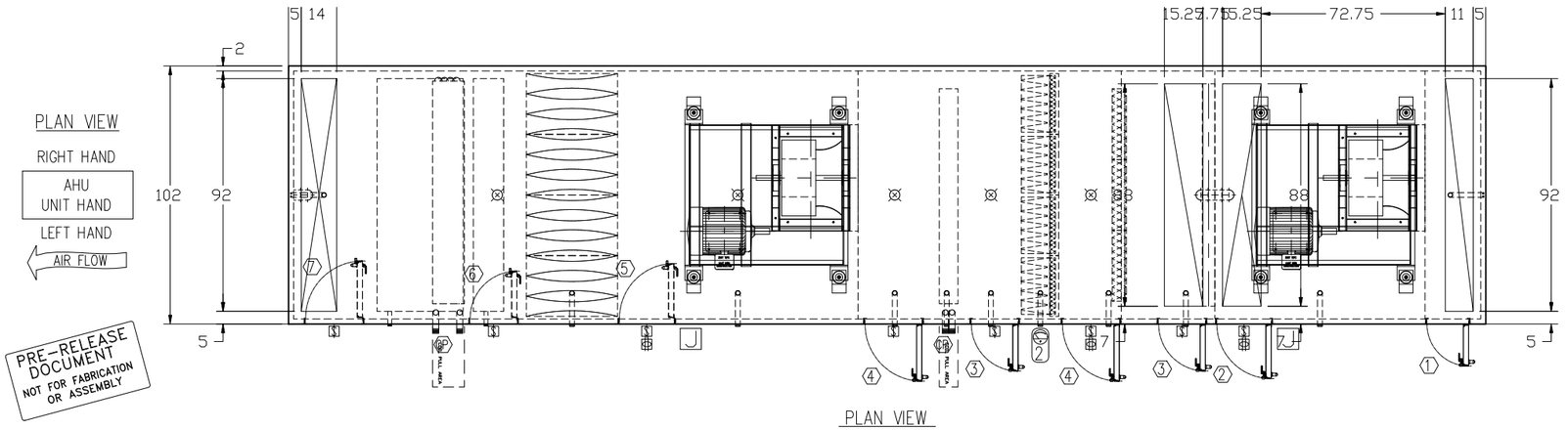
SCALE : NONE

SHEET: 2 OF 2

DRAWING NO.:

REVISION

Member VISCMA



PLAN VIEW

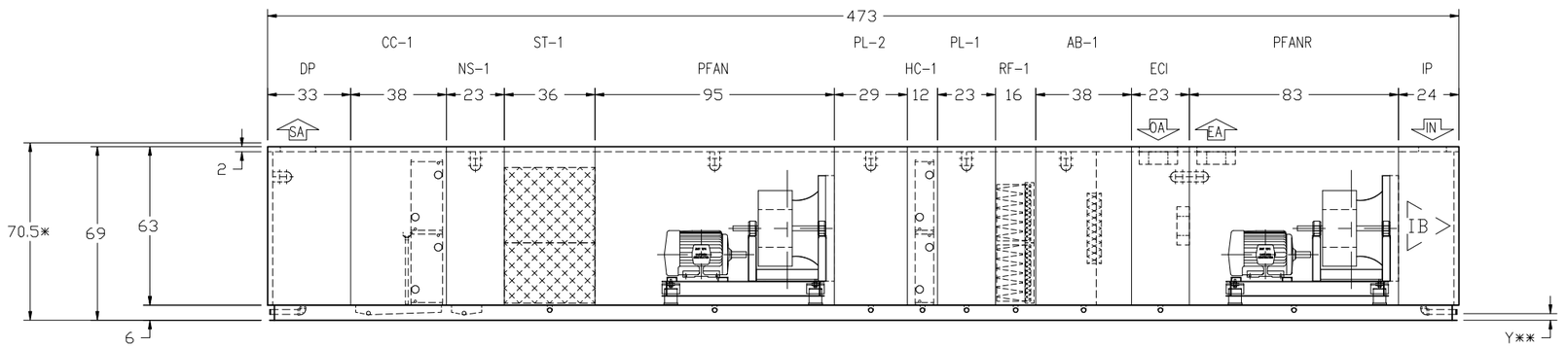
RIGHT HAND

AHU UNIT HAND

LEFT HAND

AIR FLOW

PLAN VIEW



* NOTE: MAX HEIGHT

14122LBS

** NOTE: Y – BOTTOM OF DRAIN

ELEVATION VIEW

UNIT CONSTRUCTION

Model: YC-IPF
Construction:
Indoor
Base:
6" X 1.92" X 8.2#/ft structural steel channel painted w/ 3 to 4 mil DFT Champagne Epoxy.
Base Insulation:
3" Polyurethane Foam
Exterior Material:
18 Ga. Champagne Pre-paint

NOTES

FOR ACTUAL OVERALL CABINET WIDTH DIMENSIONS ADD:
- DOOR HANDLES: 3"
- WATER COIL CONNECTIONS: 5"
- ROOF OVERHANG: 2"
- OPENING FLANGES: 1.5"
- LIGHT SWITCHES, CONVENIENCE OUTLETS: 4"

LEGEND

(1) 0-1" DP GAGE
(2) 0-2" DP GAGE
(P) P-CONE/ P-RING
(WH) WEATHERHOOD
(1) 0-1" DP GAGE ASF
(2) 0-2" DP GAGE ASF
(IB) INLET BAFFLE
(LV) LOUVER
LIGHT SWITCH
120V OUTLET
JUNCTION BOX
DISCONNECT
LIGHT FIXTURES
PENDANT
CR CORROSION RESISTANT FIXTURE
TWIN TUBE
(CP) COIL PULL PANEL
(GS) GALV SAFETY SCREEN
(SS) SS SAFETY SCREEN
(WG) GALV WALK-ON GRATING
(WS) SS WALK-ON GRATING
(WA) ALUM WALK-ON GRATING
(EH) ELECTRIC UNIT HEATER

Unless otherwise dimensioned on unit drawing, light switches, convenience outlets, disconnects and Junction boxes are to be located at the most accessible place near the applicable section's door.

ACCESS DOOR LIST

	Width	Height	Window / Options	FST	Mount.
(1)	18	57	None / T-B	GV	Vert.
(2)	23	57	12" TP / T-B	GV	Vert.
(3)	20	57	None / T-B	GV	Vert.
(4)	24	57	None / T-B	GV	Vert.
(5)	23	57	12" TP / T-B	GV	Vert.
(6)	20	57	None / T-B	GV	Vert.
(7)	24	57	None / T-B	GV	Vert.

DRAIN PAN AND FLOOR DRAIN OUTLET LOCATIONS

SECT #	DIAMETER	Y
NS-1	1.5	2.
CC-1	1.5	2.
FLOOR DRAINS	1.25	2.6

SECTION LIST

SECT #	DESCRIPTION
IP	INLET PLENUM
PFANR	RETURN FAN
ECI	INDOOR ECONOMIZER
AB-1	AIR BLENDER
RF-1	RIGID FILTER
PL-1	PLENUM
HC-1	HEATING COIL
PL-2	PLENUM
PFAN	SUPPLY FAN
ST-1	SOUND ATTENUATOR
NS-1	NON-STANDARD
CC-1	COOLING COIL
DP	DISCHARGE PLENUM

DIMENSIONAL TOLERANCES – UNIT: ±0.5 / PIPING: ±2
UNIT COMPONENTS ARE SHOWN FOR REPRESENTATIONAL PURPOSES ONLY

FILE NAME:

REV.	DATE	BY	DESCRIPTION

YORK Custom AHU

FOR
UK WILDCAT COAL LODGE AHU1REV1
YORK Custom Air Handler

Johnson Controls

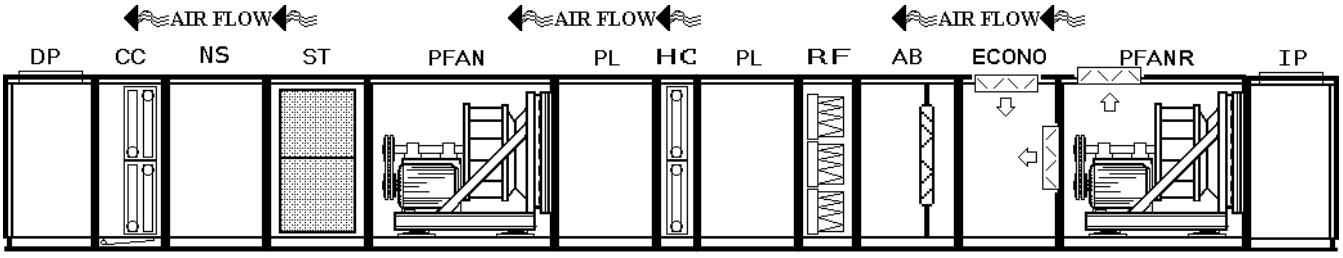
DRAWN BY: cgarcis5
DATE: 03/31/2011
JOB NUMBER: PRELIMINARY
SHEET OF

YORK CUSTOM AIR HANDLER
PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Unit Dimension (H* x W x L): 69" x 102" x 473" **Unit Weight: 14122 lb.**

* Height includes 6" base rail



(33)	(38) [2064]	(23)	(36) [1383]	(95)	(29) [512]	(12)	(23) [413]	(16)	(38) [837]	(23)	(83) [2547]	(24)
[575]		[447]		[2879]		[633]		[572]		[722]		[538]

LEGEND: ( ) = Length in inch [ ] = Weight in lb. ^ = Split

Shipping Split Summary

Group	Length (in.)	Weight (lbs.)	Type Split
DP-CC-NS23-ST-PFAN-PL29...	473	14122	None

This Unit Can Be Shipped From Hattiesburg To Kentucky.

Project Name: UK WILDCAT COAL LODGE	Sold To:
Location:	Cust. Purch. Order No.:
Engineer:	YORK Contract No.: 1E450037
Contractor:	Date: Revision Date:

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Unit Options:

Unit Construction:	Indoor
Base:	6" Structural Steel Base Rail, Painted w/ 3 to 4 mil DFT Champagne Epoxy
Floor Material:	Std Ga. G-90 Galvanized, Painted w/ 3 to 4 mil DFT Champagne Epoxy, Stitch Weld, Thermal Break
Floor Insulation:	3" Polyurethane Foam
SubFloor Material:	20 Ga. Galvanized
Wall Thickness:	2"
Exterior Material:	18 Ga. Champagne Pre-paint
Wall Insulation:	2" Foam
Interior Material:	Std Ga. G-90 Galvanized, Washdown, Thermal Break
Roof Exterior:	18 Ga. Champagne Pre-paint
Option(s):	Standard Foil Unit Nameplate YORK Custom Brand Shipping Protection: Shrink-Wrap

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
11001146001	4" FLOOR CONSTRUTION R-25 INSULATION VALUE	0	0.00
11001146002	ANTI-SLIP COATING ON WALKING AREAS WITH ACCESS DOOR	0	0.00
11001146003	EMT LIGHT CONDUIT ENCLOSURE FOR LIGHTS AND ELECTRICAL WIRING AS REQUIRED	0	0.00
11001146005	PROVIDE COG BELTS AND SHEAVE FOR THE SUPPLY AND EXHAUST FAN/MOTOR ON THIS JOB	0	0.00
11001146006	PROVIDE AUTOMATED LUBING SYSTEM FOR FAN BEARINGS ON THE SUPPLY AND EXHAUST FANS	0	0.00

Electrical Options:

ETL Listed
Wire Supply Fan Motor to NEMA 1 Junction Box on Left Side
Mount and Wire Supply Fan Motor to YORK VFD on Right Side (VFD not included)
Wire Return Fan Motor to NEMA 1 Junction Box on Left Side
Mount and Wire Return Fan Motor to YORK VFD on Left Side (VFD not included)
On/Off Toggle Switch for Each Segment with Service Light(s)
Fluorescent Vapor Resistant Pendant
GFI Outlet(s)

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Factory and Field Testing:

Leak Test:	No
Deflection Test:	No
Airflow Test:	No
Fan Vibration Test:	None
Customer Witness:	No
Test Covers:	Opening covers for field/factory leak testing (testing not included)

Warranty Options:

Coverage:	24 Months from Shipment Parts and Labor Warranty
Delayed Start-up:	None

IP - Inlet Plenum Segment

Segment Details

Inlet Opening:	Roof (11"L x 92"W, Offset Upstream in L, Centered in W)
Opening Area:	7.0 sq. ft.
Damper Type:	None
Option(s):	Inlet Baffle
	Left Door: 2" T-B Door 18"W x 57.00"H, Out-Swing, Upstream Hinge, Plated Fasteners.
	Floor Drain with Black Steel Piping, Outlet Upstream End

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

PFANR - Return Plenum Fan Segment

Segment Details

Airflow:	11731 CFM
ESP/TSP:	1.27 in. w.g. / 1.50 in. w.g.
Fan Mfg/Type/Diameter:	YORK (Twin City) EPF-300 (Class II)
Fan RPM:	966
Fan BHP:	4.31 BHP
Fan BHP w/ Belt Loss:	4.61 BHP
Motor Type:	ODP Premium Effic.7.5HP 1800RPM 213T 208-3-60 FLA: 22.12
Motor Location:	Behind, Left
Drive Type:	Adjustable HP: 7.5. 1.5 Drive Service Factor (based on BHP).
Isolation:	2" Seismic
Exhaust Opening:	Roof (15.25"L x 88"W, Offset Downstream in L, Centered in W)
Exhaust Airflow/Area:	11731 CFM / 9.3 sq. ft.
Damper Type:	Galvanized - Ultra Low Leak (Parallel Blade)
Damper Qty/Size:	(1) 15.25"L x 88"W
Damper Mounting:	Internal
Actuator Type:	None
Internal Wall:	Galvanized
Option(s):	Select 100% Width — Thrust Restraints
	Set of Spare Belts — Inertia Base
	Belt Guard — Inlet Screen
	Fan Screen
	Left Door: 2" T-B Door 23"W x 57.00"H, Out-Swing, Upstream Hinge, w/ 12" x 12" Thermal Pane Window, Plated Fasteners.
	(1) Service Light, (1) Light Switch, and (1) Convenience Outlet
	Floor Drain with Black Steel Piping, Outlet Left Side

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
11001146004	GROUND PROTECTIONG SHAFTING KIT	0	0.00

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

ECI - Indoor Economizer Segment

Segment Details

OA Opening:	Roof (15.25"L x 88"W, Offset Downstream in L, Centered in W)
OA Airflow/Area:	15535 CFM / 9.3 sq. ft.
OA Damper Type:	Galvanized - Ultra Low Leak (Parallel Blade)
OA Damper Qty/Size:	(1) 15.25"L x 88"W
OA Actuator Type:	None
RA Opening:	Internal (15.25"H x 88"W)
RA Airflow/Area:	11731 CFM / 9.3 sq. ft.
RA Damper Type:	Galvanized - Ultra Low Leak (Parallel Blade)
RA Damper Qty/Size:	(1) 15.25"H x 88"W
RA Actuator Type:	None
Internal Wall:	Galvanized
Option(s):	Downstream Left Door: 2" T-B Door 20"W x 57.00"H, Out-Swing, Upstream Hinge, Plated Fasteners. (1) Service Light and (1) Light Switch Floor Drain with Black Steel Piping, Outlet Left Side

AB - Air Blender Segment

Segment Details

Blender Qty/Size:	(3) AB28
Blender Area:	13.5 sq. ft.
Blender Arrangement:	Horizontal
Internal Wall:	Galvanized
Option(s):	Left Door: 2" T-B Door 24"W x 57.00"H, Out-Swing, Upstream Hinge, Plated Fasteners. (1) Service Light, (1) Light Switch, and (1) Convenience Outlet Floor Drain with Black Steel Piping, Outlet Left Side

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

RF - Rigid Filter Segment

Segment Details

Filter Depth:	12" with 2" prefilters
Filter Frame:	Galvanized
Blankoff Material:	Galvanized
Filter Area:	32.0 sq. ft.
Filter Qty/Size:	(8) 24"H X 24"W
Prefilter Media:	Pleated - 30% Efficient (Class I) (By Factory)
Filter Media:	90 - 95% Efficient (Single Header) (Class I) (By Factory) (MERV 14)
Spare Prefilter Media:	Pleated - 30% Efficient (Class I) (By Factory)
No. of Spare Sets:	1
Spare Filter Media:	90 - 95% Efficient (Single Header) (Class I) (By Factory) (MERV 14)
No. of Spare Sets:	1
Load Option:	Upstream Load
Option(s):	Floor Drain with Black Steel Piping, Outlet Left Side
	0 -- 2" Magnehelic Filter Gauge On Left Side

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
1111111	Filter Dirty Allowances	0	0.00

PL23 - Plenum Segment

Segment Details

Plenum Length:	23"
Option(s):	Left Door: 2" T-B Door 20"W x 57.00"H, Out-Swing, Upstream Hinge, Plated Fasteners.
	(1) Service Light and (1) Light Switch
	Floor Drain with Black Steel Piping, Outlet Left Side

HC - Heating Coil Segment

Segment Details

Coil Space Used:	12.0"
Blankoff Material:	Galvanized
Stacking Rack:	All Bright Galvanized Construction
Coil Pull:	Left
Option(s):	Floor Drain with Black Steel Piping, Outlet Left Side

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
11001314001	Provide 3/4" drain valve on each coil, cost is $100 MLP / COIL.	0	0.00

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

PL29 - Plenum Segment

Segment Details

Plenum Length:	29"
Option(s):	Left Door: 2" T-B Door 24"W x 57.00"H, Out-Swing, Upstream Hinge, Plated Fasteners.
	(1) Service Light and (1) Light Switch
	Floor Drain with Black Steel Piping, Outlet Left Side

PFAN - Supply Plenum Fan Segment

Segment Details

Airflow:	15535 CFM	
ESP/TSP:	1.50 in. w.g. / 4.17 in. w.g.	
Fan Mfg/Type/Diameter:	YORK (Twin City) EPF-300 (Class III)	
Fan RPM:	1430	
Fan BHP:	14.71 BHP	
Fan BHP w/ Belt Loss:	15.59 BHP	
Motor Type:	ODP Premium Effic.20HP 1800RPM 256T[1] 208-3-60 FLA: 51.98	
Motor Location:	Behind, Left	
Drive Type:	Fixed HP: 20. 1.5 Drive Service Factor (based on BHP).	
Isolation:	2" Seismic	
Internal Wall:	Galvanized	
Option(s):	12" Extra Section Length	Select 100% Width
	Thrust Restraints	Set of Spare Belts
	Inertia Base	Belt Guard
	Inlet Screen	Fan Screen
	Left Door: 2" T-B Door 23"W x 57.00"H, In-Swing, Upstream Hinge, w/ 12" x 12" Thermal Pane Window, Plated Fasteners.	
	(1) Service Light, (1) Light Switch, and (1) Convenience Outlet	
	Floor Drain with Black Steel Piping, Outlet Left Side	

Program Advisories

1. When using motor frame sizes 254T and above, motor j-box must be removed to fit through minimum size access door.

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
11001146004	GROUND PROTECTION SHAFTING KIT	0	0.00

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

ST - Sound Trap Segment

Segment Details

Attenuator Type:	3' Galvanized Standard Attenuator
Attenuator Area:	36.0 sq. ft.
Attenuator Size:	(4)30"H x 24"W, (4)24"H x 24"W
Blankoff Material:	Galvanized
Option(s):	Floor Drain with Black Steel Piping, Outlet Left Side

NS23 - Non-Standard Segment

Segment Details

Plenum Length:	23"
Option(s):	Non-Standard Segment
	304 Stainless Steel Drain Pan - Length = 12"
	Drain Connection: SS MNPT Connection, Left Hand
	Left Door: 2" T-B Door 20"W x 57.00"H, In-Swing, Upstream Hinge, Plated Fasteners.
	(1) Service Light and (1) Light Switch

CC - Cooling Coil Segment

Segment Details

Coil Space Used:	38.0"
Drain Connection:	Left Hand, SS MNPT
Drain Pan:	304 Stainless Steel, 34" Length
Intermediate Pan:	304 Stainless Steel
Blankoff Material:	304 Stainless Steel
Stacking Rack:	All #304 SS Construction
Coil Pull:	Left

Special Quotes

SQ#	Description	Weight (lb)	ISP (in. w.g.)
11001314001	Provide 3/4" drain connection - 100 MLP / COIL	0	0.00

DP - Discharge Plenum Segment

Segment Details

Discharge Opening:	Roof (14"L x 92"W, Offset Downstream in L, Centered in W)
Opening Area:	8.9 sq. ft.
Damper Type:	None
Option(s):	Left Door: 2" T-B Door 24"W x 57.00"H, In-Swing, Upstream Hinge, Plated Fasteners.
	(1) Service Light and (1) Light Switch
	Floor Drain with Black Steel Piping, Outlet Downstream End

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Coils Listed Starting At Air Inlet

HC Coil

See Pricing Form or Order Form for coil nomenclature.

Coil General / Physical Details

Location:	HC-01	No. of Coils:	2
Tag:		Rows:	1
Application:	Heating	Fins Per Inch:	10
Coil Type:	CDW	Tubes Per Circuit:	2
Face Type:	Full	Finned Height:	27.25*
Tube Diameter:	5/8"	Finned Length:	85*
Tube Material:	Copper	Coil Face Area:	16.09*
Tube Wall Thickness:	.035"	Conn. Loc.:	Ext. Left
Fin Material:	Aluminum	Supp Conn Size:	2
Fin Thickness:	.010"	Rtn Conn Size:	2
Casing Material:	Galvanized	No. Of Conn. Sets (per coil):	1*
Header Material:	Copper	Conn. Mat'l:	Red Brass MPT
Dry Weight (lbs.):	117.9*		

Air Side Performance

Air Flow:	7768*
Altitude (ft):	0
EAT-DB (°F):	0.0
LAT-DB (°F):	54.6
FV (ft/min):	483
TMBH:	458.4*
APD (in. w.g.):	0.12

Fluid Side Performance

EWT (°F):	180.0
LWT (°F):	130.1
GPM:	18.9*
WPD:	1.4
FPS:	2.6
Fluid Type:	Water
Fluid Vol. (ft³):	0.4*
Fluid Wt. (lbs):	22.5*

Program Advisories

* Note: Data shown per-coil.
All water, R-22 DX and steam coils are certified in accordance to ARI Standard 410.

CC Coil

See Pricing Form or Order Form for coil nomenclature.

Coil General / Physical Details

Location:	CC-01	No. of Coils:	2
Tag:		Rows:	8
Application:	Cooling	Fins Per Inch:	8
Coil Type:	CDW	Tubes Per Circuit:	8
Face Type:	Full	Finned Height:	27.25*
Tube Diameter:	5/8"	Finned Length:	88*
Tube Material:	Copper	Coil Face Area:	16.65*
Tube Wall Thickness:	.035"	Conn. Loc.:	Ext. Left
Fin Material:	Aluminum	Supp Conn Size:	2-1/2
Fin Thickness:	.010"	Rtn Conn Size:	2-1/2
Casing Material:	Stainless	No. Of Conn. Sets (per coil):	1*
Header Material:	Copper	Conn. Mat'l:	Red Brass MPT
Dry Weight (lbs.):	570.5*		

Air Side Performance

Air Flow:	7768*
Altitude (ft):	0
EAT-DB (°F):	87.0
EAT-WB (°F):	70.0
LAT-DB (°F):	52.0
LAT-WB (°F):	51.8
FV (ft/min):	466
SMBH:	302.4*
TMBH:	440.8*
APD (in. w.g.):	0.91

Fluid Side Performance

EWT (°F):	45.0
LWT (°F):	60.0
GPM:	58.6*
WPD:	12.0
FPS:	4.0
Fluid Type:	Water
Fluid Vol. (ft³):	2.2*
Fluid Wt. (lbs):	137.3*

Program Advisories

* Note: Data shown per-coil.
All water, R-22 DX and steam coils are certified in accordance to ARI Standard 410.

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Static Pressure Summary

Type SP/ Segment	Component	Area (ft²)	Velocity (ft/min)	Supply Fan (in. w.g.)	Return Fan (in. w.g.)
Specified External:				1.50	1.27
Internal:					
(IP) Inlet Plenum	Transition Loss	7.0	1669		0.01
(PFANR) SWSI Return Fan	EA Transition Loss	9.3	1259		0.15
	EA Damper	9.3	1259		0.07
(ECI) Indoor Economizer	OA Transition Loss	9.3	1667	0.01*	
	OA Damper	9.3	1667	0.11*	
	RA Transition Loss	9.3	1259	0.27	
	RA Damper	9.3	1259	0.07	
(AB) Air Blender		13.5	1151	0.10	
(RF) Rigid Filter	Pre-filter: Pleated - 30% Efficient	32.0	485	0.28	
	High Eff.: 90 - 95% Efficient (MERV 14)	32.0	485	0.56	
(HC) Heating Coil	1 row, 10 fin Heating Coil	32.2	483	0.12	
(ST) Sound Trap	3S - Standard Att.	36.0	432	0.07	
(CC) Cooling Coil	8 row, 8 fin Cooling Coil	33.3	466	0.91	
(DP) Discharge Plenum	Transition Loss	8.9	1737	0.29	
Dirty Filter Allowance:					
Total:				**4.17**	**1.50**

* NOTE: For internal pressure drop totals, the smaller of the RA and OA pressure drops will be ignored.

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Dimensions & Weights Summary

Section	Length** (in.)	Width*+ (in.)	Height+ (in.)	Weight (lbs.)
IP - Inlet Plenum Segment	24	102	63	538
PFANR - Plenum Return Fan SWSI Segment	83	102	63	2547
ECI - Indoor Economizer Segment	23	102	63	722
AB - Air Blender Segment	38	102	63	837
RF Segment - 12" Rigid Filter Segment	16	102	63	572
PL23 - Plenum Segment	23	102	63	413
HC Segment - Heating Coil Segment	12	102	63	633
PL29 - Plenum Segment	29	102	63	512
PFAN - Plenum Supply Fan SWSI Segment	95	102	63	2879
ST - 3' Sound Attenuator Segment	36	102	63	1383
NS23 - Non-Standard Segment	23	102	63	447
CC Segment - Cooling Coil Segment	38	102	63	2064
DP - Discharge Plenum Segment	33	102	63	575
Overall:	**473**	**102**	**69**	**14122**

* The width does not include coil connection extensions or door latches that extend beyond the unit casing.
** The length does not include zone dampers that extend beyond the unit casing.
+ Weatherproof Units: The unit height & width indicated does not include roof panel overhang.
Width increases by 2.00" & length increases by 2.00" from dimensions shown.
+ Weatherproof Units: The unit height indicated does not include the roof pitch.
The unit roof is pitched up as shown on drawing at 0.25" per foot.

Johnson Controls

YORK CUSTOM AIR HANDLER PERFORMANCE SPECIFICATION

Unit Tag	Qty.	Model No.	Air Flow (CFM)
AHU-1	**1**	**YC-69X102**	**15535**

Sound Summary

Sound Power Leaving Each Opening In The Unit

(dBs re 1.0 pico-Watts)

Opening	63	125	250	500	1K	2K	4K	8K	LW/LWA
IP Segment Inlet	75	83	81	72	69	66	61	52	86/77
PFANR Exhaust	79	87	90	89	77	74	68	61	94/88
Economizer OSA	79	87	91	89	77	73	68	61	94/88
DP Segment Outlet	75	72	77	65	57	59	53	48	80/70

Bare Fan Sound Power

(dBs re 1.0 pico-Watts)

Fan	63	125	250	500	1K	2K	4K	8K	LW/LWA
Return Fan Inlet	82	90	88	79	76	73	67	58	93/83
Return Fan Outlet	83	91	89	84	83	79	70	60	94/88
Supply Fan Inlet	88	96	101	99	85	81	76	70	104/98
Supply Fan Outlet	91	93	102	101	92	88	81	72	105/100

Casing Radiation

(dBs re 1.0 pico-Watts)

Fan	63	125	250	500	1K	2K	4K	8K	LW/LWA
Return Fan	68	72	66	56	61	44	31	18	74/64
Supply Fan	76	74	79	73	70	53	42	30	82/75
Combined	76	76	79	73	70	53	42	30	82/75

Sound power levels are derived from data collected on representative fans in accordance with AMCA Standard No. 300 and sound intensity methods. For draw through and blow through configurations, the reported sound power levels include corrections for plenum attenuation. The corrections are based on the physical size of the plenum, locations of openings, and insulation package. Openings upstream of the return fan are based on return fan data. Openings downstream of the supply fan are based on supply fan data. Openings between the supply fan and return fan are based on both supply and return fan data. "Bare fan" levels are as measured in the laboratory with no plenum correction.

YORK Custom Air Handler Submittal Detail

Project Name: UK WILDCAT COAL LODGE Folder Name: AHU1REV1 System ID: 25 Ship Weight: 14122

Unit Tag: AHU-1 Unit Type: YC Quantity: 1

*The Unit column shows the standard unit construction. Deviations are shown under the affected section. Endnotes indicated thus: #

Unit Sections	Unit	DP	CC-1	NS-1	ST-1	PFAN	PL-2	HC-1	PL-1	RF-1	AB-1	ECI	PFANR	IP				
Internal SP (in.)	2.90	0.29	0.91		0.07			0.12		0.84	0.10	0.34	0.22	0.01				
Base																		
Floor Mat'l Thickness	Std																	
Floor Material	G90P/TB																	
Sbflr Mat'l Thckness	20Ga.																	
Subfloor Material	G90																	
Floor Attachment	STW																	
Floor Drain		BSTL			BSTL	BSTL	BSTL	BSTL	BSTL	BSTL	BSTL	BSTL	BSTL	BSTL				
Drain Pan Thick/Mat'l			16Ga./304	16Ga./304														
Casing																		
Thickness (in.)	2"																	
Interior Mat'l Thickness	Std																	
Interior Material	G90/WT																	
Insulation Thickness	2"																	
Insulation Type	IPF																	
Blank-off Wall			304		G90	G90		G90		G90	G90	G90	G90	G90				
Mylar																		

Special Construction: Curb Height:

Brand: YORK Custom ETL Label (UL1995/NEC-2002): Yes Unit Name Plate: Standard Foil Curb Insulation:

Shipping Protection: Shrink-Wrap Lifting Lugs: Removable. (1)

Electricals: The unit will have 23W Fluorescent Vapor Resistant Pendant lights and light switches as shown on drawing.

Outlet type to be GFI. Approximate location for electrical components as shown on drawing.

Vestibule Heater:

Fan & Motor - Supply:							
Type	Plenum/TC	CFM	15535	TSP	4.17	ISP	2.67	ESP	1.50
Model/Class	EPF/III	Size/Width	300/100%	Scroll Drain/Door		VFD	See Data Sheet-RH	Drive Type	Belt
Wheel Type	Steel Airfoil	P-Ring		Inertia Base	Concrete By Others	RPM - Fan/Motor	1430/1800	SF (1.5 x BHP)	Fixed
Arrangement	3H	Econodisk w/Actr.		Lube Lines	Internal	BHP Fan/HP Motor	14.7/20	Spare Belts	Yes
Deflection	2"	Inlet Screen	Yes	Bearings	200K L-50	Frame Size	256T	Spare Drive Set	
Isolation Type	Seismic	Fan Screen	Yes	Motor Disc.		Type-Efficiency	ODP-Prem	Spare Sheave	
		Belt Guard	Yes	Fan Wire J-Box	NEMA 1-LH	Volt/Phase/Hz.	208/3/60		

Fan & Motor - Return:							
Type	Plenum/TC	CFM	11731	TSP	1.50	ISP	0.23	ESP	1.27
Model/Class	EPF/II	Size/Width	300/100%	Scroll Drain/Door		VFD	See Data Sheet-LH	Drive Type	Belt
Wheel Type	Steel Airfoil	P-Ring		Inertia Base	Concrete By Others	RPM - Fan/Motor	966/1800	SF (1.5 x BHP)	Adjustable
Arrangement	3H	Econodisk w/Actr.		Lube Lines	Internal	BHP Fan/HP Motor	4.3/7.5	Spare Belts	Yes
Deflection	2"	Inlet Screen	Yes	Bearings	200K L-50	Frame Size	213T	Spare Drive Set	
Isolation Type	Seismic	Fan Screen	Yes	Motor Disc.		Type-Efficiency	ODP-Prem	Spare Sheave	
		Belt Guard	Yes	Fan Wire J-Box	NEMA 1-LH	Volt/Phase/Hz.	208/3/60		

YORK Custom Air Handler Submittal Detail

Filter	Qty.	Filter Size 1	Qty.	Filter Size 2	Load Type	Efficiency	MERV	Class	Spare	Frame Type	Frame Mat'l
RF-1 Prefilter	8	24 x 24 x 2			Upstream	30%		I	1	UHF	GALV
RF-1 Rigid Filter	8	24 x 24 x 12			Upstream	90 - 95%	14	I	1	UHF	GALV

Coil	Qty	FPI	Row	Tube Dia.	Type	"H" X "W"	Stack Rack	Drain/Intermediate Pan	Connection Dia.	Offset	*See Coil Performance Sheet
HC-1	2	10	1	5/8"	CDW	27.25 X 85	G90		2" R.B. MPT	6"	
CC-1	2	8	8	5/8"	CDW	27.25 X 88	304	304 / 304	2.5" R.B. MPT	6"	

Damper	"W" X "H"	Type	Blade	Blade Orientation	Actuator Type
PFANR Exhaust	88 X 15.25	Ultra Low Leak	GALV	Parallel	None
ECI Outside	88 X 15.25	Ultra Low Leak	GALV	Parallel	None
ECI Return	88 X 15.25	Ultra Low Leak	GALV	Parallel	None

Sound Trap	Type	Sound Trap Mat'l	Area (ft~ 2)
ST-1	Standard	G90	36.0

Air Blender	Size	Qty	Arrangement	Area Ratio
AB-1	28	3	Horizontal	0.34

Factory and Field Testing

Leak Test: No Test SP: Leakage:

Airflow Test: No Deflection Test: No Criteria: Include Roof:

Fan Vibration Test: None Opening covers for field/factory leak testing: Yes (testing not included) /2/ Customer Witness: No

Warranty Options

Coverage: 24 Months from Shipment Parts and Labor Warranty

Delayed Start-up: None

Special Quote	SQ Number	Description	Qty.	Wght.	ISP/Fan
PFANR	11001146004	GROUND PROTECTIONG SHAFTING KIT	1		
RF-1	1111111	Filter Dirty Allowances	1		
HC-1	11001314001	Provide 3/4" drain valve on each coil, cost is $100 MLP / COIL.	1		
PFAN	11001146004	GROUND PROTECTION SHAFTING KIT	1		
CC-1	11001314001	Provide 3/4" drain connection - 100 MLP / COIL	1		
Unit	11001146001	4" FLOOR CONSTRUTION R-25 INSULATION VALUE	1		
Unit	11001146002	ANTI-SLIP COATING ON WALKING AREAS WITH ACCESS DOOR	1		
Unit	11001146003	EMT LIGHT CONDUIT ENCLOSURE FOR LIGHTS AND ELECTRICAL WIRING AS REQUIRED	1		
Unit	11001146005	PROVIDE COG BELTS AND SHEAVE FOR THE SUPPLY AND EXHAUST FAN/MOTOR ON THIS JOB	1		
Unit	11001146006	PROVIDE AUTOMATED LUBING SYSTEM FOR FAN BEARINGS ON THE SUPPLY AND EXHAUST FANS	1		

Sound Summary

Sound Power Leaving Each Opening In The Unit

Opening	Band	63	125	250	500	1K	2K	4K	8K	LW/LWA
IP Segment Inlet		75	83	81	72	69	66	61	52	86/77
PFANR Exhaust		79	87	90	89	77	74	68	61	94/88
Economizer OSA		79	87	91	89	77	73	68	61	94/88
DP Segment Outlet		75	72	77	65	57	59	53	48	80/70

(dBs re 1.0 pico-Watts)

Casing Radiation Sound Level

Fan	Band	63	125	250	500	1K	2K	4K	8K	LW/LWA
Supply Fan		68	72	66	56	61	44	31	18	74/64
Return Fan		76	74	79	73	70	53	42	30	82/75
Combination		76	76	79	73	70	53	42	30	82/75

(dBs re 1.0 pico-Watts)

* Reference Only — Performance Information – (Height & Width – inches) (Area – sq.ft.) (Face Velocity – ft./min.) — * Reference Only

Segment	Location	H/(qty)	X	W	Area	Face Vel.	Segment	Location	H/(qty)	X	W	Area	Face Vel.	Segment	Location	H/(qty)	X	W	Area	Face Vel.
IP	Roof	11	X	92	7.0	1669	PFANR	Roof	15.2	X	88	9.3	1259	ECI	Internal	15.2	X	88	9.3	1259
ECI	Roof	15.2	X	88	9.3	1667	AB-1	Airstream	(3)	X	28	13.5	1151	RF-1	Airstream	48	X	96	32.0	485
HC-1	Airstream	54.5	X	85	32.2	483	ST-1	Airstream	54	X	96	36.0	432	CC-1	Airstream	54.5	X	88	33.3	466
DP	Roof	14	X	92	8.9	1737				X							X			

#	Notes
1	See "as built" base drawing for exact qty and location of removable lifting lugs.
2	Covers over openings will be suitable for +/- 10" testing. Covers for positive pressure sections will be designed for positive test pressure and negative pressure sections will be designed for negative test pressure. All factory or field leak testing requires an additional SQ prior to releasing.

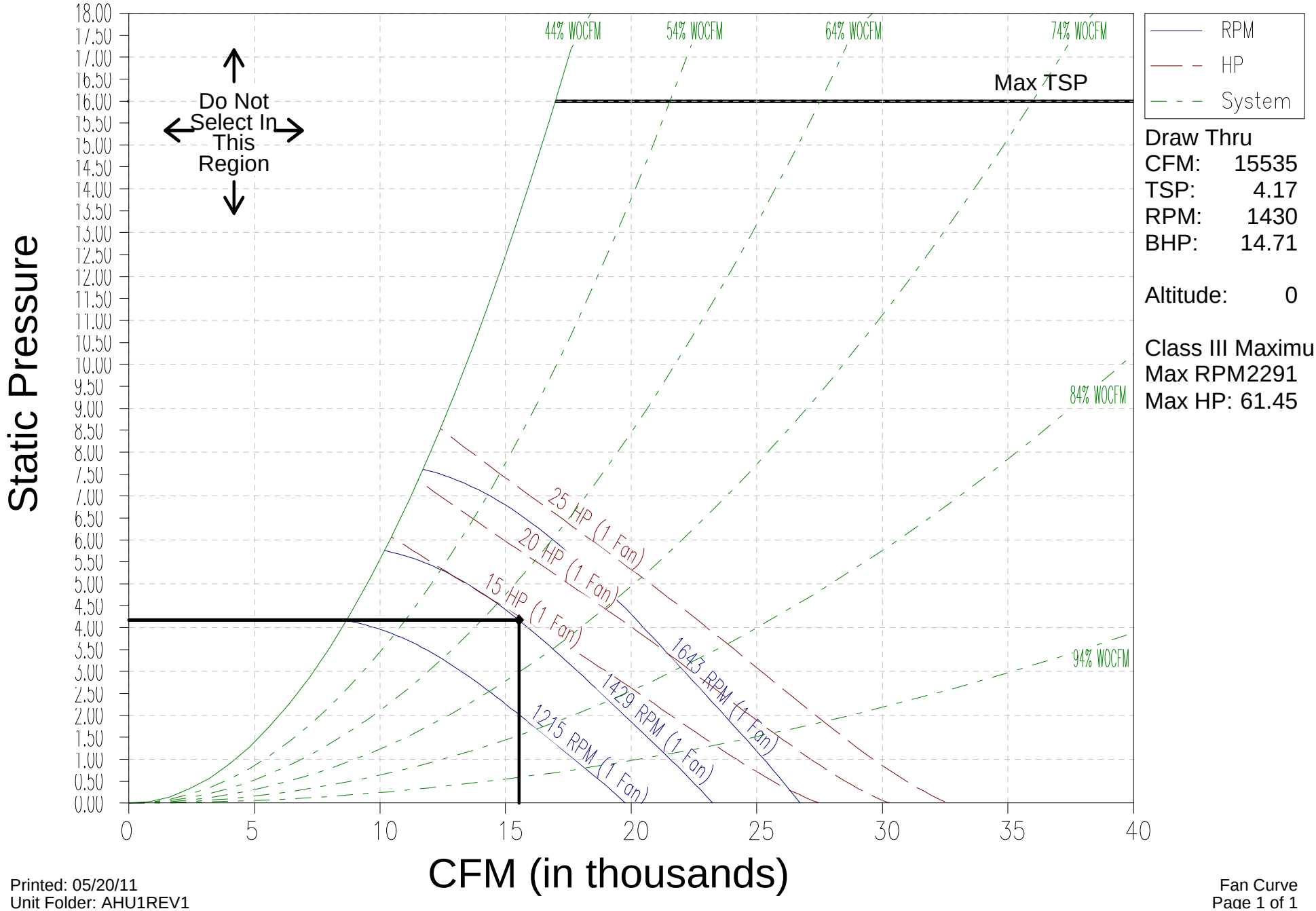
Legend

Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
304	304 Stainless Steel	BSTL	Black Steel	G90	Galvanized G90
G90P	Galvanized G90 Champagne Epoxy Paint	GALV	Galvanized	IPF	Injected Polyurethane Foam
LH	Left Hand Placement	MPT	Male Pipe Thread	R.B.	Red Brass
RH	Right Hand Placement	STW	Stitch Weld	TB	Thermal Break
TC	Twin City Fan	UHF	Universal Holding Frame (Type 8)	WD	Washdown
WT	Washdown and Thermal Break				

Johnson Controls

YORK CUSTOM AIR HANDLER
FAN CURVE

Project Name	Unit Tag	Qty	Model	Section	CFM	Fan Type	Class	Fan Size	VIV
UK WILDCAT COAL LODGE	AHU-1	1	TC	FP	15535	EPF	III	300	No



Draw Thru
CFM: 15535
TSP: 4.17
RPM: 1430
BHP: 14.71

Altitude: 0

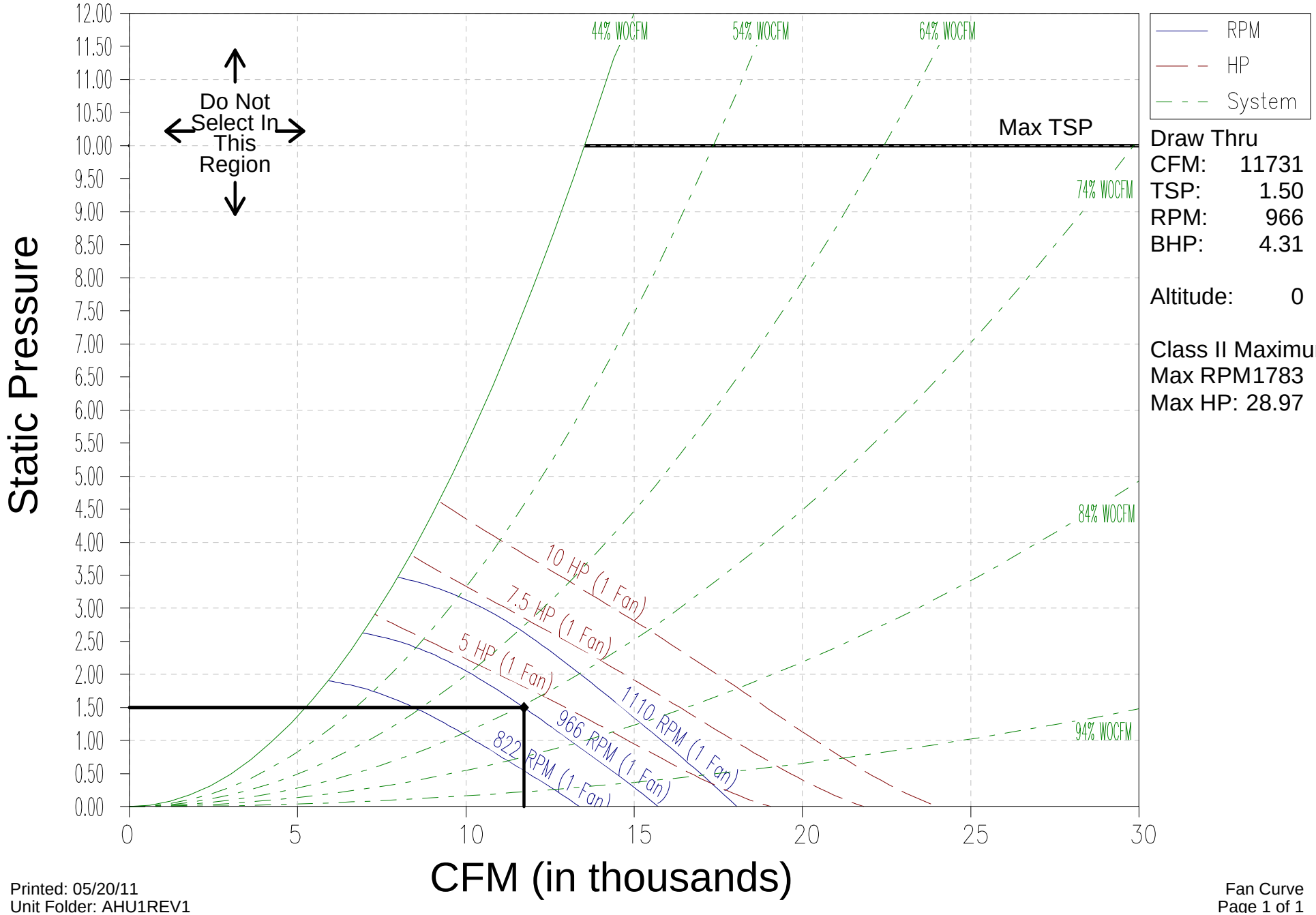
Class III Maximums
Max RPM2291
Max HP: 61.45

Printed: 05/20/11
Unit Folder: AHU1REV1

Johnson Controls

YORK CUSTOM AIR HANDLER FAN CURVE

Project Name	Unit Tag	Qty	Model	Section	CFM	Fan Type	Class	Fan Size	VIV
UK WILDCAT COAL LODGE	AHU-1	1	TC	FR2	11731	EPF	II	300	No



Draw Thru
CFM: 11731
TSP: 1.50
RPM: 966
BHP: 4.31

Altitude: 0

Class II Maximums
Max RPM1783
Max HP: 28.97

Printed: 05/20/11
Unit Folder: AHU1REV1

Johnson Controls	HORIZONTAL, LOW PROFILE FAN COILS	
INSTALLATION, OPERATION & MAINTENANCE	New Release	Form 115.24-NOM5 (908)

MODELS FHF / FHP / FHX

LD13884

TABLE OF CONTENTS

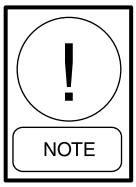
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



NOTE is used to highlight additional information which may be helpful to you.

SAFETY CONSIDERATIONS

The equipment covered by this manual is designed for safe and reliable operation when installed and operated within its design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experienced personnel perform these functions using good judgment and safe practices. See the following cautionary statements.

ELECTRICAL SHOCK HAZARDS. All power must be disconnected prior to installation and serving this equipment. More than one source of power may be present. Disconnect all power sources to avoid electrocution or shock injuries.

MOVING PARTS HAZARDS. Motor and Blower must be disconnected prior to opening access panels. Motors can start automatically, disconnect all power and control circuits prior to servicing to avoid serious crushing or dismemberment injuries.

HOT PARTS HAZARD. Electric Resistance heating elements must be disconnected prior to servicing. Electric Heaters may start automatically, disconnect all power and control circuits prior to servicing to avoid burns.

Check that the unit assembly and component weights can be safely supported by rigging and lifting equipment.

All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its final location.

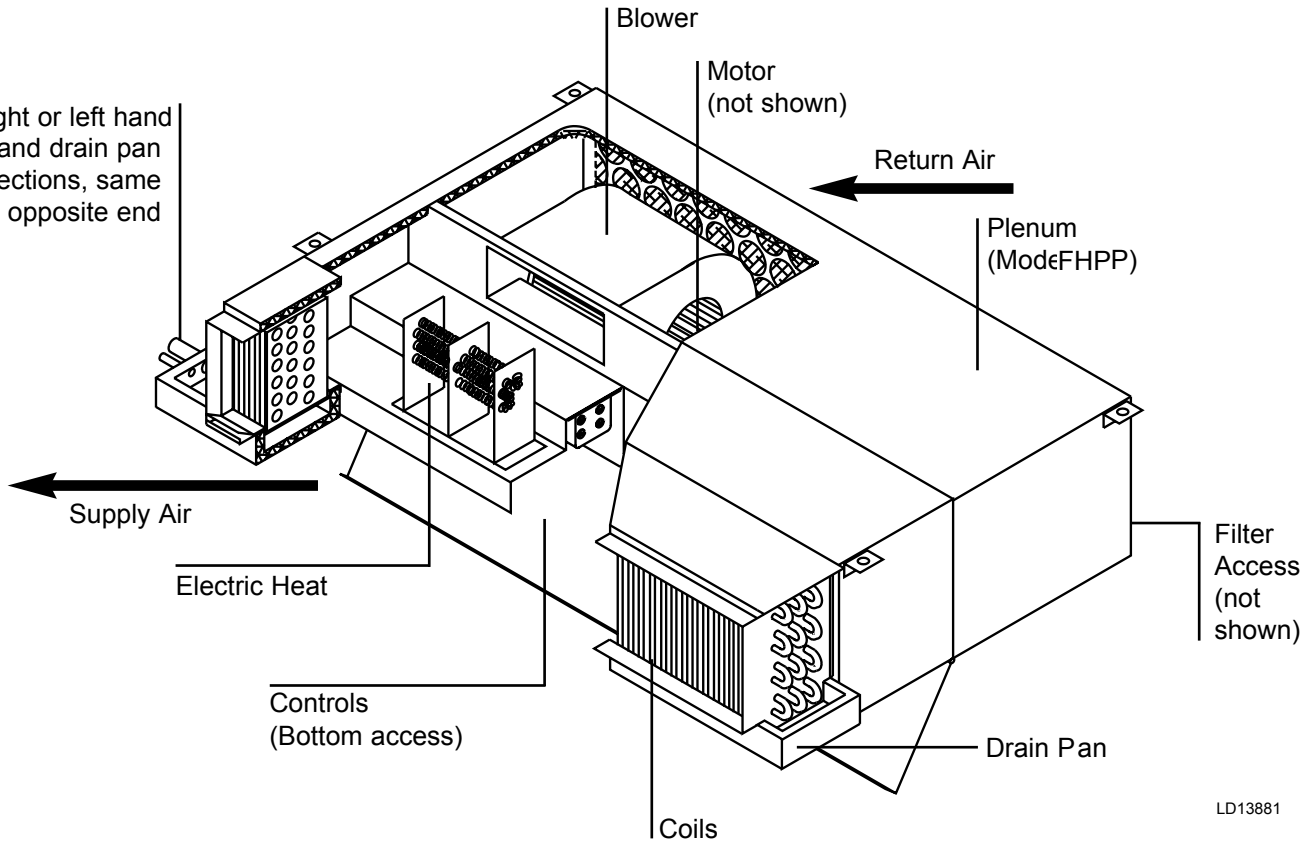
All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation and vibration.

Protect adjacent flammable materials when brazing, Use flame and heat protection barriers where needed. Have fire extinguisher available and ready for immediate use.

SECTION ONE - RECEIPT & INITIAL INSTALLATION

FH SERIES FEATURES



PREFACE

Johnson Controls fan coils represent a prudent investment which can, with proper installation, operation, and regular maintenance, give trouble-free operation and long service.

Your equipment is initially protected under the manufacturer's standard warranty; however, this warranty is provided under the condition that the steps outlined in this manual for initial inspection, proper installation, regular periodic maintenance, and everyday operation of the equipment be followed in detail. This manual should be fully reviewed in advance of any actual work being done on the equipment. Should any questions arise, please contact your local Sales Representative or the factory BEFORE proceeding.

The equipment covered by this manual is available with a vast variety of options and accessories. Consult the approved unit submittal, order acknowledgement, and other manuals for details on the options and accessories provided with the equipment on each project.

No attempt should be made to handle, install, or service any unit without following safe practices regarding mechanical equipment.

All power must be disconnected before any installation or service should be attempted. More than one power source may be supplied to a unit. Power to remote mounted control devices may not be supplied through the unit. Never wear bulky or loose fitting clothing when working on any mechanical equipment. Gloves should only be worn when required for proper protection from heat or other possible injury. Safety glasses or goggles should always be worn when drilling, cutting, or working with chemicals such as refrigerants or lubricants.

Never pressurize any equipment beyond specified operating pressures. Always pressure test with some inert fluid or gas such as clear water or dry nitrogen to avoid possible damage or injury in the event of a leak or component failure during testing.

Always protect adjacent flammable material when welding or soldering. Use suitable heat shield material to contain sparks or drops of solder. Have fire extinguisher available for use when welding or brazing.

The manufacturer assumes no responsibility for personal injury or property damage resulting from improper or unsafe practices during the handling, installation, service, or operation of any equipment.

UNPACKING & INSPECTION

All units are carefully inspected at the factory throughout the manufacturing process under a strict detailed quality assurance program, and where possible, all major components and subassemblies are carefully tested for proper operation and verified to be in full compliance with the factory manufacturing documents. Customer furnished components such as control valves, switches and DDC controls are not factory tested.

Each unit is carefully packaged for shipment to avoid damage during normal transport and handling. The equipment should always be stored in a dry place in the proper orientation as marked on the carton.

All shipments are made F.O.B. factory and it is the responsibility of the receiving party to inspect the equipment upon arrival. Any obvious damage to the carton and/or its contents should be recorded on the bill of lading and a claim should be filed with the freight carrier.

After determining the condition of the carton exterior, carefully remove each unit from the carton and inspect for hidden damage. At this time check to make sure that "furnished only" items such as switches, thermostats, etc. are accounted for. Any hidden damage should be recorded and immediately reported to the carrier and a claim filed as before. In the event a claim for shipping damage is filed, the unit, shipping carton, and all packing must be retained for physical inspection by the freight carrier. All equipment should be stored in the factory-shipping carton with internal packing in place until installation.

At the time of receipt, the equipment type and arrangement should be verified against the order documents. Should any discrepancy be found, the local Sales Representative should be notified immediately so that the proper action may be instituted. Should any question arise concerning warranty repairs, the factory must be notified BEFORE any corrective action is taken. Where local repairs or alterations can be accomplished, the factory must be fully informed as to the extent and expected cost of those repairs before work is begun. Where factory operations are required, the factory must be contacted for authorization to return equipment and a Return Authorization Number will be issued. Unauthorized return shipments of equipment and shipments not marked with an authorization number will be refused. In addition, the manufacturer will not accept any claims for unauthorized expenses.

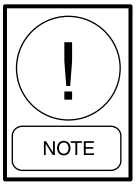
HANDLING & INSTALLATION

While all equipment is designed for durability and fabricated for sturdy construction and may present a rugged appearance, great care must be taken to assure that no force or pressure be applied to the coil, piping or drain stub-outs during handling. Also, depending on the options and accessories, some units could contain delicate components that may be damaged by improper handling. Wherever possible, all units should be maintained in an upright position and handled by the chassis as close as possible to the mounting point locations.

In the case of a full cabinet unit, the unit must obviously be handled by the exterior casing. This is acceptable providing the unit is again maintained in an upright position and no impact forces are applied that may damage internal components, access panels, or painted surfaces. The equipment covered in this manual IS NOT suitable for outdoor installations. The equipment should never be stored or installed where it may be subjected to a hostile environment such as rain, snow, or extreme temperatures.

During and after installation, special care must be taken to prevent foreign material such as paint, plaster, and drywall dust from being deposited in the drain pan or on the motor or blower wheels. Failure to do so may have serious adverse effects on unit operation and in the case of the motor and blower assembly, may result in immediate or premature failure. All manufacturers' warranties are void if foreign material is allowed to be deposited on the motor or blower wheels of any unit. Some units and/or job conditions may require some form of temporary covering during construction.

While the manufacturer does not become involved in the design and selection of support methods and components, it should be noted that unacceptable system operating characteristics and/or performance might result from improper or inadequate unit structural support. In addition, adequate clearance must be provided for service and removal of the equipment and its accessory components. Anchoring the equipment in place is accomplished by using the mounting points provided and positioning the unit to maintain the unit on a LEVEL plane. The drain pan is internally sloped toward the outlet connection. Care must be taken to insure that the unit drain pan does not slope away from the outlet connection. All units are supplied with hanger brackets with rubber grommet isolators and brass inserts for use with 3/8" all thread hanger rod.



The unit's drain pan is factory sloped toward the drain connection when the unit is installed level and plumb.

Drain Pan

LD13882

Standard drain pans are externally insulated, single wall galvanized steel and can be equipped with a secondary drain connection. The FH drain pan is easily removable for cleaning or reversing connections. Auxiliary drip pan to catch condensed moisture from valves and piping must be sloped toward the drain pan.

Coils

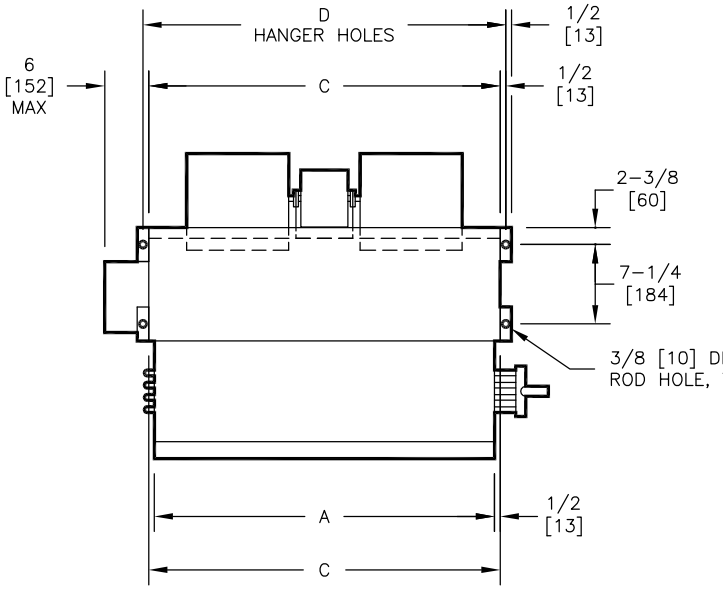
All fan coils are available in 2 or 4 pipe configurations. Heating coils are available in reheat or preheat position. Heating and cooling coils are available with right, left or opposite side connections.

Verify that the proper types of service are actually provided to the unit. On units with steam heating coils, the maximum steam pressure applied to the unit should never exceed 15 PSIG. The drain piping and steam trap should be sized and routed to allow for proper condensate flow. The electrical service to the unit should be compared to the unit nameplate to verify compatibility. The routing and sizing of all piping, and the type and sizing of all wiring and other electrical components such as circuit breakers, disconnect switches, etc. should be determined by the individual job requirements and should not be based on the size and/or type of connection provided on the equipment. All installations should be made in compliance with all governing codes and ordinances. Compliance with all codes is the responsibility of the installing contractor.

FH SERIES DIMENSIONAL DATA

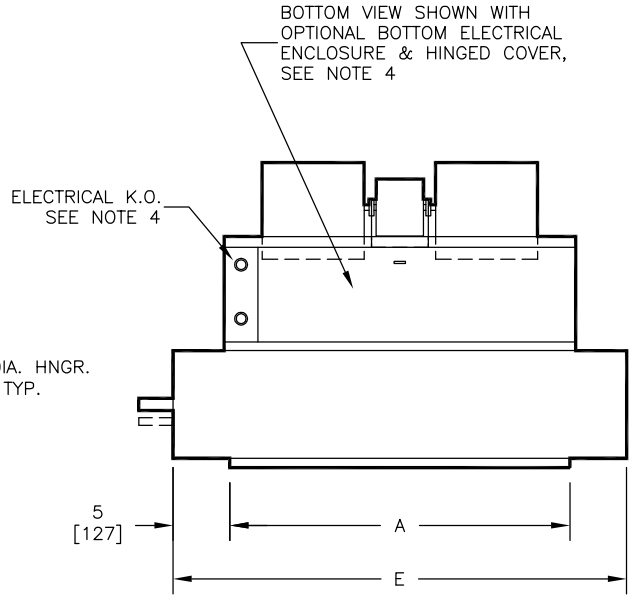
Drawings are subject to change without notice.

Model FHF (Free Return)

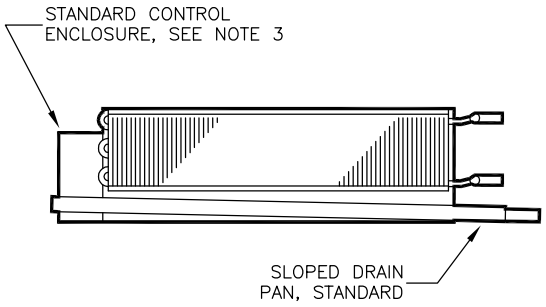


TOP VIEW

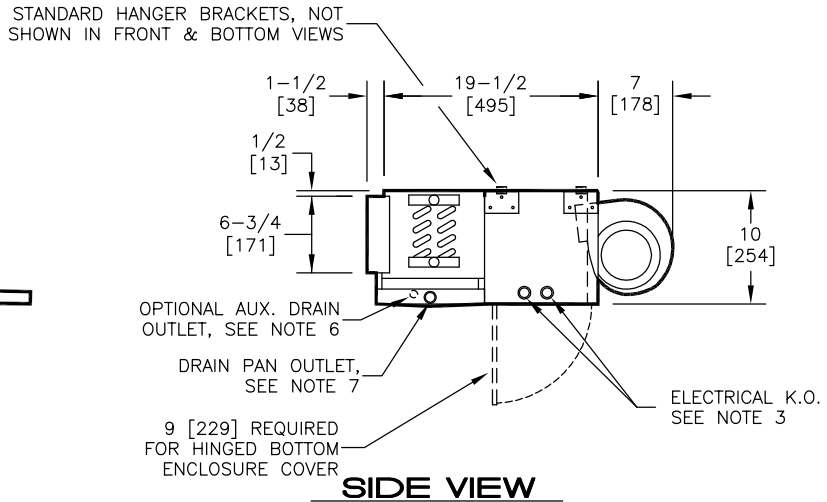
(Drain Pan Omitted)



BOTTOM VIEW



FRONT VIEW



SIDE VIEW

LD13885

DIMENSIONS - In [mm]

UNIT SIZE	A	C	D	E
20	20 [508]	21 [533]	22 [559]	30 [762]
25	26 [660]	27 [686]	28 [711]	36 [914]
30	30 [762]	31 [787]	32 [813]	40 [1016]
40	40 [1016]	41 [1041]	42 [1067]	50 [1270]
50	50 [1270]	51 [1295]	52 [1321]	60 [1524]
60	60 [1524]	61 [1549]	62 [1575]	70 [1778]

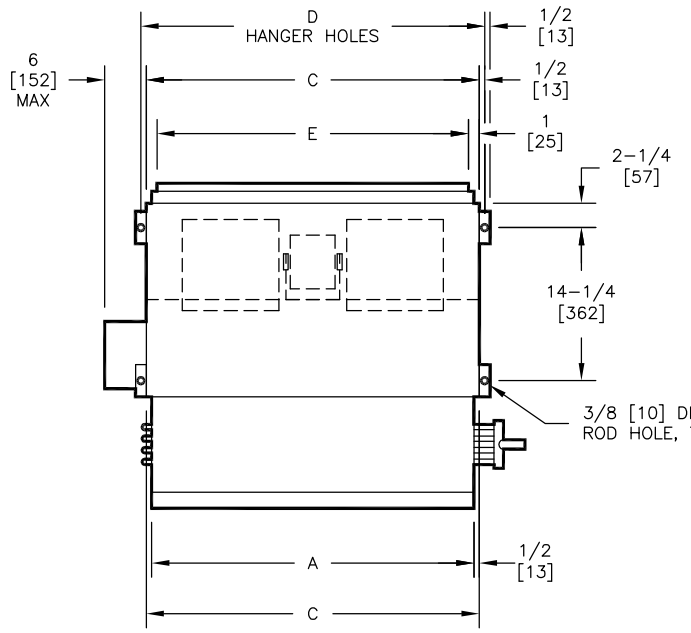
NOTES:

1. All dimensions in Inches [millimeters]. All dimensions ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown, right hand unit opposite.
3. Standard control enclosure is mounted on unit side opposite cooling coil connections. Unit casing includes (2) knockouts on each side. Provide sufficient clearence to access electrical controls and comply with applicable codes and ordinances.
4. Optional bottom control enclosure with hinged cover replaces standard side mounted enclosure and includes (2) additional knockouts on bottom of unit, on left side.
5. Standard externally foam coated galvanized steel drain pan has 7/8" ODM copper outlet. Stainless steel drain pan has 3/4" MPT galvanized steel outlet.
6. Aux. drain outlet is 5/8" ODM copper or 3/8" MPT galvanized steel respectively.
7. See coil connection drawings for coil connection sizes and locations.

FH SERIES DIMENSIONAL DATA

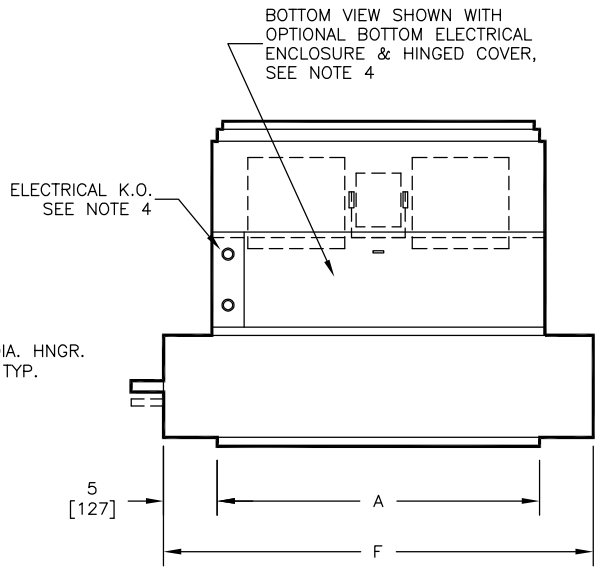
Drawings are subject to change without notice.

Model FHP (Plenum)

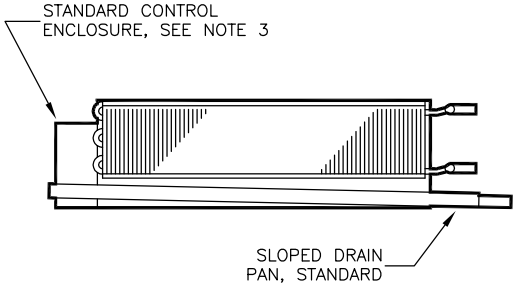


TOP VIEW

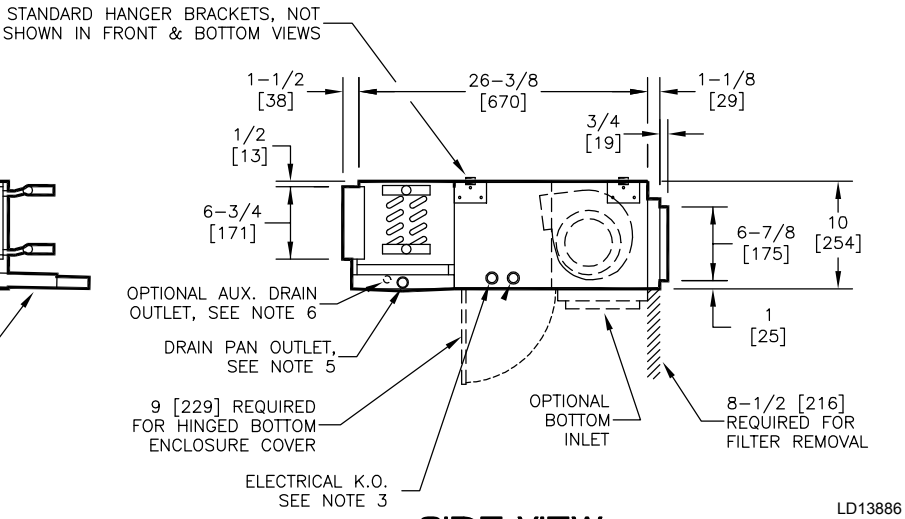
(Drain Pan Omitted)



BOTTOM VIEW



FRONT VIEW



SIDE VIEW

LD13886

DIMENSIONS - In [mm]

UNIT SIZE	A	C	D	E	F
20	20 [508]	21 [533]	22 [559]	19 [483]	30 [762]
25	26 [660]	27 [686]	28 [711]	25 [635]	36 [914]
30	30 [762]	31 [787]	32 [813]	29 [737]	40 [1016]
40	40 [1016]	41 [1041]	42 [1067]	39 [991]	50 [1270]
50	50 [1270]	51 [1295]	52 [1321]	49 [1245]	60 [1524]
60	60 [1524]	61 [1549]	62 [1575]	59 [1499]	70 [1778]

NOTES:

1. All dimensions in Inches [millimeters]. All dimensions ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown, right hand unit opposite.
3. Standard control enclosure is mounted on unit side opposite cooling coil connections. Unit casing includes (2) knockouts on each side. Provide sufficient clearence to access electrical controls and comply with applicable codes and ordinances.
4. Optional bottom control enclosure with hinged cover replaces standard side mounted enclosure and includes (2) additional knockouts on bottom of unit, on left side.
5. Standard externally foam coated galvanized steel drair pan has 7/8" ODM copper outlet. Stainless steel drain pan has 3/4" MPT galvanized steel outlet.
6. Aux. drain outlet is 5/8" ODM copper or 3/8" MPT galvanized steel respectively.
7. See coil connection drawings for coil connection sizes and locations.

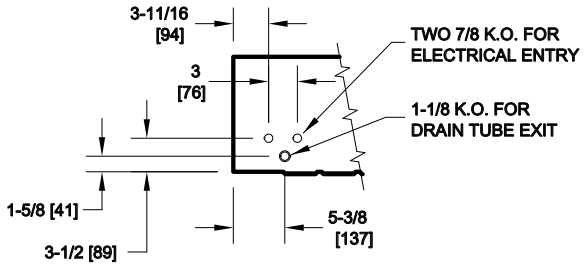
FH SERIES DIMENSIONAL DATA

Drawings are subject to change without notice.

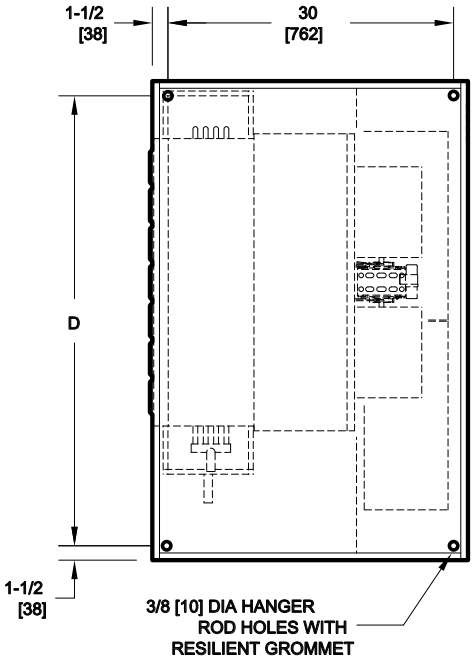
Model FHX Horizontal Exposed Fan Coil

Front Stamped Supply Grille, Bottom Stamped Return Grille

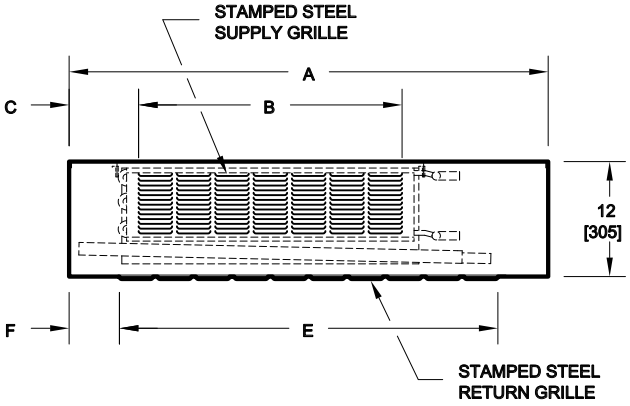
NOTES:
1. All dimensions are inches [millimeters]. All dimensions ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown, right hand unit opposite.
3. Electrical enclosure size and location may vary with optional features.
   Provide sufficient clearance to access electrical controls and comply with applicable codes and ordinances.
4. Drain piping should be routed through casing opening indicated to provide proper drain slope.
5. Louvered bottom panel is hinged and removable for access to filter and fan assembly.
6. Fixed bottom panel is removable for access to optional electrical enclosure, coil, and drain pan.
7. Internal insulation of field piping may be required.
8. Field piping casing penetrations must be cut in the field to match individual job requirements.



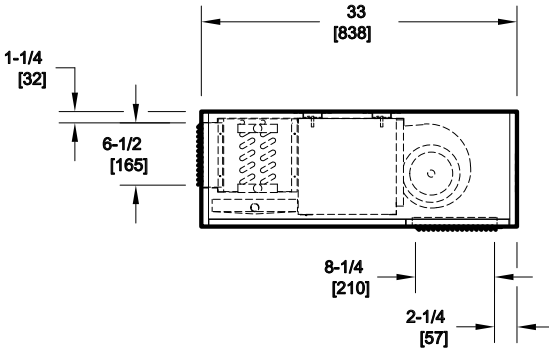
PARTIAL REAR VIEW
(TYPICAL EACH SIDE)



TOP VIEW



FRONT VIEW



SIDE VIEW

DIMENSIONS - In [mm]

UNIT SIZE	A	B	C	D	E	F
20	40 [1016]	19-1/2 [495]	6-1/4 [159]	37 [940]	27-1/2 [699]	6-1/4 [159]
25	46 [1168]	23-1/2 [597]	6-1/4 [159]	43 [1092]	35-1/2 [902]	5-1/4 [133]
30	50 [1270]	27-1/2 [699]	7-1/4 [184]	47 [1194]	39-1/2 [1003]	5-1/4 [133]
40	60 [1524]	39-1/2 [1003]	6-1/4 [159]	57 [1448]	47-1/2 [1207]	6-1/4 [159]
50	70 [1778]	47-1/2 [1207]	7-1/4 [184]	67 [1702]	59-1/2 [1511]	5-1/4 [133]
60	80 [2032]	59-1/2 [1511]	6-1/4 [159]	77 [1956]	67-1/2 [1715]	6-1/4 [159]

LD13883

COOLING/HEATING MEDIUM CONNECTIONS

Toxic residues and loose particles resulting from manufacturing and field piping techniques such as joint compounds, soldering flux, and metal shavings may be present in the unit and the piping system. Special consideration must be given to system cleanliness when connecting to solar, domestic or potable water systems.

ARI STANDARD RATINGS

MODEL / SIZE	COIL		AIRFLOW CFM (DRY FLOW)	COOLING CAPACITY		WATER		POWER INPUT (WATTS)
	Rows	FPI		QT (BTUH)	QS (BTUH)	Flow Rate GPM	WPD ft-wg	
FHF20	3	10	330	7800	6100	1.8	1.6	81
FHF25	3	10	450	11500	8500	2.6	3.4	138
FHF30	3	10	640	13900	11000	3.2	7.6	152
FHF40	3	10	800	18500	14300	4.2	3.7	263
FHF50	3	10	1140	24000	19300	5.4	7.4	402
FHF60	3	10	1590	34000	26500	7.6	14.6	489
FHF20	4	10	320	8500	6000	1.8	3.1	77
FHF25	4	10	430	11600	8600	2.6	6.6	135
FHF30	4	10	610	16900	12600	3.9	10.9	151
FHF40	4	10	780	21900	16400	4.9	7.2	261
FHF50	4	10	1040	28500	22500	6.4	12.9	380
FHF60	4	10	1510	41400	31300	9.2	27.1	466
FHP20	3	10	270	6900	5300	1.6	1.2	81
FHP25	3	10	420	10900	8100	2.5	3.1	132
FHP30	3	10	540	12600	9800	2.8	6.1	152
FHP40	3	10	770	18100	13900	4.1	3.5	263
FHP50	3	10	1010	22300	18200	5.0	7.1	372
FHP60	3	10	1460	32300	25600	7.2	13.3	489
FHP20	4	10	260	7400	5200	1.6	2.5	77
FHP25	4	10	410	10900	8100	2.5	6.0	130
FHP30	4	10	520	15600	11500	3.5	10.0	151
FHP40	4	10	740	21300	15900	4.8	6.9	261
FHP50	4	10	970	27200	21400	6.1	11.9	361
FHP60	4	10	1370	38600	29700	8.6	23.8	466
FHX20	3	10	240	6300	4800	1.5	1.1	75
FHX25	3	10	310	8900	6500	2.0	2.2	127
FHX30	3	10	450	11100	8600	2.5	4.9	135
FHX40	3	10	650	16300	12400	3.7	2.9	245
FHX50	3	10	820	19500	15700	4.4	5.6	337
FHX60	3	10	1130	27500	21500	6.1	10.0	402
FHX20	4	10	240	6300	4700	1.5	2.1	65
FHX25	4	10	300	8700	6300	2.0	4.0	125
FHX30	4	10	440	13600	10000	3.1	7.9	130
FHX40	4	10	630	18900	14000	4.2	5.5	235
FHX50	4	10	780	23400	18300	5.3	9.1	321
FHX60	4	10	1040	31900	24200	7.1	16.8	383

NOTE: Based on 80°F DB and 67°F WB EAT, 45°F EWT, 10°F temperature rise, high fan speed. Motor type is PSC and motor voltage is 115/1/60. Airflow under dry coil conditions. Model FHX tested at 0.0" external static pressure. Models FHF and FHP tested at 0.05" external static pressure.

LD13887J

HEATING CAPACITY

UNIT TYPE	UNIT SIZE	NOMINAL CFM	1 ROW			2 ROW			3 ROW			4 ROW		
			QS (MBH)	GPM	WPD	QS (MBH)	GPM	WPD	QS (MBH)	GPM	WPD	QS (MBH)	GPM	WPD
FHP FHF	20	250	8.6	0.4	0.2	15.7	0.8	0.9	19.7	1.0	0.3	22.9	1.2	0.5
	25	400	15.0	0.6	0.6	21.0	1.1	3.1	30.0	1.5	1.1	28.3	1.4	1.8
	30	500	16.1	0.8	0.6	29.2	1.5	3.2	38.3	2.0	1.2	43.4	2.2	0.7
	40	750	23.6	1.2	1.5	40.5	2.1	1.6	55.2	2.8	1.1	64.9	3.3	1.8
	50	1000	28.7	1.5	0.7	53.7	2.7	2.9	73.7	3.8	2.0	86.5	4.4	3.4
	60	1400	36.1	1.9	1.1	66.9	3.4	4.7	92.4	4.7	3.4	108.3	5.5	5.6
FHX	20	250	7.9	0.4	0.3	14.0	0.8	1.5	19.2	1.0	0.5	17.4	0.9	0.8
	25	350	10.8	0.6	0.5	19.3	1.0	2.6	27.2	1.4	0.9	25.4	1.3	1.5
	30	450	13.5	0.7	0.9	24.0	1.3	4.8	30.7	1.6	1.7	34.4	1.8	1.0
	40	650	20.4	1.1	2.0	34.0	1.8	1.7	46.0	2.4	1.2	49.6	2.6	1.9
	50	850	22.5	1.2	0.7	40.7	2.1	3.1	53.0	2.8	2.1	59.4	3.0	3.3
	60	1200	30.9	1.6	1.2	55.4	2.9	5.5	72.6	3.8	3.9	80.0	4.1	6.0

NOTE: Based on 70°F DB EAT, 180°F EWT, 40°F temperature drop, high fan speed.

LD13888J

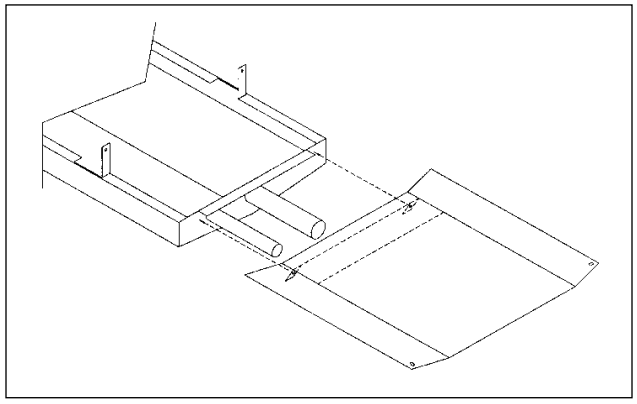
Submittals and Product Catalogs detailing unit operation, controls, and connections should be thoroughly reviewed BEFORE beginning the connection of the various cooling and/or heating mediums to the unit.

All accessory valve packages should be installed as required, and all service valves should be checked for proper operation.

If coil and valve package connections are to be made with "sweat" or solder joint, care should be taken to assure that no components in the valve package are subjected to a high temperature which may damage seals or other materials. Many two-position electric control valves, depending on valve operation, are provided with a manual-opening lever. This lever should be placed in the "open" position during all soldering or brazing operations. Valve bodies should be wrapped with a wet rag to help dissipate heat encountered during brazing.

If the valve package connection at the coil is made with a union, the coil side of the union must be prevented from twisting ("backed up") during tightening to prevent damage to the coil tubing. Over-tightening must be avoided to prevent distorting the union seal surface and destroying the union. In the case of field installed valves and piping, the chilled water valve cluster (or expansion valve on DX units) should be installed in such a way that any dripping or sweating is contained in the auxiliary drain pan or other device. Valves and TXV's should be secured or supported to avoid damage to coil headers or distributor tubes.

AUXILIARY DRAIN PANS



LD13889

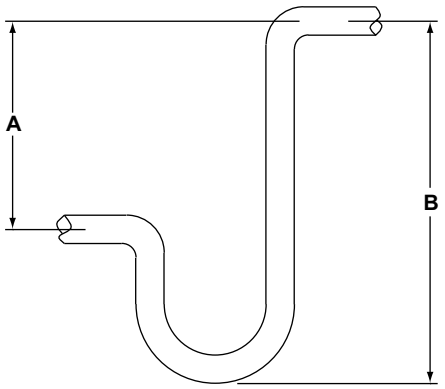
Mounted directly to the unit drain pan, AUXILIARY DRAIN PANS may also be secured by the mounting holes to field supports or to the unit coil utilizing pipe hanger wire, plastic ties, or metal strapping.

After the connections are completed, the system should then be tested for leaks. Since some components are not designed to hold pressure with a gas, hydronic systems should be tested with water.

All water coils must be protected from freezing after initial filling with water. Even if the system is drained, unit coils may still hold enough water to cause damage when exposed to temperatures below freezing.

Refrigerant systems should be tested with dry nitrogen rather than air to prevent the introduction of moisture into the system. In the event that leaking or defective components are discovered, the Sales Representative must be notified BEFORE any repairs are attempted. All leaks should be repaired before proceeding with the installation.

Condensate Trap



NOTE:
"A" DIMENSION (IN.) DEPTH MUST BE EQUAL TO OR GREATER THAN UNIT'S NEGATIVE FAN PRESSURE AT CONDENSATE PAN (INWC).

"B" DIMENSION MUST BE EQUAL TO (A x 1.5) + ID OF DRAIN LINE.

LD13891

After system integrity has been established the piping should be insulated in accordance with the project specifications. ALL chilled water piping and valves or refrigerant suction piping not located over drain pans must be insulated to prevent damage from sweating. This includes factory and field piping inside the unit cabinet.

The drain should always be connected and piped to an acceptable disposal point. For proper moisture carry-off, the drain piping should be sloped away from the unit at least 1/8" per foot. A drain trap may be required by local codes and it is strongly recommended for odor containment.

DUCTWORK CONNECTIONS

All ductwork and/or supply and return grilles should be installed in accordance with the project plans and specifications. If not included on the unit or furnished from the factory, Johnson Controls supply and return grilles are available in a variety of types.

All units must be installed in non-combustible areas.

Some models are designed to be connected to duct-work with a MINIMUM amount of external static pressure. Consult the approved submittals and the product catalog for unit external static pressure limitations.

Units provided with outside air for ventilation should have some form of low temperature protection to prevent coil freeze-up.

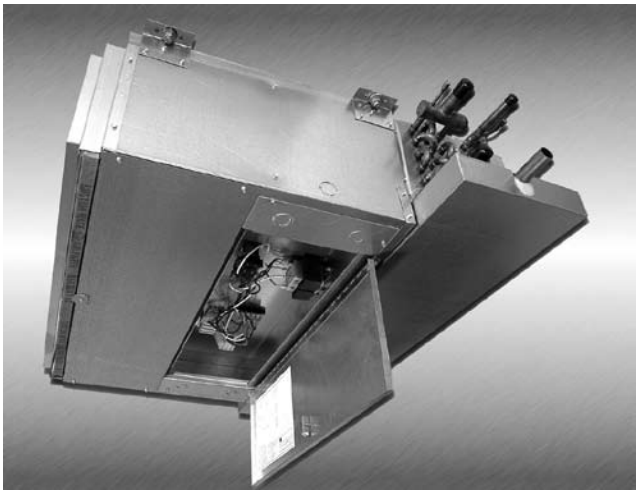
It should be noted that none of these methods would adequately protect a coil in the event of power failure. The safest method of freeze protection is to use glycol in the proper percent solution for the coldest expected air temperature.

The manufacturer assumes no responsibility for undesirable system operation due to improper design, equipment or component selection, and/or installation of ductwork, grilles, and other field supplied components.

ELECTRICAL CONNECTIONS

The unit nameplate lists the unit electrical characteristics such as the required supply voltage, fan and heater amperage and required circuit ampacities. The unit-wiring diagram shows all unit and field wiring. Since each project is different and each unit on a project may be different, the installer must be familiar with the wiring diagram and nameplate on the unit BEFORE beginning any wiring. This unit is not acceptable for installation in hazardous/explosive areas.

Electrical Enclosure



LD13890

The optional bottom hinged electrical enclosure provides access to a spacious electrical compartment. This compartment houses all electric heat and control components. Terminal strips are furnished for simple power and control wiring connections.

All components furnished for field installation, by either the factory or the controls contractor should be located and checked for proper function and compatibility. All internal components should be checked for shipping damage and all electrical connections should be tightened to minimize problems during start-up.

Any devices such as fan switches or thermostats that have been furnished from the factory for field installation must be wired in strict accordance with the applicable wiring diagrams. Failure to do so could result in personal injury or damage to components and will void all manufacturers' warranties.

The fan motor(s) should never be controlled by any wiring or device other than the factory furnished switch or thermostat/switch combination, without factory authorization.

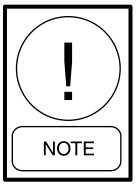
All field wiring should be done in accordance with governing codes and ordinances. Any modification of the unit wiring without factory authorization will result in voiding of all factory warranties and will nullify any agency listings.

The manufacturer assumes no responsibility for any damages and/or injuries resulting from improperly field installed or wired components.

TELESCOPING BOTTOM PANEL

LD13892

The telescoping bottom panel allows for fully recessing the unit while permitting service access into the ceiling plenum. The architectural ceiling panel is finished with a durable powder coat paint.



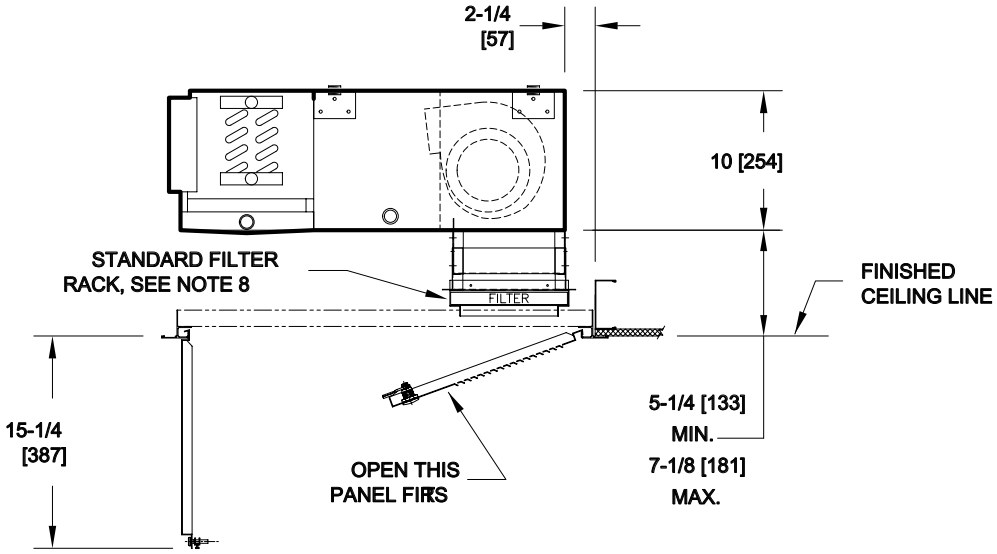
Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired. Telescoping skirt and collar assembly must be field adjusted to assure a proper fit between filter frame and louvered inlet panel assembly. Refer to assembly submittal drawings for specific dimensions.

MODEL FHP HORIZONTAL FAN COIL

Optional Telescoping Bottom Panel Assembly, Typical Installation Instructions

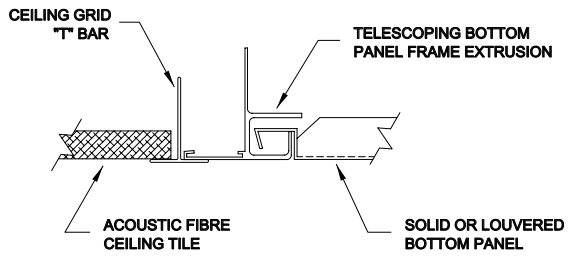
Drawings are subject to change without notice.

TYPICAL INSTALLATION METHODS



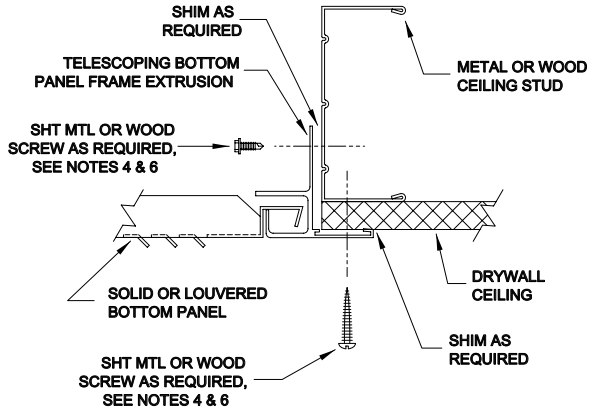
SIDE VIEW

SUSPENDED GRID/TILE CEILING SYSTEM

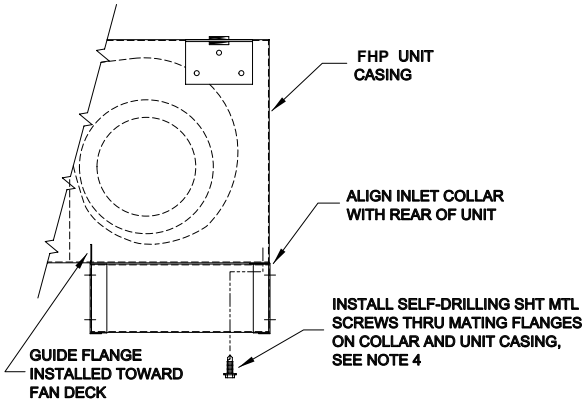


NOTE: CEILING "T" BAR GRID MAY NOT SUPPORT TELESCOPING BOTTOM PANEL ASSEMBLY. BOTTOM PANEL ASSEMBLY MAY REQUIRE INDEPENDENT SUPPORT.

STUD/DRYWALL CEILING SYSTEM



INLET COLLAR INSTALLATION



NOTES:

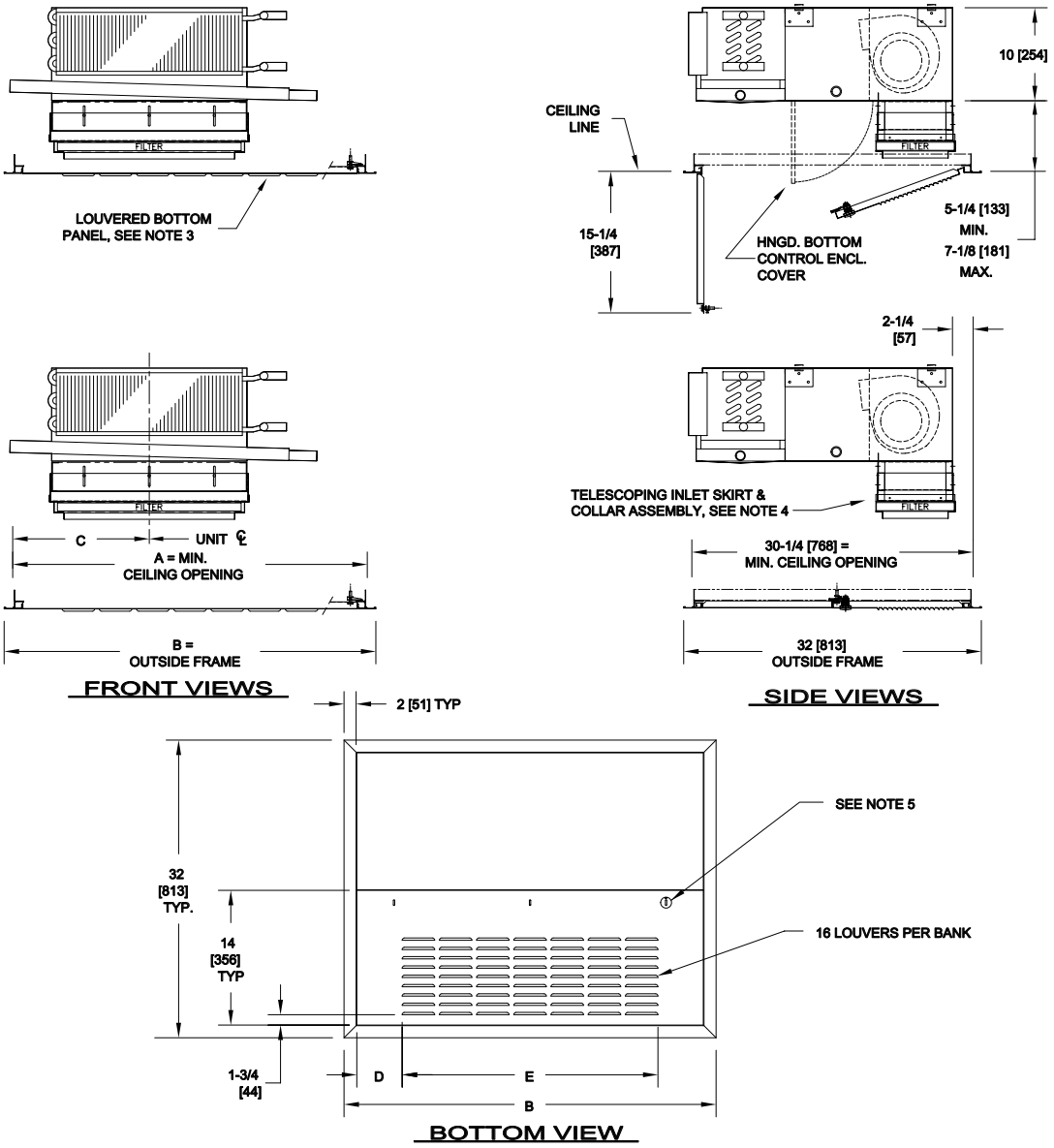
1. All dimensions are inches [millimeters]. All dimensions ±1/4" [6mm]. Metric values are soft conversion.
2. All drawings subject to change without prior notice.
3. Left hand unit shown, right hand unit opposite.
4. Mounting hardware not provided. Mounting holes must be located and drilled to suit individual job requirements.
5. Remove solid and louvered bottom panels before mounting frame assembly.
6. Frame assembly must be installed flat and square. Failure to do so may result in poor bottom panel fit and improper airflow pattern. Shim frame to support as required.
7. Telescoping skirt assembly must be field adjusted to assure close fit of filter rack to louvered bottom panel.
8. Attach standard filter rack assembly to bottom of telescoping skirt, after final adjustment of skirt location. Filter removal direction is optional.
9. Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired.

LD13893

MODEL FHP HORIZONTAL FAN COIL

Optional Telescoping Bottom Panel Assembly

Drawings are subject to change without notice.



DIMENSIONS - In [mm]

UNIT SIZE	STANDARD PANEL				
	A	B	C	D	E
20	38-1/8 [968]	40 [1016]	14-1/2 [368]	4-1/4 [108]	27-1/2 [699]
25	44-1/8 [1121]	46 [1168]	17-1/2 [445]	3-1/4 [83]	35-1/2 [902]
30	48-1/8 [1222]	50 [1270]	19-1/2 [495]	3-1/4 [83]	39-1/2 [1003]
40	58-1/8 [1476]	60 [1524]	24-1/2 [622]	4-1/4 [108]	47-1/2 [1207]
50	68-1/8 [1730]	70 [1778]	29-1/2 [749]	3-1/4 [83]	59-1/2 [1511]
60	78-1/8 [1984]	80 [2032]	34-1/2 [876]	4-1/4 [108]	67-1/2 [1715]

NOTES:
1. All dimensions are Inches [millimeters]. All dimensions ±1/4" [6mm]. Metric values are soft conversion.
2. Left hand unit shown, right hand unit opposite.
3. Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired.
4. Telescoping skirt and collar assembly must be field adjusted to assure a proper fit between filter frame and louvered inlet panel assembly.
5. 1/4 Turn latch, (2) qty for standard sizes, (3) qty for sizes 40-60.

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SECTION TWO - START-UP

GENERAL

Before beginning any start-up operation, the start-up personnel should familiarize themselves with the unit, options and accessories, and control sequence to understand the proper system operation. All personnel should have a good working knowledge of general start-up procedures and have the appropriate start-up and balancing guides available for consultation.

The initial step in any startup operation should be a final visual inspection. All equipment, plenums, duct-work, and piping should be inspected to verify that all systems are complete and properly installed and mounted, and that no debris or foreign articles such as paper or drink cans are left in the units or other areas. Each unit should be checked for loose wires, free blower wheel operation, and loose or missing access panels or doors. Except as required during start-up and balancing operations, no fan coil units should be operated without all the proper ductwork attached, supply and return grilles in place, and all access doors and panels in place and secure. A clean filter of the proper size and type must also be installed. Failure to do so could result in damage to the equipment or building and furnishings, and/or void all manufacturers' warranties.

COOLING/HEATING SYSTEM

Prior to the water system start-up and balancing, the chilled/hot water systems should be flushed to clean out dirt and debris, which may have collected in the piping during construction. During this procedure, all unit service valves must be in the closed position. This prevents foreign matter from entering the unit and clogging the valves and metering devices. Strainers should be installed in the piping mains to prevent this material from entering the units during normal operation.

During system filling, air venting from the unit is accomplished by the use of the standard manual, or optional automatic, air vent fitting installed on the coil. In the case of the manual air vent fitting, the screw should be turned counterclockwise no more than 1-½ turns to operate the air vent. Automatic air vents may be unscrewed one turn counterclockwise to speed initial venting but should be screwed in for automatic venting after start-up operations.

The air vent provided on the unit is not intended to replace the main system air vents and may not release air trapped in other parts of the system. Inspect the entire system for potential air traps and vent those areas as required, independently. In addition, some systems may require repeated venting over a period of time to properly eliminate air from the system.

AIR SYSTEM BALANCING

All duct-work must be complete and connected, and all grilles, filters, access doors and panels must be properly installed to establish actual system operating conditions BEFORE beginning air balancing operations.

Each individual unit and attached duct-work is a unique system with its own operating characteristics. For this reason, air balancing is normally done by balance specialists who are familiar with all procedures required to properly establish air distribution and fan system operating conditions. These procedures should not be attempted by unqualified personnel.

After the proper system operation is established, the actual unit air delivery and the actual fan motor amperage draw for each unit should be recorded in a convenient place for future reference such as the inspection, installation, & start-up check sheet, a copy of which is provided on the back of this manual. Contact the Sales Representative or the factory for additional copies of this sheet.

MOTOR AND FAN DATA

UNIT SIZE	FAN SPEED	MOTOR H.P. (QTY.)	# OF FANS	115 VOLTS		208/230 VOLTS		277 VOLTS	
				AMPS	WATTS	AMPS	WATTS	AMPS	WATTS
20	High	(1) 1/30	1	0.8	57	0.6	77	0.3	71
	Medium	(1) 1/50		0.4	39	0.3	49	0.3	48
	Low	(1) 1/60		0.3	33	0.3	43	0.3	41
25	High	(1) 1/15	1	1.0	125	0.5	120	0.5	120
	Medium	(1) 1/30		0.9	90	0.3	80	0.3	80
	Low	(1) 1/60		0.5	60	0.2	60	0.2	60
30	High	(1) 1/10	2	1.9	165	0.8	158	0.8	162
	Medium	(1) 1/30		0.8	76	0.3	75	0.5	65
	Low	(1) 1/60		0.5	47	0.2	54	0.4	41
40	High	(1) 1/6	2	2.5	261	1.4	284	1.0	254
	Medium	(1) 1/12		1.5	162	0.5	171	0.5	152
	Low	(1) 1/40		0.6	75	0.4	79	0.3	74
50	High	(1) 1/8	3	1.6	215	0.9	216	0.8	214
		(1) 1/6		2.5	257	1.4	233	1.0	255
	Medium	(1) 1/15		1.3	145	0.6	109	0.5	132
		(1) 1/12		1.5	156	0.5	106	0.5	151
	Low	(1) 1/40		0.8	69	0.3	63	0.3	86
		(1) 1/40		0.6	75	0.4	62	0.3	84
60	High	(2) 1/6	4	5.0	522	2.8	568	2.0	508
	Medium	(2) 1/12		3.0	324	1.0	342	1.0	304
	Low	(2) 1/40		1.2	150	0.6	158	0.6	148

NOTES:

1. Motor electrical data is nameplate data. Actual data will vary with application.
2. 230 volt motor is nameplated for 208/230/1/60. Use 230 volt motor data for 208 volt applications.
3. Unit size 30, 208/230 and 277 volt motors are 1/12 HP at high tap.

WATER SYSTEM BALANCING

A complete knowledge of the hydronic system, its components, and controls is essential to proper water system balancing and this procedure should not be attempted by unqualified personnel. The system must be complete and all components must be in operating condition BEFORE beginning water system balancing operations.

Each hydronic system has different operating characteristics depending on the devices and controls in the system. The actual balancing technique may vary from one system to another.

After the proper system operation is established, the appropriate system operating conditions such as various water temperatures and flow rates should be recorded in a convenient place for future reference.

Before and during water system balancing, conditions may exist which can result in noticeable water noise or undesired valve operation due to incorrect system pressures. After the entire system is balanced, these conditions will not exist on properly designed systems.

CONTROLS OPERATION

Before proper control operation can be verified all other systems must be in proper operation. The correct water and air temperatures must be present for the control function being tested. Some controls and features are designed to not operate under certain conditions.

A wide range of controls and electrical options and accessories may be used with the equipment covered in this manual. Consult the approved unit submittals, order acknowledgement, and other manuals for detailed information regarding each individual unit and its controls. Since controls and features may vary from one unit to another, care should be taken to identify the controls to be used on each unit and their proper control sequence. Information provided by component manufacturers regarding installation, operation, and maintenance of their individual controls is available upon request.

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UNIT SIZE	FAN SPEED	MOTOR H.P. (QTY.)	# OF FANS	115 VOLTS		208/230 VOLTS		277 VOLTS	
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	Medium	(1) 1/50		0.4	39	0.3	49	0.3	48
	Low	(1) 1/60		0.3	33	0.3	43	0.3	41
25	High	(1) 1/15	1	1.0	125	0.5	120	0.5	120
	Medium	(1) 1/30		0.9	90	0.3	80	0.3	80
	Low	(1) 1/60		0.5	60	0.2	60	0.2	60
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50	High	(1) 1/8	3	1.6	215	0.9	216	0.8	214
		(1) 1/6		2.5	257	1.4	233	1.0	255
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SECTION THREE - NORMAL OPERATION & PERIODIC MAINTENANCE

GENERAL

Each unit on a job will have its own unique operating environment and conditions that may dictate a maintenance schedule for that unit that is different from other equipment on the job. A formal schedule of regular maintenance and an individual unit log should be established and maintained. This will help to achieve the maximum performance and service life of each unit on the job.

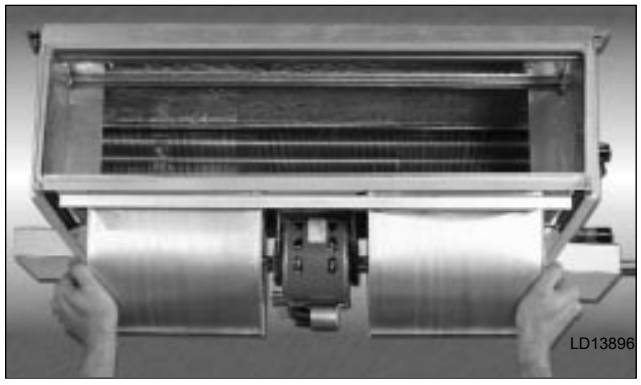
Information regarding safety precautions contained in the preface at the beginning of this manual should be followed during any service and maintenance operations.

For more detailed information concerning service operations, consult your Sales Representative or the Factory.

MOTOR/BLOWER ASSEMBLY

The type of fan operation is determined by the control components and their method of wiring, and may vary from unit to unit. Refer to the wiring diagram for each unit for that unit's individual operating characteristics. Motors are permanently lubricated, PSC type and do not require field lubrication.

Fan Deck



The fan assembly is easily removed from the unit without disconnecting the ductwork for service access to motors and blowers at, or away from the unit.

Should the assembly require more extensive service, the motor/ blower assembly may be removed from the unit to facilitate such operations as motor or blower wheel/housing replacement, etc. Dirt and dust should not be allowed to accumulate on the blower wheel or housing. This can result in an unbalanced blower wheel condition that can damage a blower wheel or motor. The wheel and housing may be cleaned periodically using a vacuum cleaner and a brush taking care not to dislodge the factory balancing weights on the blower wheel blades.

COIL

Coils may be cleaned in place by removing the motor/ blower assemblies and brushing the entering air face between fins with a soft brush parallel to fins. Do not brush perpendicular to fin orientation as damage may occur. Brushing should be followed by cleaning with a vacuum cleaner. If a compressed air source is available, the coil may also be cleaned by blowing air through the coil fins from the leaving air face. Vacuuming should again follow this. Units provided with the proper type of air filters, replaced regularly, may require periodic coil cleaning.

ELECTRIC RESISTANCE HEATER ASSEMBLY

Electric resistance heaters typically require no normal periodic maintenance when unit air filters are changed properly. Other conditions and equipment may affect the operation and service life in the system. The two most important operating conditions for an electric heater are proper airflow and proper supply voltage. High supply voltage and/or poorly distributed or insufficient airflow over the element will result in element overheating. This condition may result in the heater cycling on the high limit thermal cutout. Open wire type heaters provided have an automatic reset switch with a back-up high limit thermal switch. Automatic reset switches are as the name implies; they reset automatically after the heater has cooled down. High limit thermal switches must be replaced once the circuit has been broken. The high limit thermal cutout device is a safety device only and is not intended for continuous operation. With proper unit application and during normal operation, the high limit thermal cutout will not operate. This device only operates when some problem exists and ANY condition that causes high limit cutout MUST be corrected immediately. High supply voltage also causes excessive amperage draw and may result in tripping of the circuit breaker or blowing of the fuses on the incoming power supply.

ELECTRICAL WIRING & CONTROLS

The electrical operation of each unit is determined by the components and wiring of the unit and may vary from unit to unit. Consult the wiring diagram for the actual type and number of controls provided on each unit. The integrity of all electrical connections should be verified at least twice during the first year of operation. Afterwards, all controls should be inspected regularly for proper operation. Some components may experience erratic operation or failure due to age. Wall thermostats may also become clogged with dust and lint and should be periodically inspected and cleaned to provide reliable operation.

When replacing any components such as fuses, contactors, or relays, use only the exact type, size, and voltage component as furnished from the factory. Any deviation without factory authorization could result in personnel injury or damage to the unit and will void all factory warranties. All repair work should be done in such a manner as to maintain the equipment in compliance with governing codes and ordinances or testing agency listings.

More specific information regarding the use and operating characteristics of the standard controls offered by this manufacturer is contained in other manuals.

VALVES & PIPING

No formal maintenance is required on the valve package components most commonly used with fan coil units other than a visual inspection for possible leaks in the course of other normal periodic maintenance. In the event that a valve should need replacement, the same precautions taken during the initial installation to protect the valve package from excessive heat should also be used during replacement. In some cases, the valve actuator may fail and usually can be replaced without removing valve body from piping.

FILTERS, THROWAWAY

The type of throwaway filter most commonly used on fan coil units should be replaced on a regular basis. The time interval between each replacement should be established based on regular inspection of the filter and should be recorded in the log for each unit. Refer to the chart below for recommended filter size for each product type and size. If the replacement filters are not purchased from the factory, the filters used should be the same type and size as that furnished from or recommended by the factory. Pleated media or extended surface filters should not be used since the high air pressure drops encountered with these types of filters is not compatible with the type of fan coil unit covered in this manual. Consult the factory for applications using filter types other than the factory standard or optional product.

Face Area, Free Area and Filter Sizes

UNIT SIZE	COIL FACE AREA	RETURN AIR GRILLE FREE AREA	SUPPLY AIR GRILLE FREE AREA	FILTER FACE AREA	NOMINAL FILTER SIZES
20	1.04 [.09]	0.47 [.04]	0.40 [.04]	1.18 [.11]	20 x 8.5 x 1 [508 x 216 x 25]
25	1.35 [.13]	0.58 [.05]	0.50 [.05]	1.54 [.14]	26 x 8.5 x 1 [660 x 216 x 25]
30	1.56 [.14]	0.68 [.06]	0.56 [.05]	1.77 [.16]	30 x 8.5 x 1 [762 x 216 x 25]
40	2.08 [.19]	0.81 [.08]	0.80 [.07]	2.36 [.22]	(2) 20 x 8.5 x 1 [508 x 216 x 25]
50	2.60 [.24]	1.01 [.09]	0.96 [.09]	2.95 [.27]	(1) 20, (1) 30 x 8.5 x 1 [508, 762 x 216 x 25]
60	3.13 [.29]	1.15 [.11]	1.20 [.11]	3.54 [.33]	(2) 30 x 8.5 x 1 [762 x 216 x 25]

NOTES:
1. Face and free areas are in square feet [square meters].
2. Filter sizes are in inches [millimeters].
3. Free area of Johnson Controls Model FHX and Telescoping Bottom Panel return grilles.
4. Free area of Johnson Controls Model FHX supply grille and minimum free area allowable for a supply grille supplied by others.

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UNIT WEIGHT DATA (lbs.)

COMPONENT		UNIT SIZE					
		20	25	30	40	50	60
FHF BASE UNIT		40 [18]	51 [23]	59 [27]	69 [31]	91 [41]	111 [50]
FHP BASE UNIT		45 [20]	56 [25]	65 [30]	80 [36]	103 [47]	123 [56]
FHX BASE UNIT		119 [54]	138 [63]	155 [70]	181 [82]	220 [100]	257 [117]
COIL ROWS	1 ROW - DRY	8 [4]	10 [5]	11 [5]	13 [6]	15 [7]	18 [8]
	1 ROW - WET	10 [5]	12 [5]	13 [6]	15 [7]	18 [8]	21 [10]
	2 ROW - DRY	11 [5]	13 [6]	15 [7]	18 [8]	22 [10]	26 [12]
	2 ROW - WET	14 [6]	16 [7]	18 [8]	22 [10]	27 [12]	32 [15]
	3 ROW - DRY	14 [6]	17 [8]	19 [9]	24 [11]	29 [13]	34 [15]
	3 ROW - WET	17 [8]	21 [10]	24 [11]	30 [14]	36 [16]	42 [19]
	4 ROW - DRY	17 [8]	20 [9]	23 [10]	29 [13]	36 [16]	42 [19]
	4 ROW - WET	21 [10]	25 [11]	29 [13]	36 [16]	45 [20]	53 [24]

NOTE: Unit weight data is in pounds [kilograms].

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DRAIN

The drain should be checked before initial start-up and at the beginning of each cooling season to assure that the lines are clear. If it is clogged, steps should be taken to clear the debris so that condensate will flow easily.

Periodic checks of the drain should be made during the cooling season to maintain a free flowing condensate. Should the growth of algae and/or bacteria be a concern, consult an air conditioning and refrigeration supply organization familiar with local conditions for chemicals available to control these agents.

REPLACEMENT PARTS

Factory replacement parts should be used wherever possible to maintain the unit performance and operating characteristics and the testing agency listings. Replacement parts may be purchased through the local Sales Representative.

Contact the local Sales Representative or the factory before attempting any unit modifications. Any modifications not authorized by the factory could result in personnel injury and damage to the unit and could void all factory warranties.

When ordering parts, the following information must be supplied to ensure proper part identification:

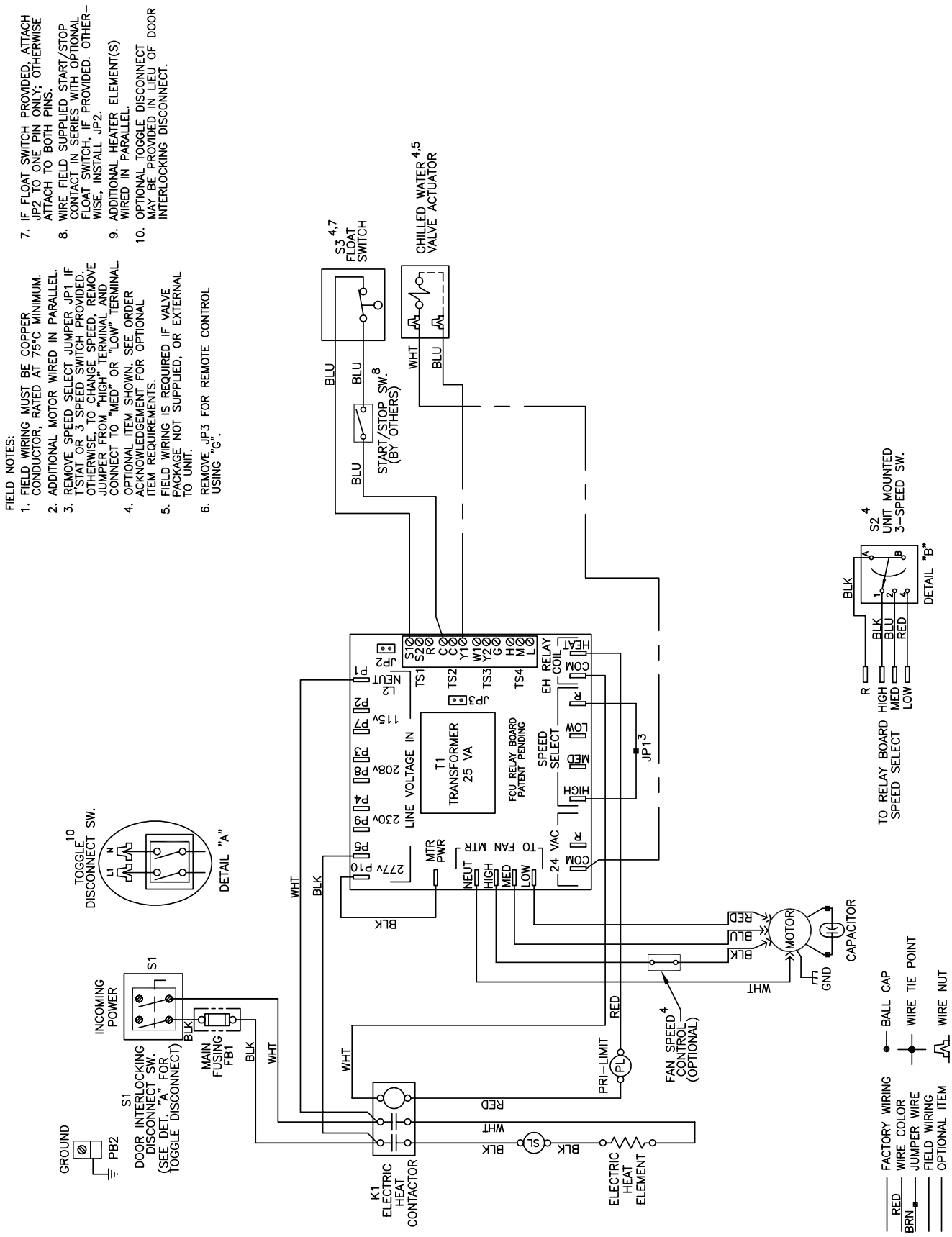
1. Complete unit model number
2. Unit hand connection (right or left hand) while facing the direction of airflow at the inlet
3. Complete part description including any numbers.

On warranty replacements, in addition to the information previously listed, the project CO # that appears on the unit nameplate, is required. Contact the factory for authorization to return any parts such as defective parts replaced in warranty. All shipments returned to the factory MUST be marked with a Return Authorization Number, which is provided by the factory.

All equipment and components sold through the Parts Department are warranted under the same conditions as the standard manufacturer's warranty with the exception that the warranty period is 12 months unless the component is furnished as warranty replacement. Parts furnished as warranty replacements are warranted for the remaining term of the original unit warranties.

EXAMPLE WIRING DIAGRAMS

"Example Wiring Diagram - Typical 24 VAC Control Drawing (Refer to unit control enclosure for actual order-specific drawing)"



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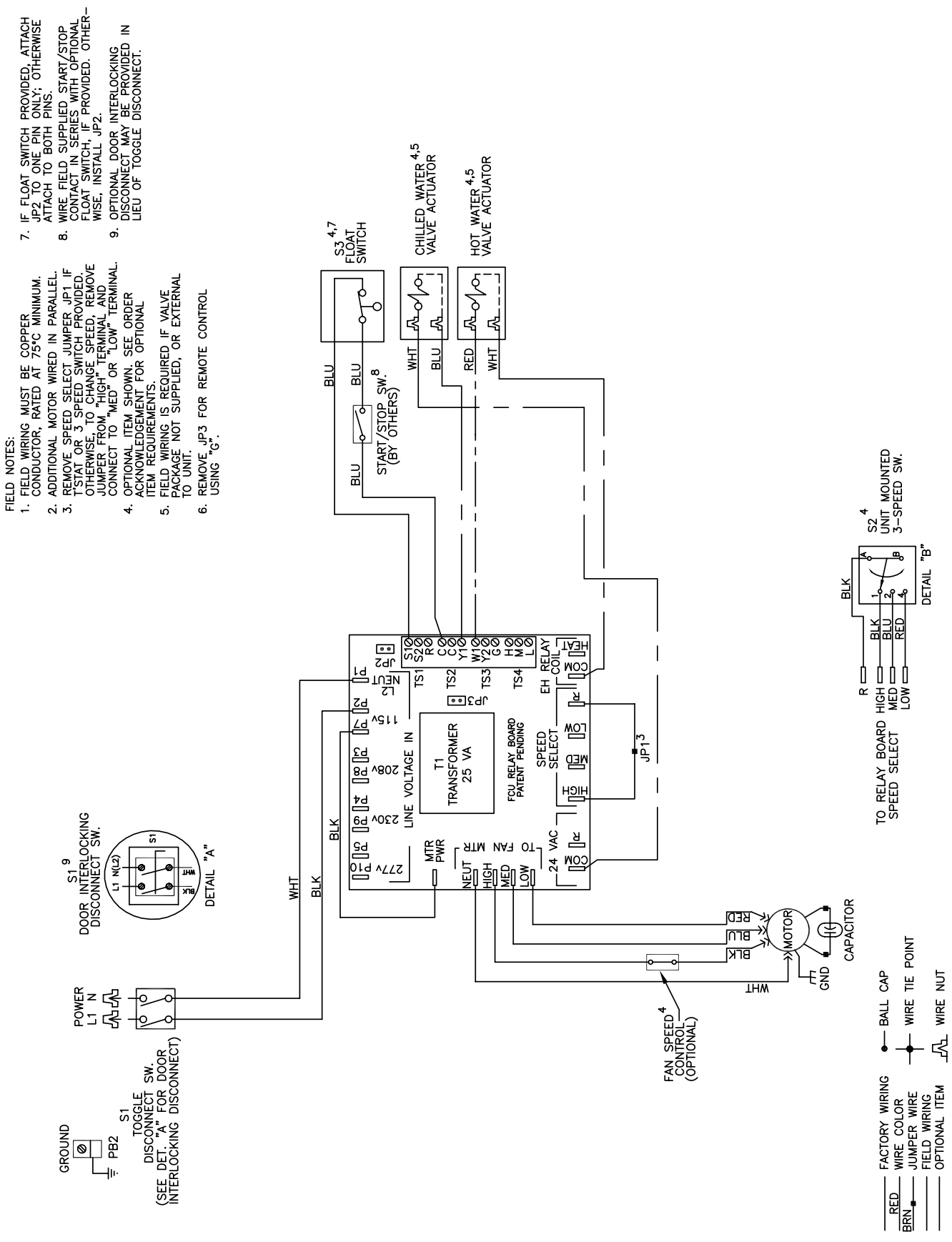
EXAMPLE WIRING DIAGRAMS (Continued)

"Example Wiring Diagram - Typical 24 VAC Control Drawing (Refer to unit control enclosure for actual order-specific drawing)"



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SECTION FOUR - INSPECTION & START-UP CHECKLIST

RECEIVING & INSPECTION

- □ Unit Received Undamaged.
- □ Unit Arrangement/Hand Correct.
- □ Unit Received Complete As Ordered
- □ Unit Structural Support Complete & Correct

HANDLING & INSTALLATION

- □ Unit Mounted Level & Square.
- □ Proper Electrical Service Provided.
- □ Proper Service Switch/Disconnect Provided
- □ Proper Chilled Water Line Size to Unit.
- □ Proper Refrigerant Line Sizes to Unit.
- □ Proper Steam Condensate Trap on Return Line.
- □ All Services to Unit In Code Compliance.
- □ Proper Access Provided For Unit & Accessories
- □ Proper Overcurrent Protection Provided
- □ Proper Hot Water Line To Unit
- □ Proper Steam Line Sizes To Unit
- □ Proper Steam Supply Pressure to Unit (15psi Max)
- □ All Shipping Screws & Braces Removed

COOLING/HEATING CONNECTIONS

- □ Protect Valve Package Components From Heat.
- □ Connect Field Piping To Unit.
- □ Install Drain Line & Traps As Required
- □ Install Condensate Pan under Piping as Required
- □ Mount Valve Packages
- □ Pressure Test All Piping for Leaks
- □ Insulate All Piping as Required

DUCTWORK CONNECTIONS

- □ Install Ductwork, Fittings & Grilles As Required.
- □ Control Outside Air For Freeze Protection.
- □ Proper Supply & Return Grille Type & Size Used
- □ Insulate All Ductwork as Required

ELECTRICAL CONNECTIONS

- □ Refer To Unit Wiring Diagram.
- □ All Field Wiring In Code Compliance.
- □ Connect Incoming Power Service or Services

UNIT STARTUP

- □ General Visual Unit & System Inspection.
- □ Record Ambient Temperature.
- □ Close All Unit Isolation Valves.
- □ Fill Systems With Water/Refrigerant.
- □ All Ductwork & Grilles In Place.
- □ Start Fans, Etc.
- □ Check All Ductwork & Units For Air Leaks.
- □ Record All Final Settings For Future Use.
- □ Check All Dampers For Proper Operation.
- □ Verify Proper Heating Operation.
- □ Record Electrical Supply Voltage
- □ Check All Wiring for Secure Connections
- □ Flush Water Systems
- □ Vent Water Systems as Required
- □ All Unit Panels & Filters in Place
- □ Check for Overload Condition of All Units
- □ Balance Air Systems As Required
- □ Check Piping & Ductwork For Vibration
- □ Verify Proper Cooling Operation
- □ Reinstall All Covers & Access Panels

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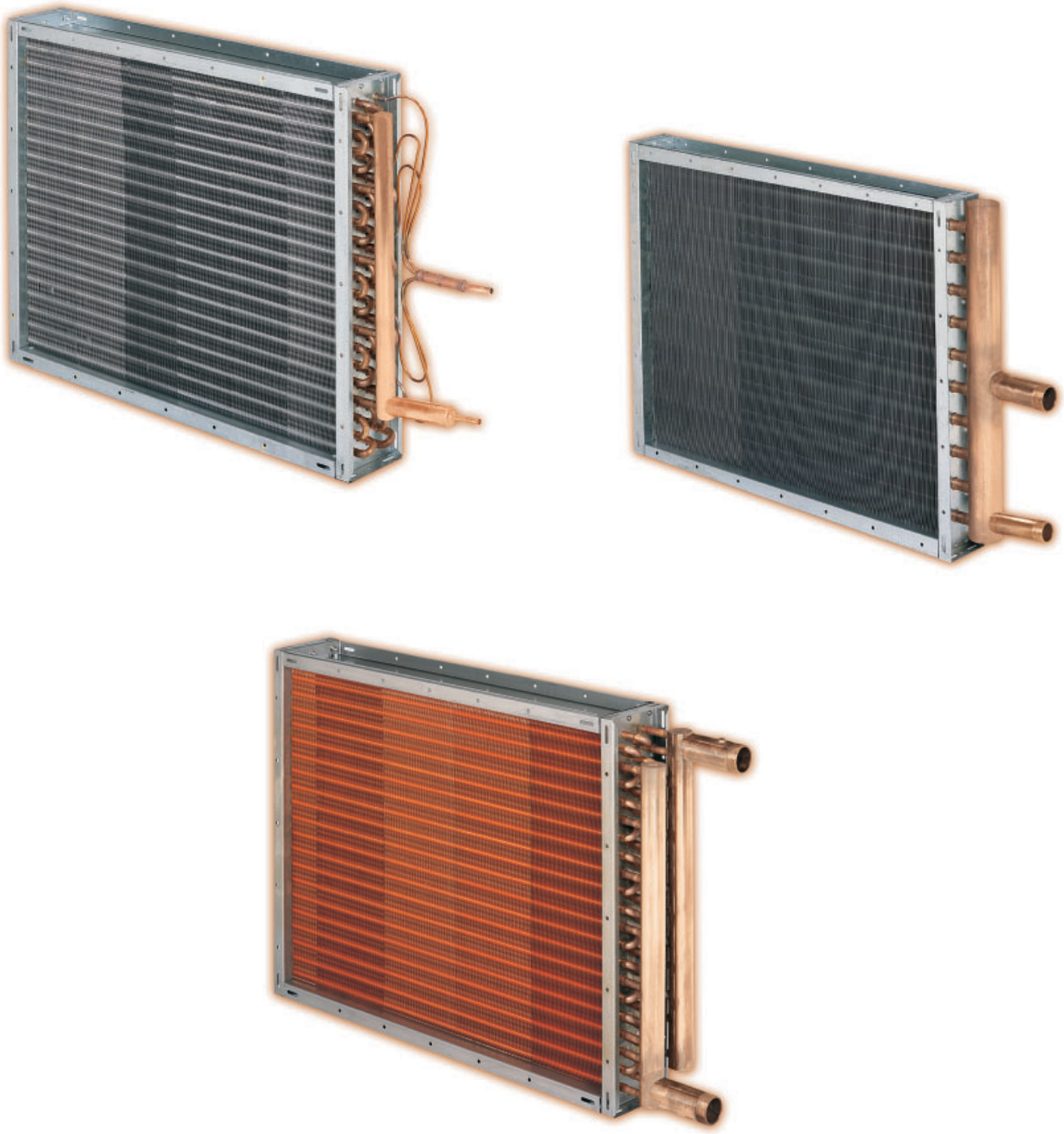
New Release

Johnson Controls	LOOSE COILS	
INSTALLATION, OPERATION & MAINTENANCE	New Release	Form 105.00-NOM1 (408)

WATER, DX, STEAM & BOOSTER COILS



IMPORTANT!
READ BEFORE PROCEEDING!
GENERAL SAFETY GUIDELINES

During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, and materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation, which if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

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

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest Johnson Controls Service office.

It is the responsibility of operating/service personnel to verify the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

TABLE OF CONTENTS

LIST OF FIGURES

SECTION 1 - INSTALLATION

COIL PIPING

Do not test, clean and flush piping through this equipment.

Isolate this equipment from pressure testing of water, steam, gas and air piping.

Consult the job specifications and submittal drawings for specific piping requirements, coil connection sizes and location. The coil should be level to assure proper venting and draining of coils. The piping arrangements must provide for a balanced flow in multiple coil installations (*see Fig. 1 showing factory coil connections*).

Support all connecting piping independently of the coils. Provide swing joints or flexible fittings in all piping connections, particularly adjacent to heating coils, to absorb expansion and contraction strains. Rigid piping connections can cause coil damage

The coil supply and the return pipe connections are labeled. When attaching piping to the coil header, make the connection only tight enough to prevent leaks. Excessive tightening may cause damage to the header. A backup wrench must be firmly held on the coil connection so that in tightening the connecting piping the torque is not transmitted to the coil header, thus damaging the coil connection.

Application Notes - Drain and vent taps on water coils are pipe thread shipped with plugs installed. These taps are installed approximately two inches back from the end of the threaded connections and require a hexagon (Allen) wrench to remove.

WATER

Water Coils - Drainable Water

Connect the water supply to the header connection on the leaving air side of the coil to achieve the counter flow of water and air. The return pipe will be connected to the remaining coil connection.
Install an air vent in place of the top pipe plug on the return header. In order to provide for drainage, install a drain line and shutoff valve in the supply near the coil or in place of the plug in the supply connection.

Hot Water Coils

The temperature rise of the air leaving the coil is dependent on the airflow across the coil, the gallons of water flow through the coil and the entering water temperature into the coil. Consult the submittal for each specific job for the above information.

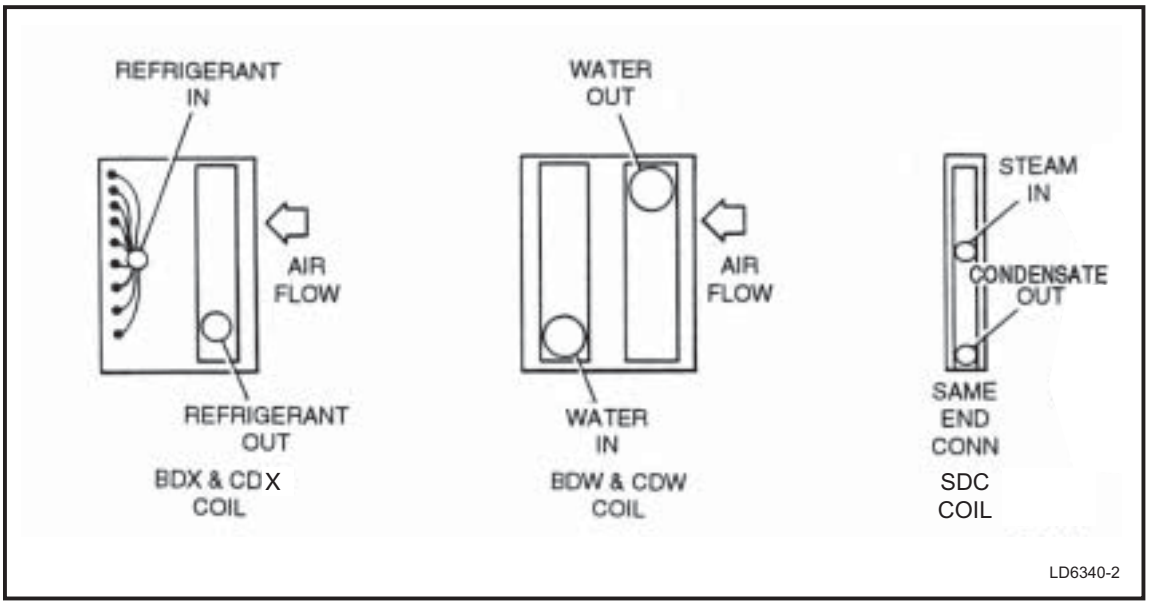


FIG. 1 – FACTORY COIL CONNECTIONS

Chilled Water Coils

See Fig. 2 for piping diagram.

Water Treatment

Any copper tube coils may be attacked by acid condensate. The practice of boiler water treatment should include CO_2 removal to assure longer tube life.

Freeze Protection

Chilled water, hot water and steam coils can be damaged during freezing weather. Precautionary measures must be taken to prevent freezing such as:

- Positive coil freeze protection must be used in installations where any part of the water coil is subjected to temperatures of 32 degrees or lower. This may be accomplished by using a suitable antifreeze solution. If the coil is not in use, it is recommended that the coil be completely drained and the inside of the tubes blown dry with compressed air.
- After draining, flush coils with an antifreeze solution such as ethylene glycol. A solution of 50% ethylene glycol and 50% water will protect from freezing to approximately 35 degrees F below zero at sea level. *Also refer to ASHRAE and ARI guidelines.*
- During winter operation due to the possibility of shutdowns such as power failure, night shutdown and weekend shutdown, the controls should be installed so the return air dampers will go to the full open position, and all fresh air dampers go to the full closed position. A source of auxiliary heat must be maintained inside the unit cabinet.
- Other means of protection such as various electro-mechanical switches and the full constant flow of water can be used; however, Johnson Controls will not be responsible for water coils damaged by freezing.

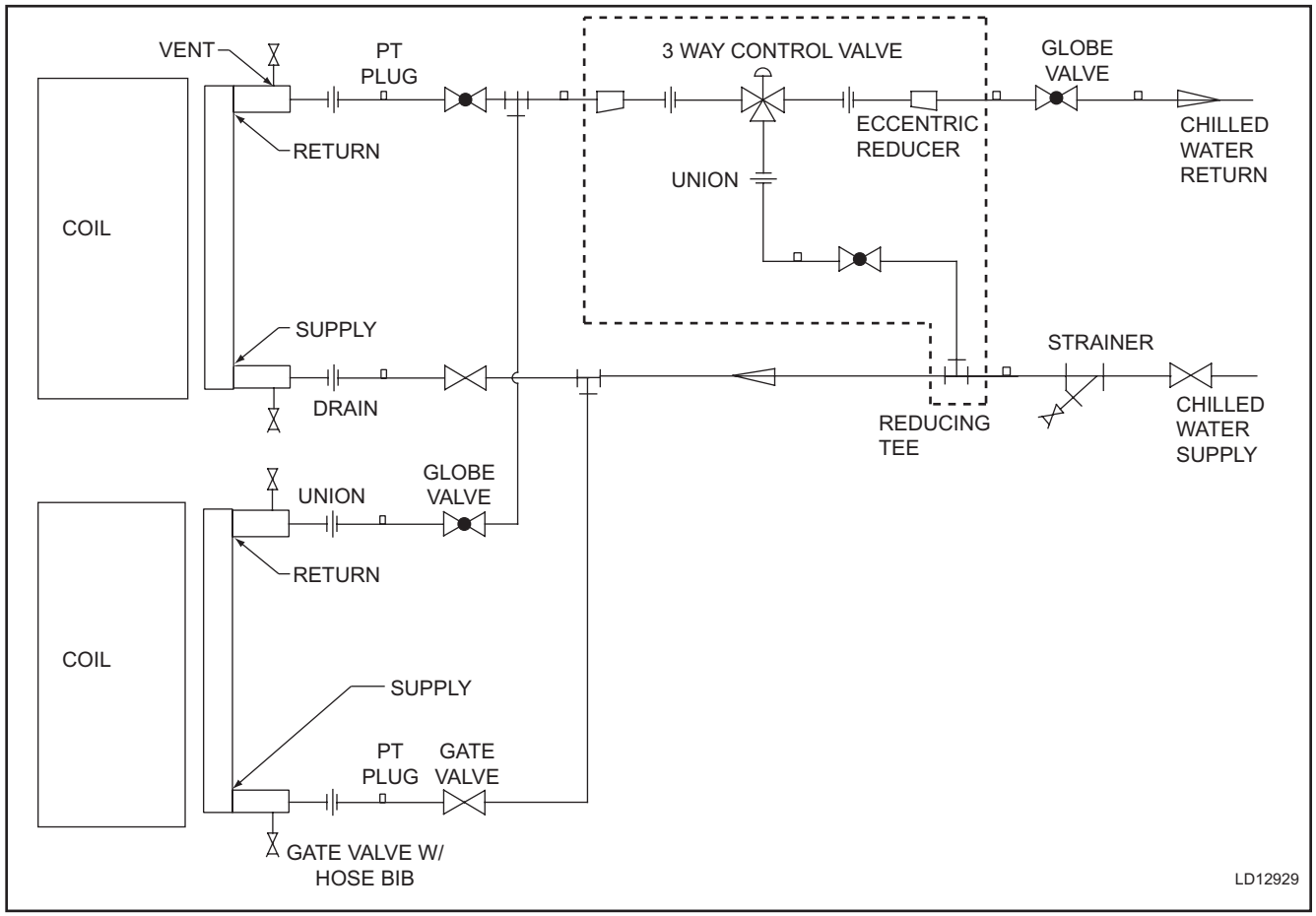


FIG. 2 – CHILLED WATER COIL CONNECTIONS

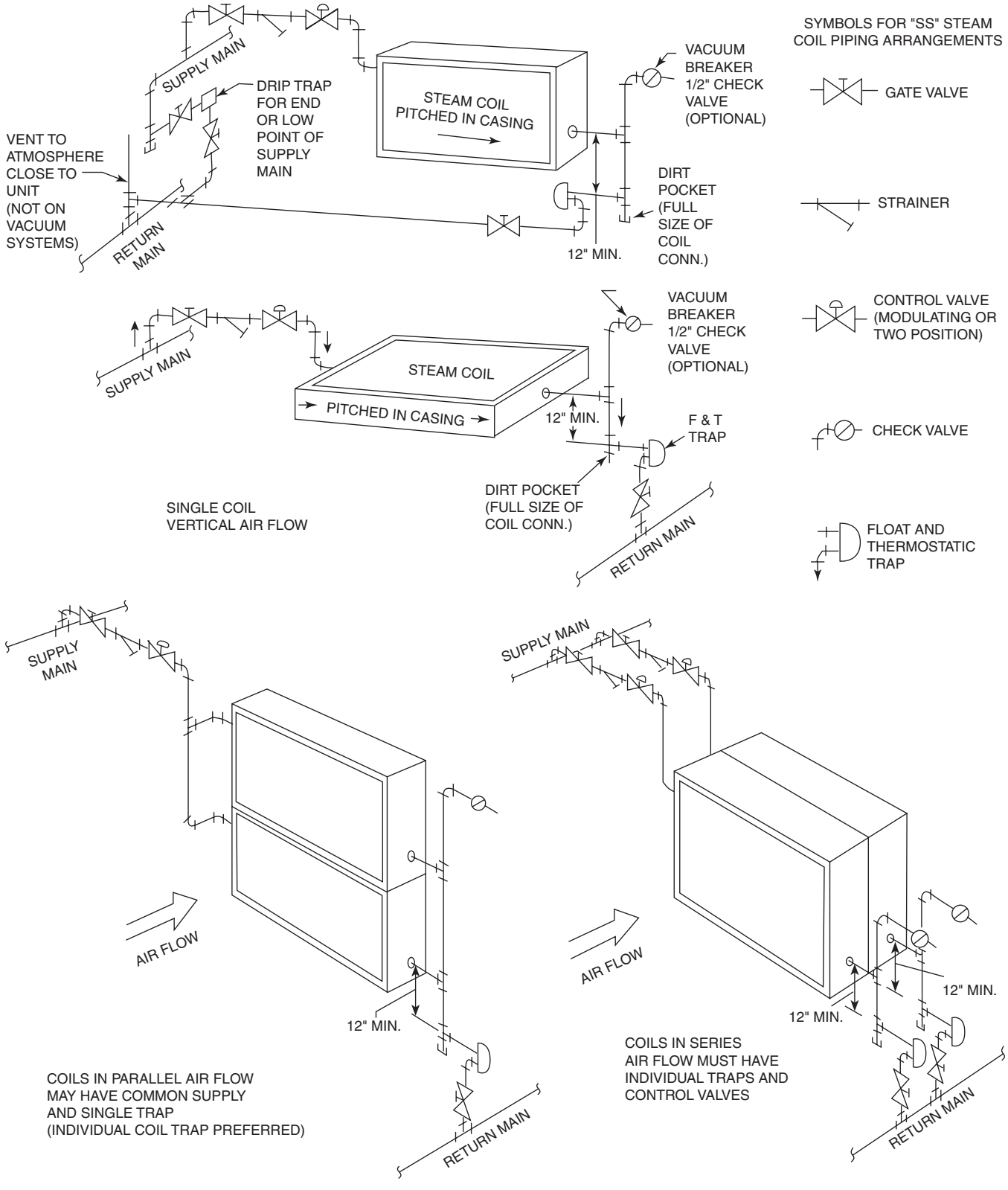


FIG. 3 – STEAM COIL PIPING ARRANGEMENTS

STEAM

Refer to Fig. 3 "Steam Coil Piping Arrangements."

Steam Coils

The operation of steam coils is dependant on airflow quantity and temperature. Consult the submittal issued for each specific unit for above information.

Steam Distributing Coils

Do not bush or reduce the coil return pipe size. Use a full size return pipe to the bottom of a dirt pocket. The supply pipe may be reduced at the coil connection if necessary. Install the coil casing level with the return down. A coil must be sufficiently elevated to allow a 12 inch minimum drop between the return connection on the coil and the trap. A greater than 2 inch drop is required for protection from freezing. The return main should be located below the trap. *Refer to Fig. 3.*

Steam Control

Continuous steam supply ensures long coil life and minimizes potential trapping, venting and freezing problems. A rapid cycling of the modulating steam supply or a frequent on-off steam supply control results in repeated thermal and piping stresses which will shorten the coil life. Modulating steam control valves must not be oversized but must be carefully selected, and cannot be used on 100% outside air applications. A substantial variation in the supply pressure will require the installation of a pressure-reducing valve ahead of the automatic control valve.

Light load operation with a modulated steam supply can be improved by the installation of a vacuum breaker check valve. An open relief line to the atmosphere from the return line near the coil is desirable, except on vacuum systems.

With a modulated steam supply, it is not practical to lift the condensate to an overhead return. Locate the coil well above the return, or provide condensate unit, or a boiler return trap below the coil.

Individual control valves are required on each coil installed in series with respect to airflow. When a modulating steam valve supplies two or more coils in parallel, with respect to airflow, the piping must be designed to provide for uniform steam distribution to each of the coils.

Steam Traps

Float and Thermostatic (F. & T.) traps are recommended for all low or medium pressure applications. Use thermostatic traps only for air venting, for outdoor applications where an F. & T. trap might be subject to freezing. Use bucket traps only for a non-modulated steam supply. Size the steam traps in accordance with the manufacturer's recommendations (usually several times the steady state steam flow). Use the actual operating conditions (coil pressure vs. return pressure) for the selection of a trap.

It is preferable to provide an individual trap for each coil but a single trap may be used for coils operating in parallel with respect to the airflow. Coils in series with respect to airflow must be supplied with individual traps. Locate the trap at least 12 inches below the coil return connection and even lower when freeze protection is required. Do not attempt to lift condensate modulated steam supply.

REFRIGERATION

Direct Expansion Coils (DX)

DX coils are divided into splits depending upon the unit size and coil circuiting. Each split requires its own distributor nozzle, expansion valve and suction piping. Suction headers are on the air entering side with suction connection at bottom end of headers when the coil is properly installed. Matching distributor connections for each coil refrigeration circuit are on the air leaving side. *See certified drawing and/or connection labeling to ensure correct matching of suction and distributor connections.*

CAUTION

Direct-expansion coils are shipped charged with nitrogen.

Do not leave piping open to the atmosphere unnecessarily. Water and water vapor are detrimental to the refrigerant system. Until the piping is complete, recap the system and charge with nitrogen at the end of each workday. Clean all piping connections before brazing joints. Use nitrogen when brazing connections to prevent scaling.

The orientation of the refrigerant distributor is not critical but the distributor tubes must not be kinked or bent in a non-uniform configuration. For this and other piping & sundry tips, *refer to Fig. 4.*

The orientation of the refrigerant distributor is not critical but the distributor tubes must not be kinked or bent in a non-uniform configuration. For this and other piping & sundry tips, *refer to Fig. 4.*

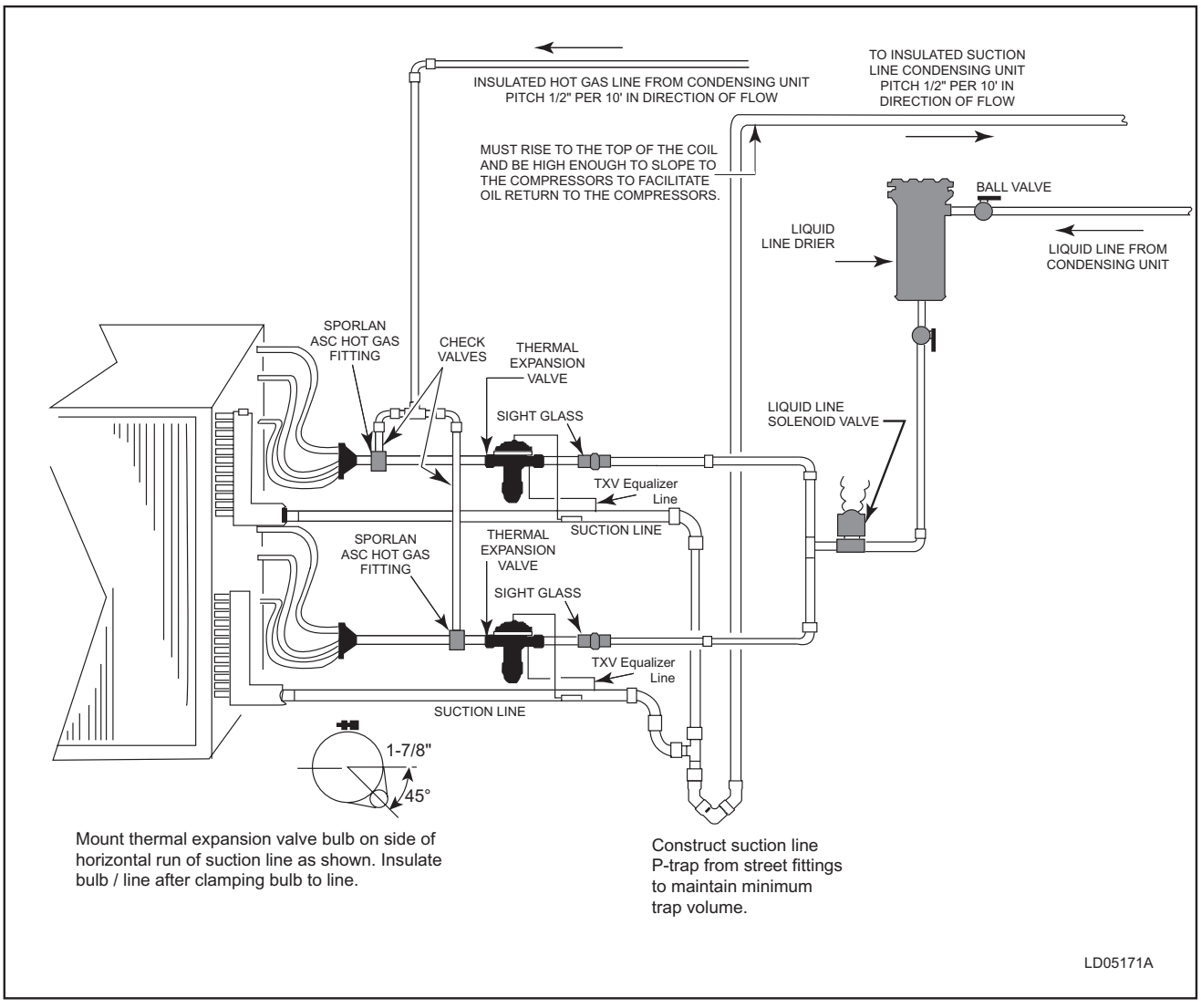


FIG. 4 – TYPICAL PIPING AND SUNDRIES AT THE DX COIL

DX Coil Types

There are three basic types of coil arrangements used in field erected split systems, interlaced, row split and face split.

Interlaced

Interlaced coils are the most desirable type of coil "field erected" designs. Interlaced coils ensure the entire face of the coil is active with any number of compressors operating. Interlaced circuitry interweaves coil tubing in both circuits across the entire face of the coil assuring uniform cooling of the air by the refrigerant. This type of coil also allows one circuit to operate while the other circuit is turned off. Interlaced coils provide excellent temperature control at full and part loads as well as good TXV superheat control. TXV control is essential for compressor reliability.

Row Split

Row split coils arrangements place coils back to back in the air stream. Air passes through one coil before passing through the next. Generally, the last coil in the air stream is activated first. Each circuit may be controlled independently in this arrangement. When both coils are operating, the coil closest to the leaving air will operate at a lower temperature. This type of coil may not permit lead lag of the circuits and it may be difficult to balance the capacity between the coils.

Face Split

On a face split coil, the circuiting is divided between two separate coils. In field-erected systems, this arrangement may suffer from TXV superheat control problems and compressor reliability. At low airflow, low load situations, the TXV may have difficulty controlling system superheat.

Air stratification, poor humidity control and condensation on downstream components can also occur when using face split coils. One way to address TXV control at part load is to provide a face damper to shutoff airflow when a coil face is inactive.

Combined Coil Types

Coil types may be combined in some systems. This requires special care. Control sequences and piping tying the multiple systems and coils together should be well thought out and advice from an experienced design engineer is necessary.

DX Coil Circuiting

On many coil banks, two, or even all three of the methods of circuiting may be combined depending upon the cooling capacity and the level of control required. However, coil sections must be married or combined so that they provide for full-face operation (*see Fig. 5*).

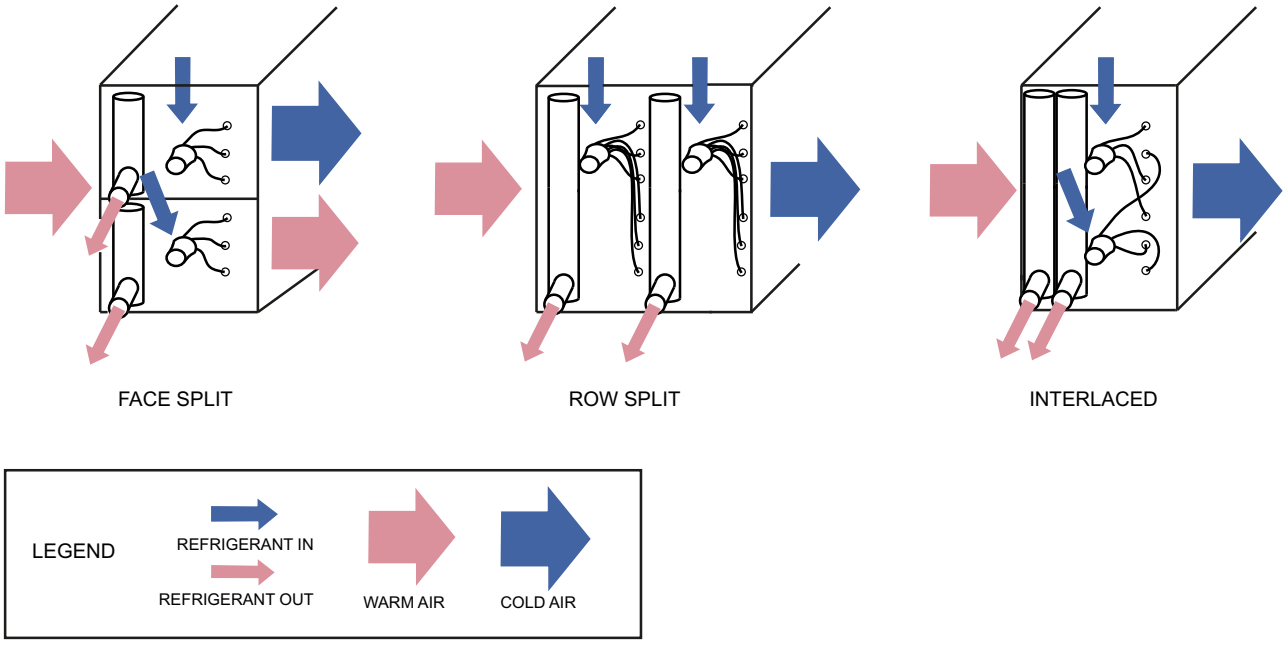


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FIG. 5 – DX COIL CIRCUITING TYPES

The coil designs fall into the two following categories.

Coil Design	Fin Height
Non-Stacked	48" and less
Stacked	Greater than 48"

Fig's. 6 through 8 illustrate the available coil arrangements.

NOTE

Face-split DX coils must be configured to provide full-face coverage at all condensing unit load steps. Johnson Controls assumes no responsibility for compressor failure if full-face coverage is not applied. Consult the factory, if application assistance is needed to convert split face to full-face operation.

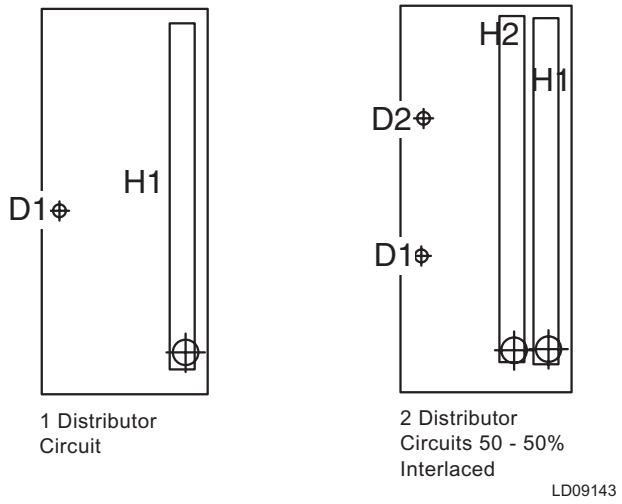


FIG. 6 – NON-STACKED COIL DESIGN

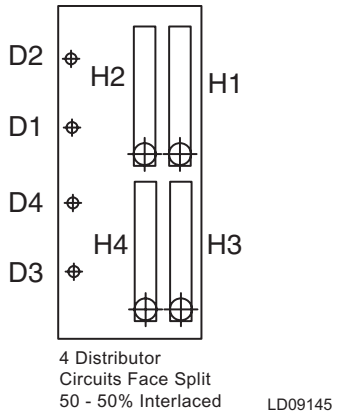


FIG. 7 – STACKED COIL DESIGN

DX Coil Circuiting and Staging

On tall coils, a minimum of four coil circuits should be used to achieve full-face control (Fig. 8). Each coil distributor circuit requires its own Thermostatic Expansion Valve (TXV). Each condensing unit circuit requires its own liquid line solenoid valve (LLSV). When the condensing unit has two compressors per refrigerant circuit, either one or two coil circuits may be used for each refrigerant circuit depending upon the cooling capacity.

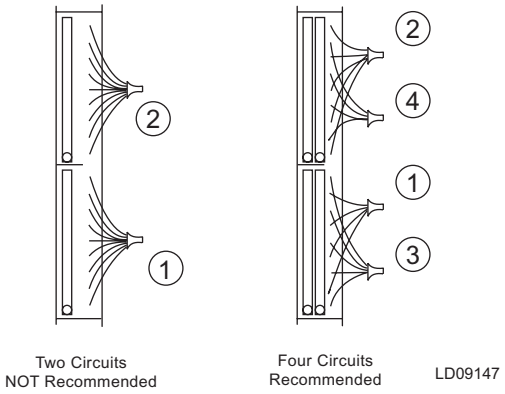


FIG. 8 – STACKED COIL CIRCUITING

If one coil circuit is used (Fig. 9), the LLSV and TXV must be sized to handle the full capacity of the refrigerant circuit. When two coil circuits are used per refrigerant circuit (Fig. 10), each TXV should be sized to handle half of the capacity of the refrigerant circuit and the LLSV should be sized to handle the full capacity of the refrigerant circuit.

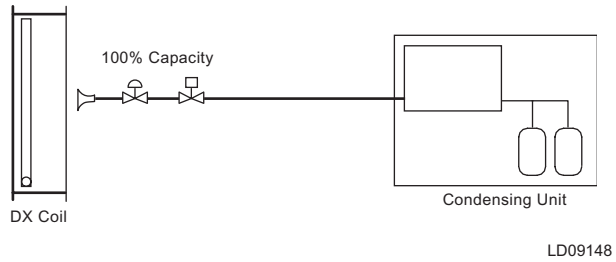


FIG. 9 – ONE COIL CIRCUIT PER REFRIGERANT CIRCUIT

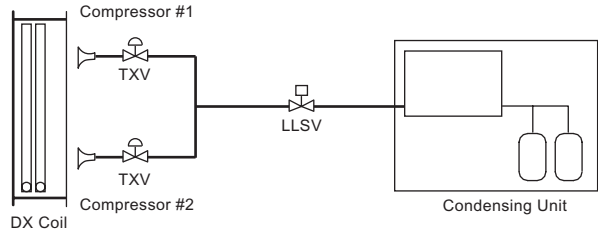


FIG. 10 – TWO COIL CIRCUITS PER REFRIGERANT CIRCUIT

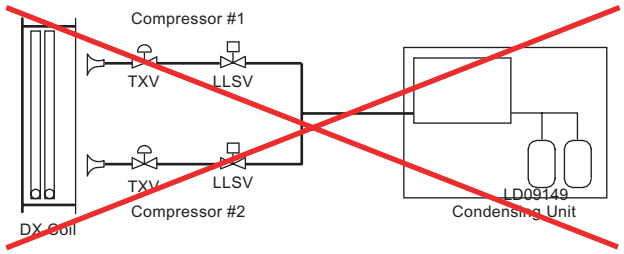


FIG. 11 – DO NOT USE THE ABOVE CONFIGURATION.

When the condensing unit has three compressors per circuit, two coil circuits should be used for each refrigerant circuit (Fig. 12). Each coil circuit must have a dedicated TXV and distributor to handle one coil circuit and the LLSV should be sized to handle the full capacity of the refrigerant circuit. The hot gas bypass line should be connected to all of the distributors in the coil circuit.

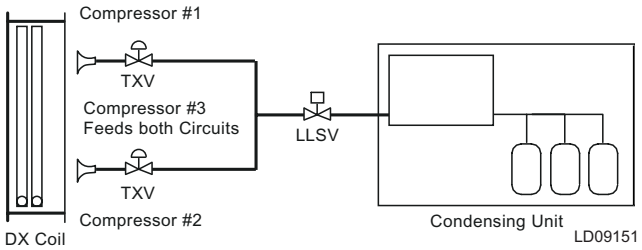


FIG. 12 – THREE COMPRESSOR YCUL

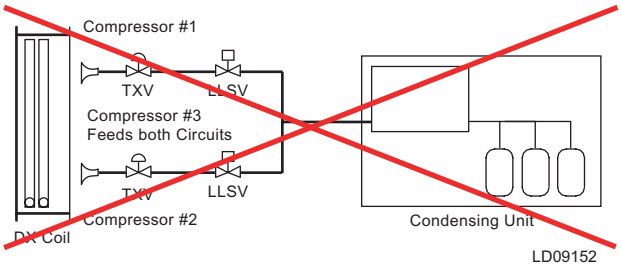


FIG. 13 – DO NOT USE THE ABOVE CONFIGURATION.

In the case of a tall coil with four coil circuits piped to a condenser with six compressors, the coil circuits would be face-split and interlaced with two interlaced circuits on the lower coil section and two on the upper (Fig. 14).

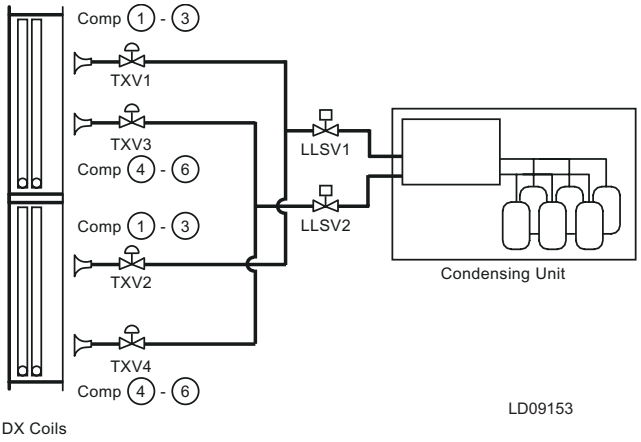


FIG. 14 – SIX COMPRESSOR YCUL

NOTE

When sizing TXV's, each TXV must be sized for the refrigerant circuit tonnage divided by the number of DX coil liquid distributors. The TXV should be equal to or smaller than the calculated value.

The first three compressors (*see Fig. 14*) would be tied into LLSV1, TXV1 and TXV2. This would provide full-face control of the coil at even the lowest cooling loads. Both distributors on each of the coil circuits would include auxiliary side connectors for HGBP.

The second set of 3 compressors would be tied into LLSV2, TXV3 and TXV4 to maintain full-face control at higher loads. *Reference Form 050.40-ES3 Section 9 for compressor staging solutions.*

The more control stages used, the more precise the control of the air temperature will be. Smaller incremental changes in capacity will result in a more consistent DX coil leaving air temperature. This will eliminate temperature swings in the conditioned space and improve the comfort level, but more importantly, a consistent space temperature is crucial to many process applications. The smaller changes in capacity that result from using a greater number of control stages will also extend equipment life. The most important thing to remember is to maintain full-face control of the coil at all cooling loads. When row split coils are used, make sure that the first LLSV is energized with the last coil circuit in the leaving air stream. This is always the last one de-energized too.

Thermostatic Expansion Valves (TXV)

Each coil distributor circuit requires its own Thermostatic Expansion Valve (TXV). Each condensing unit circuit requires its own liquid line solenoid valve (LLSV). TXV's 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 valve manufacturer's recommendations, allowing approximately 35 PSI pressure drop throughout 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, not recommended therefore, 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.

Hot Gas Bypass

When using discharge air temperature control or systems with outside air economizer cooling, always include hot gas bypass (HGBP). It is not as critical to use HGBP with return duct air temperature control, or suction pressure control, but it provides better capacity control at low loads.

The HGBP line should be sized for 100% of the capacity of one compressor and the hot gas lines must be insulated. YCUL discharge head pressure control is required on hot gas bypass applications. At low ambient temperatures, the condensing unit is very efficient and there is very little hot gas available for capacity control. Discharge pressure control assures enough differential pressure to push sufficient hot gas from the high side to the low side of the system.

Typical distributors utilize a selectable nozzle versus the older venturi type. Either device requires the use of an auxiliary side connector (ASC) for introducing the hot gas into the system and mixing it with saturated liquid refrigerant just ahead of the distributor. Most distributors are ordered with an integral ASC. Where multiple coils are stacked (or side by side), and ASC must be provided on all coils for that YCUL system. When ASC’s are field installed, the ASC must be located direct to the distributor, or a maximum of 2” to 3” away. Additionally, the side connection must be positioned upward to eliminate oil and refrigerant logging in the hot gas line when not in operation.

Hot gas must be fed to all coils to assure that full-face operation is achieved. Since all applications have job specific operating characteristics, the hot gas bypass valve setting must be field adjusted for the proper setting, after the system has been put into operation.

Hot gas piping must never be designed to trap liquid. If the hot gas line traps liquid during off periods, it will send a large slug of liquid into the DX coil when the hot gas is activated. This slug of liquid will not be fully evaporated in the DX coil and a liquid slug will be fed to the compressor, potentially causing damage. A hot gas line should be sloped so that it drains into the DX coil distributor from above the distributor, which also promotes oil return.

Local, state and federal energy standards such as ASHRAE 90.1 may limit the use of hot gas bypass in some applications. Be sure to consult local code requirements before installing the system.

Check Valves – All multiple HGBP auxiliary connections on a single circuit MUST include check valves as shown in Fig. 4. The use of these valves prevents one coil circuit from short circuiting to the other and influencing its operating pressure. This short circuiting produces unwanted TXV hunting and refrigerant over and under feed.

Check valves shall be refrigeration grade selected for suitable pressures involved. Valve bodies shall be constructed of copper with an integral check ball permitting flow only to the distributor (not reversed). Valves installed in the near horizontal must include a spring-loaded design. Valves must not exceed a 1 psi pressure drop at the design flow-tons for hot gas applications.

Maintaining Adequate Airflow

An electrical interlock between the air handler and the condenser must be included for permissive run of the condenser. In addition, a differential pressure switch mounted across the supply fan must always be included to ensure airflow across the coil before the condensing unit is energized. The condenser must never be operated unless the air handler fan is operating and air is flowing across the active coil. Insufficient airflow will result in liquid refrigerant returning to the condensing unit, which could damage the compressors by liquid slugging or washing oil from the bearing surfaces.

In variable volume systems, the minimum acceptable airflow for fixed speed or VAV systems is 350 FPM face velocity across each DX coil, as applied to split DX systems. This is critical to assure that the TXV does not overfeed, causing compressor failure.

The air velocity flowing through chilled water and direct expansion coils must not exceed specific recommended values, to prevent water carryover.

SECTION 2 - OPERATION AND MAINTENANCE

COIL SEGMENT

Coil Cleaning Procedure

Suggested Tools, Equipment & Materials List

- Pressure washer that does not exceed 2000 PSI.
- Sprayer (utility garden, etc.) applicator.
- Plastic sheeting.
- Duct tape.
- Screening.
- Coil cleaner (safe, commercial grade, disinfecting).
- Garden hose.
- Garden hose spray nozzle.
- Rags.
- Pail.
- Trash bags.
- Power cords.
- Four inch paintbrush.

Cleaning Procedure

Perform cleaning of dehumidification coils at least once a year or when air pressure drop exceeds 125% of design.

1. Cover electrical components such as fan motors, damper motors, compressors, thermostats, etc. with plastic. Care should be taken on interior coil cleaning. Remove filters; cover fan bearings and any insulation to keep these items free of water damage. Condensate drain piping should be screened to allow coil-cleaning water to flow freely. Screening keeps traps and drain lines from clogging with debris washed from the coils.
2. Prior to any application of wet cleaning materials, use a wide soft bristle paint brush to dust off any heavy dust, leaves, bugs or other foreign matter that may be on the coil fin surface.

Safety glasses should be worn when cleaning coils.

3. When possible, remove dirt lodged in the depth of the coil by using clean oil-free air under pressure. Caution should be taken not to use extreme high-pressure air as this may cause fin surface damage. Direct the air straight at the openings between the fins and never at an angle, which may bend the fins against one another. Always apply the air from the air leaving side of the coil.
4. On heavily soiled coils, use a safe commercial grade coil cleaner.

Follow the safety and mixing instructions as noted on or with the cleaning agent.

5. Spray the cleaning agent on both sides of the coil to be cleaned. Allow the cleaning agent to remain in contact with the dirty surface for about 5 minutes or as recommended by the agent instructions. Then flush the coil with clean water from a hose (with spray nozzle or from pressure washer). Flush from the air leaving side of the coil. Caution should be taken, as extreme water pressure may result in fin surface damage. Direct the water straight at the openings between the fins and never at an angle, which may bend the fins against one another. This process will wash away surface dirt on the air entering side of the coil, and prevent it form loading within the depth of the coil.
6. Most cleaners are concentrated detergents and can be diluted with up to 10 parts of water. Dilute as per cleaning agent instructions and coil condition. Re-spray both sides of the coil with cleaner. Allow to stand 5 minutes and flush as described previously. Finish flushing from both sides of the coil.

Follow cleaning agent instructions. Agent should meet environmental and OSHA standards.

7 Some extreme oil and dirt conditions may require steam cleaning. Most steam equipment can be adjusted to provide a mixture of water and steam at a moderate pressure. Steam alone without the presence of water does not work well with most cleaning agents. Cleaning the coils with steam should be done as described previously.

8. Comb out any bent or flattened areas of fin surface.
9. Restore equipment to operational state.

Condensate Drain Pan, Trap and Drain Line Cleaning Procedure

Tools and Materials

- Toilet bowl brush or similar utility cleaning brush.
- Cleaning agent (safe, commercial grade, disinfecting).
- Rags.
- Trash bags.
- Garden hose with spray nozzle or power washer.
- Scraper.
- Screening.
- Wet vacuum.

Cleaning Procedure

Clean condensate drain pan, trap, drain line and adjacent wetted surfaces at least once per year or as often as required to retard growth of microbial substances.

Testing of Drain Pans - ***To minimize conditions of water stagnation that may result in microbial growth, drain pans shall be field-tested under normal operating conditions to ensure proper drainage.***

Exception: ***Field testing of drain pans is not required if units with factory-installed drain pans have been certified (attested in writing) by the manufacturer for proper drainage when installed as recommended.***

1. Cover any nearby components such as motors, control devices or wiring.
2. Sweep, gather and remove debris from drain pan, auxiliary pans and splash guards.
3. Scrape loose and remove any clinging substances.
4. Cover drain pan outlet with screening to prevent drain clogging.
5. Prepare cleaning agent per manufacturer's instructions.
6. Apply cleaning agent with spray applicator or brush.
7. Apply cleaner to ***ALL*** surfaces including: under side of coil, header and return bends if in air stream, coil supports, coil wall or bulkhead, auxiliary drain pans, splash guards, any other surfaces subject to wetting by condensation dripping or carried by normal air flow, drain pan and outlet.
8. Add ample amount of cleaning agent to drain line and trap.
9. Allow cleaner to stand for time required by manufacturer's instructions.
10. Flush with clean water from pressure washer or garden hose with spray nozzle.
11. Apply as much water under pressure as possible to drain outlet to clean trap and drain line.
12. Remove water from any puddle areas with wet vacuum.
13. Wipe down if necessary to remove any stubborn material.
14. Restore equipment to operational state.

Winterizing Drain Traps

During the winter months when the cooling system is turned off and the unit is exposed to freezing conditions, an antifreeze solution, which is environmentally friendly and safe for the roof can be poured in the condensate drain trap to prevent freezing and possible damage. The condensate drain trap may also be removed as well as heat traced and insulated.

MONTHLY MAINTENANCE CHECK

Refrigerant Coils - Check holding charge pressure monthly to be sure that the pressure has not dropped. If pressure has dropped, the unit should be inspected for signs of visible damage which may have caused loss of pressure. If pressure drops more than 2 psi, the unit should be pressure tested to locate the leak; the leak should be repaired and the unit recharged with nitrogen to 5 psig pressure.

WARRANTY

The standard warranty policy is described by Form 50.05-NM2.

COIL LEAKS

Reporting coil leaks that occur during the standard warranty period must be done in accordance with the procedure outlined in Service Bulletin SB0033. This form is required for warranty claim processing.

REPLACEMENT COILS

To order coils, refer to the Loose Coil Quick Shipment Guide for product offering and ordering instructions.

NOTES:

P.O. Box 423, Milwaukee, WI 53203
www.johnsoncontrols.com

Printed in USA 105.00-NOM1 (408)
New Release

Johnson Controls	SINGLE DUCT VAV TERMINALS	
INSTALLATION, OPERATION & MAINTENANCE	New Release	Form 130.13-NOM1 (808)

MODELS TSS & TSL

TSS

TSL

TABLE OF CONTENTS

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

NOTE is used to highlight additional information which may be helpful to you.

SAFETY CONSIDERATIONS

The equipment covered in this manual is designed for safe and reliable operation when installed and operated within its' design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experience personnel familiar with local codes and regulations, perform these functions using good judgment and safe practices. *See the following cautionary statements.*

ELECTRICAL SHOCK HAZARDS
All power must be disconnected prior to installation and servicing this equipment. More then one source of power may be present. Disconnect all power sources to avoid electrocution or shock hazards.

HOT PARTS HAZARD
Electric resistance heating elements must be disconnected prior to servicing. Electric heaters may start automatically; disconnect all power and control circuits prior to servicing to avoid burns.

Check that rigging and lifting equipment can safely support the unit assembly and component weights.

All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its' final location.

All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live, seismic or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation and vibration.

Secure all dampers when servicing damper, actuators or linkage. Dampers may activate automatically, disconnect the control circuits or pneumatic control systems to avoid injury.

Protect adjacent flammable material when brazing. Use flame and heat protection barriers where needed. Have fire extinguisher ready for immediate use.

INSPECTION

Upon receipt of equipment, carefully check all items against the bill of lading to ensure that all equipment has been received (including shipped loose items). Note any discrepancy on the bill of lading before signing.

Inspect all equipment for any signs of damage caused during transit. On units with re-heat, check the coil fins and/or ensure that the resistance heat coils are not damaged. Note any visual damage on the bill of lading before signing. Immediately report all visual and concealed damage to the carrier and file a claim with the carrier.

Locate the model number on the nameplate and check that the correct units have been received. Verify that all options have been included, such as controls, heating coils, etc. Also ensure that unit voltage agrees with the building parameters. If a discrepancy is discovered between what was ordered and received, contact your local Johnson Controls representative immediately.

DO NOT USE FLOW SENSOR, CONNECTING TUBES, COIL STUBOUTS OR DAMPER SHAFT AS A HANDLE WHEN LIFTING OR MOVING EQUIPMENT, AS DAMAGE MAY OCCUR.

DO NOT HANDLE EQUIPMENT'S HEATING ELEMENTS, AS PERMANENT DAMAGE MAY OCCUR.

CHECK assembly and component weights to be sure that the rigging equipment can handle them safely. Note; also check the centers of gravity and any specific rigging instructions.

CHECK for adequate ventilation so fumes do not migrate through ductwork to occupied spaces when welding or cutting around the unit.

DO NOT work on damper until associated actuator is disconnected.

NEVER pressurize equipment above specified test pressure.

PROTECT adjacent flammable materials when brazing. Use flame and heat protection barriers where needed. Have a fire extinguisher at hand and ready for immediate use.

STORAGE

If equipment is to be stored prior to installation, observe the following precautions:

1. Choose a dry storage site that is reasonably level and sturdy to prevent undue stress or permanent damage to the equipment. Set equipment off ground if in moisture prone areas.
2. Tag and store in a safe place until needed. Cover entire equipment with protective tarp or moisture proof cover. Extend cover under equipment if stored on ground. Secure cover with adequate tie downs and store indoors. Be sure that piping connections have protective shipping caps installed.

PRE-INSTALLATION INSPECTION

DO NOT USE FLOW SENSOR, CONNECTING TUBES, COIL STUBOUTS OR DAMPER SHAFT AS A HANDLE WHEN LIFTING OR MOVING EQUIPMENT, AS DAMAGE MAY OCCUR.

DO NOT HANDLE EQUIPMENT'S HEATING ELEMENTS, AS PERMANENT DAMAGE MAY OCCUR.

Ensure that all linkages are connected properly. Check the linkage that connects the actuator to the damper shaft to ensure that the nuts are tight.

While viewing the damper from the discharge of the unit, rotate the shaft fully. The damper should close fully and there should be no gaps between the damper gasketing and the inside of the valve.

SEQUENCE OF OPERATION

Single Duct

The basic unit consists of a sheet metal casing and an air valve, which is used to modulate the air being delivered into the occupied zone. Air enters the air valve inlet and exits into the sheet metal casing to be distributed to the occupied zone through ductwork attached to the discharge of the unit.

The basic unit can be ordered with either a factory mounted hot water heating coil or an electric heater.

These re-heat units are used primarily to reheat the air-to-zone temperature when the load in the occupied space drops off.

The primary air is modulated through the FlowStar™ air valve by rotating the damper blade. The air valves come in rectangular and round. The round valves only come in diameters of 4, 5, 6, 8, 10, 12, 14 and 16 inches; an adapter must be used for metric ductwork.

INSTALLATION

DO NOT USE FLOW SENSOR, CONNECTING TUBES, COIL STUBOUTS OR DAMPER SHAFT AS A HANDLE WHEN LIFTING OR MOVING EQUIPMENT, AS DAMAGE MAY OCCUR.

DO NOT HANDLE EQUIPMENT'S HEATING ELEMENTS, AS PERMANENT DAMAGE MAY OCCUR.

All terminal equipment with electric heaters must be installed in a horizontal plane with respect to the airflow stream. Low height equipment (Model TSL) can be flipped over in the field to vary or change control section handing.

Clearances

All equipment covered in this document, including those with electric heat, are ETL listed for 0.0" clearance to combustibles. Refer to NEC and/or local codes for minimum electrical clearances required for service. Equipment should not make contact with any structure located above the equipment without appropriate isolation. Equipment supplied with bottom access panels requires sufficient clearance to access fasteners, and to lower and slide panel horizontally until clear of bottom of unit.

Hanging and Mounting Equipment

Although the basic equipment is generally light enough that it can be supported by the ductwork, Johnson Controls strongly recommends that all equipment be suspended from the upper most ceiling or a structural element of the building, independent of the false ceiling grid. Suspension devises are field supplied, sized and designed by others. Johnson Controls will not accept responsibility for unit support. Equipment must be installed in a level horizontal plane. Failure to level equipment properly may prevent proper operation of controls. Provisions for proper support in seismically active regions is the responsibility of others. *See table 1 through 4 for unit weights.*

UNIT WEIGHTS

TABLE 1 - SINGLE DUCT TERMINAL UNIT WEIGHTS

UNIT SIZE	TSS		TSS w/ SA		TSS w/ EH	
	SINGLE WALL	DOU-BLE WALL	SINGLE WALL	DOU-BLE WALL	SINGLE WALL	DOU-BLE WALL
04	20 (9)	25 (11)	35 (16)	50 (23)	64 (29)	79 (36)
05	20 (9)	25 (11)	35 (16)	50 (23)	64 (29)	79 (36)
06	19 (9)	24 (11)	34 (15)	49 (22)	62 (28)	77 (35}
08	20 (9)	26 (12)	37 (17)	53 (24)	71 (32)	87 (39)
10	25 (11)	32 (15)	44 (20)	62 (28)	78 (35)	96 (44)
12	28 (13	36 (16)	50 (23)	71 (32)	89 (40)	110 (50)
14	35 (16)	44 (20)	59 (27)	84 (38)	106 (48)	131 (59)
16	37 (17)	47 (21)	63 (29)	90 (41)	113 (51)	140 (64)
19	49 (22)	62 (28)	85 (39)	120 (55)	141 (64)	176 (80)
22	51 (23)	65 (29)	90 (41)	127 (58)	148 (67)	185 (84)

TABLE 2 - TSS WATER COIL WEIGHT ADDS

UNIT SIZE	# OF ROWS			
	1 ROW	2 ROW	3 ROW	4 ROW
04	4 (2)	5 (2)	8 (4)	12 (5)
05	4 (2)	5 (2)	8 (4)	12 (5)
06	4 (2)	5 (2)	8 (4)	12 (5)
08	4 (2)	6 (3)	9 (4)	13 (6)
10	5 (2)	8 (4)	12 (5)	18 (8)
12	7 (3)	10 (5)	16 (7)	22 (10)
14	9 (4)	14 (6)	21 (10)	30 (14)
16	10 (5)	16 (7)	24 (11)	34 (15)
19	12 (5)	20 (9)	28 (13)	40 (18)
22	13 (6)	22 (10)	32 (15)	44 (20)

Adds for water coils reflect actual operating weight.

TABLE 3 - SINGLE DUCT LOW HEIGHT TERMINAL UNIT WEIGHTS

UNIT SIZE	TSL		TSL w/ SA		TSL w/ EH	
	SINGLE WALL	DOUBLE WALL	SINGLE WALL	DOUBLE WALL	SINGLE WALL	DOUBLE WALL
10	26 (12)	30 (14)	43 (19)	58 (26)	62 (28)	77 (35)
12	28 (13)	35 (16)	49 (22)	68 (31)	74 (34)	93 (42)
14	39 (18)	47 (21)	62 (28)	82 (37)	90 (41)	110 (50)
16	45 (20)	55 (25)	73 (33)	96 (44)	103 (47)	126 (57)

TABLE 4 - TSL WATER COIL WEIGHT ADDS

UNIT SIZE	# OF ROWS			
	1 ROW	2 ROW	3 ROW	4 ROW
10	9 (4)	12 (5)	15 (7)	18 (8)
12	11 (5)	15 (7)	19 (9)	23 (10)
14	13 (6)	18 (8)	22 (10)	27 (12)
16	15 (7)	21 (9)	27 (12)	32 (15)

Adds for water coils reflect actual operating weight.

When requested, equipment is supplied with optional hanger brackets for use with up to a 3/8" diameter hanger rod. S*ee submittal drawings for hanger bracket locations.*

Hanger straps may be utilized as an alternate means of suspending the equipment. Do not secure hanger straps to electric heaters, coils or control enclosures. Hanger straps can be mounted directly to the sides and bottom of equipment casing, such that they do not interfere with working components or access panels, using screws that do not penetrate the unit cabinet more than 3/8".

When hanging equipment, always use the support method as prescribed for rectangular duct in the job specifications.

Duct Connections

When fastening ductwork to equipment, DO NOT use fasteners that penetrate equipment cabinet more than 3/8" [10mm]. Fasteners penetrating the equipment cabinet over 3/8" [10mm] may come in contact with live electrical parts or penetrate other components within the equipment casing causing damage.

All duct connections should be configured and installed in accordance with SMACNA guidelines and all local code requirements.

Allow a minimum of 1½-duct diameters of straight duct prior to equipment inlet and equipment discharge. The diameter of the inlet duct for round valves must be equal to the listed size of the equipment. The round air valve inlet collar of the equipment is 1/8" smaller then listed size in order to allow the round ductwork to slip over the air valve inlet collar. DO NOT INSERT DUCTWORK INTO AIR VALVE INLET COLLAR. When making ductwork connection to air valve inlet collar and insulating air valve inlet, take caution not to damage or remove the flow sensor connections, which are vital to unit control. Provide insulation around entire inlet collar (all the way to the equipment casing).

Permissible discharge duct connections are straight flanged, slip and drive or drive and screw.

If equipment is to be installed in a location with high humidity, external insulation around the heating coil should be installed.

Sound Critical Applications

Flexible duct connectors are not recommended on equipment discharge. The sagging membrane of these fittings can cause turbulence and higher air velocities that generate noise. Also, lightweight membrane material allows noise to breakout, which can increase sound levels in the space below.

Coil Connections

Hot water and steam coils are male sweat connections. Use appropriate brazing alloy for system temperature and pressure. Refer to unit construction submittal drawing for specific connection size. MAXIMUM HYDRONIC SYSTEM OPERATING PRESSURE MUST NOT EXCEED 300 PSIG. MAXIMUM STEAM SYSTEM PRESSURE MUST NOT EXCEED 15 PSIG.

Electrical

All field wiring must comply with NEC and all local codes. Electrical and/or control wiring diagrams are located on the control enclosure box. All electric heaters are staged per specifications.

The installing electrician should rotate the incoming electric service by phase to help balance the building electrical load.

Minimum circuit ampacity (MCA) designates the maximum operating load of the equipment for sizing wire feeders. Fuse size of the internal fuse if supplied. Maximum Overcurrent Protection (MOP) designates the largest breaker or fuse in the electrical service panel that can be used to protect the equipment.

Use Copper conductors only.

OPERATION

Start-Up

Thorough safety precautions should always be taken when performing startup and service. Only qualified individuals should perform these tasks.

Check that all electrical work is finished and properly terminated. Check that all electrical connections are tight and that the proper voltage is connected.

3 Phase Balancing

AC power imbalance must not exceed 2%. Be sure that the following guides are met:

1. AC power is within 10% of rated voltage at rated frequency. *(See equipment nameplate for ratings).*
2. AC power is within 5% of rated frequency at rated voltage.
3. A combined variation in the voltage and frequency of 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed 5% of rated frequency.

Equipment with electric heat requires a minimum of 0.1" w.g. downstream static pressure.

Prior to start-up, the project control sequence/wiring diagram should be obtained and thoroughly understood. If factory supplied analog or DDC controls are utilized, refer to the applicable Operation Manual for start-up and balancing information.

MAINTENANCE

Optional Damper Actuator

An optional factory mounted floating type actuator is available, which mounts directly to the damper operating shaft. The actuator is not provided with and does not require any limit switches but is electronically protected against overload.

Manual Override

A button on the side of the actuator cover disengages the gear train so the drain shaft can be moved manually. Releasing the button will re-engage the gear train.

Mechanical Angle of Rotation Stops

The adjustable stops may be field adjusted to halt the rotation of the damper blade before the damper blade reaches the damper stops. The actuator can be indefinitely stalled in any position without harm.

1. Loosen the two end stop screws using a No. 2 Phillips head screwdriver, being careful not to unscrew the captive nut under the slot.
2. Move the stops (in 2.5° steps) to the desired position and retighten the screws.

External Terminal Strip

The external terminal strip is located on the top of the actuator. Connections are numbered. The terminals are designed for 26 to 16 gauge wires. For most installations, 18 or 16 gauge wire will work well with the actuator *(see table 5 for maximum wire lengths).*

TABLE 5 - MAXIMUM WIRE LENGTHS	
WIRE SIZE	MAX FEET
16 GA	1225 FT
18 GA	725 FT
20 GA	400 FT
22 GA	200 FT

Overload Protection

The actuators are electronically protected against mechanical overload. In the actuator, an electronic circuit maintains the current at a level that will not damage the motor while providing adequate holding torque.

Checkout Instructions

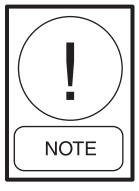
1. Disconnect actuator from the controller.
2. Apply 24 VAC to the COM and CW terminals on the actuator. Actuator should rotate in a clockwise direction.
3. Apply 24 VAC to the COM and CCW terminals on the actuator. Actuator should rotate in a counter clockwise direction.
4. If actuator moves in both directions, it is operational.
5. If the actuator does not rotate, it may be at an end stop or there is a problem with the damper.
6. Loosen the set screw to free the actuator from the damper shaft. Check to make sure that the damper shaft rotates freely.
7. Check to make sure that actuator is not against stop. Repeat steps 2 and 3.
8. If actuator does not rotate, replace.

Damper Shaft

There is an indicator on the end of the damper shaft that can be used to determine the position of the damper blade. If the indicator is horizontal, the damper is completely open. The damper shaft is ½" diameter.

Coil

The frequency of required cleaning is dependent on the operating hours of the system, filter maintenance and efficiency as well as dirt load.



Important: Coils may become externally dirty as result of normal operation. Dirt on the surface of the coil reduces its ability to transfer heat that can result in reduced performance, and increased operating energy cost. If the dirt on the surface of the coil becomes wet, microbial growth (mold) can result, possibly causing unpleasant odors and serious health related indoor air quality problems.

Fin edges are sharp. Fins are fragile; care must be exercised to avoid damaging fins. Do not use solutions to clean coils; drain pans are not present to remove collected solution.

Cleaning

1. Disconnect all electrical power to the equipment, tag and lock out power source.
2. Gain access to coil either through ductwork or optional coil access panel.
3. Use soft brush and vacuum to remove loose debris from sides of coil. Do not use fluid or solvents to clean coils, as no provisions for collecting liquids exist on this type of equipment.
4. Straighten any coil fins that may have been damaged during cleaning process with fin comb.
5. Replace ductwork or access panel and restore electrical power to equipment.

Electric Heat

Johnson Controls electric heaters require little or no maintenance.

Electric heaters come equipped with a primary auto-reset limit switch. These limit switches provide protection against overheating. The auto-reset limits switches automatically cut the heater off when overheating occurs, and turns the heater back on when the elements have cooled down. Electric heaters also come equipped with a secondary one-time trip limit switch. Should the secondary limit switches trip, they will need to be replaced with a limit switch that has the same trip temperature as the one-time trip limit switch that was originally supplied with the electric heater. An optional manual reset secondary is available, which can be reset by depressing the reset switch.

Minimum Operating Conditions

Airflow must be at least 70 CFM per kW. A minimum of 0.1" w.g. external pressure is required.

Electric Heater Rack Replacement

JOHNSON CONTROLS HEATERS

1. Turn off power supply before servicing.
2. Locate T-Plate inside on heater control enclosure.
3. Before removing wires from the element rack T-Plate, mark where the wires are connected so that they can be reconnected correctly on the new element rack.
4. Remove the wires and screws holding the heater T-plate in the control enclosure and remove element rack.
5. Insert new element rack into control enclosure and replace screws to secure the element rack to control enclosure.
6. Replace wires.
7. Close control enclosure cover before turning on the power.

Electric Heater Element Replacement

TUTCO HEATERS

1. Turn off power supply before servicing.
2. Disconnect field wiring from Electric Heater Control Enclosure.
3. Disconnect Amp Plug Connectors if equipped.
4. Remove 4 mounting screws from inside Electric Heater Control Enclosure.
5. Slide entire heater assembly out of Single Duct Terminal.
6. Remove wires and any jumpers from heater element terminal ends, noting which wire and jumper goes to which terminal.
7. Remove ¼" hex head screws located near terminal ends.
8. Remove ¼" hex head screws from opposite of terminal end on heater rack.
9. Remove elements and replace with new ones.
10. Reassemble, replace wires correctly.
11. Close control enclosure cover before turning on power.

ELECTRIC HEATER TROUBLESHOOTING GUIDE

JOHNSON CONTROLS AND TUTCO

TABLE 6 - HEATER TROUBLESHOOTING GUIDE

Check wiring diagrams to ensure that heater is properly wired.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
HEATER DOES NOT OPERATE	No Power	Check Disconnect.
	No Control Voltage	Check Control Signal (i.e. 24 VAC).
		Check transformer and transformer fusing (if applicable), replace if necessary.
	Blown Fuse	Replace fuse.
	Open Limit (primary or secondary)	Replace limits or reset as applicable.
		Check for continuity across limit to determine if open, replace as necessary.
	Airflow Incorrect Direction	Check sensing tube, rotate if needed.
	Low Airflow Static Pressure	Increase airflow.
	Damaged Elements	Check for open or damaged elements and replace as necessary.
LOW OR HIGH TEMPERATURE RISE	Incompatible Thermostat or Controller	Check Wiring.
		Check for compatibility.
	Problems with Additional Stages	Check location of thermostat; may be installed in a “too hot” or “too cold location. Check heat outputs on controller.
		Check contactors for open coil.
		Check for damaged elements.
	Incorrect CFM	Check for blocked duct or location of heater.
SHORT CYCLING	Improper Airflow	Check for even airflow across the face of the element section.
		Check for blocked duct.
		Verify installation per SMACNA and ASHRAE guidelines.
		Check for dirty filters.
	Low CFM	*See remedies for “Improper Airflow”.*
		Check air velocity of 70 CFM per kW.
HEATER WITH SSR DOES NOT OPERATE	Incorrect Signal Applied	Verify signal input.
	Interface Board Fuse Blown	Replace fuse.
	See SSR Troubleshooting (next page)	

PROPORTIONAL HEAT CONTROL

(SSR) TROUBLESHOOTING GUIDE

Johnson Controls Heaters

Lethal voltages are present in the heater control enclosure. Use extreme caution when taking measurements in these units. Always disconnect power before removing or re-applying any connections.

1. Before applying power, verify wiring matches diagram in cover of heater control enclosure, and that correct line voltage has been wired to heater line block.
2. Verify 24 VAC +15% or -10% between P1 and P2 of interface circuit board (ETPHCI, ETPHCV2, etc., depending on input).
3. The table below lists responses to input signal by interface model as explained in step 4. If any of these inputs cannot be obtained, refer to the literature on the device that is supposed to provide the input. Otherwise, proceed to step 4.

INTERFACE MODEL	"PULSE" INPUT	FULL OFF INPUT	FULL ON INPUT	INPUTS
ETPHCI	12.0 mA	4.0 mA	20.0 mA	Sig, Com
ETPHCV2	6.0 VDC	2.0 VDC	10.0 VDC	Sig, Com
ETPHCC	50%	0 VAC	24 VAC	Sig, Com
ETPHCC1	50%	0 VAC	24 VAC	+18, Com

4. Apply Full Off Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is off. If the unit is single phase, measure voltage between P4 and P6 and verify 0.3 VDC + or - 0.3 VDC. Replace the interface circuit board if the voltage is higher than specified, or the LED is on.
5. Apply Full On Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is on. If the unit is single phase, measure voltage between P4 and P6 and verify between 3 and 5 VDC.
6. If the module provided is an ETPHCC or ETPHCC1, go to step 7. Apply "Pulse" Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is flashing at an interval of about one second. If the unit is single phase, the voltage between P4 and P6 of the interface board should vary between the Full Off and Full On voltages in steps 4 and 5 in intervals of about one second.

Some voltmeters will not respond this quickly, so the value of the voltages may not appear to be correct; however, if the voltage appears to be changing at regular intervals, it may be assumed that this function is operating properly.

This completes the low voltage portion of the unit test. Go to step 8.

7. For the ETPHCC or ETPHCC1, the associated consignment controller must be directed to output a 50% On pulse width modulation signal. For three phase, verify that the LED is pulsing at regular intervals. The rate of the pulse is based on the output from the consignment controller. If the unit is single phase, the DC voltage between P4 and P6 of the interface board should vary between the full Off and full On voltages in steps 4 and 5.

Some voltmeters will not respond this quickly, so the value of the voltages may not appear to be correct; however, if the voltage appears to be changing at regular intervals, it may be assumed that this function is operating properly.

8. If the heater always remains energized when power is applied, remove the wire from P4 of the interface circuit board. If the heat remains on, there is a wiring error or the SSR is defective.

Remove Power From the Unit Before Proceeding With the Next Step.

9. If the heater is always de-energized when power is applied, remove the line and load connections to the proportional heat control and temporarily tie them together. If the system is a three phase arrangement, do the phases one at a time.

Always remove power from the unit before moving to the next phase).

Make sure there is no danger of the temporary connection shorting to another component or the chassis. Briefly reapply power. If the section of heat under test now energizes, the SSR is defective. If heater still will not energize, one of the heater safety devices (limits, safety contactor or airflow switch) or elements is defective.

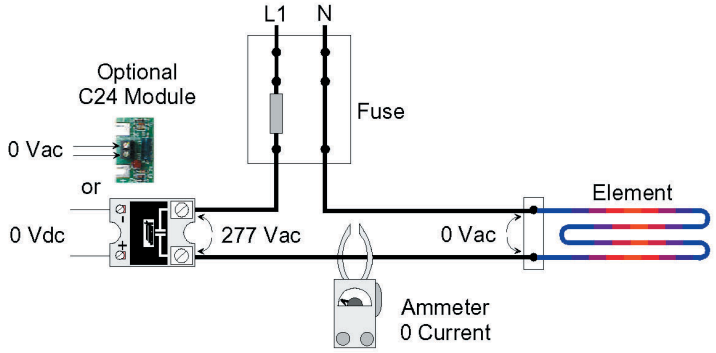
PROPORTIONAL HEAT CONTROL

(SSR) TROUBLESHOOTING GUIDE

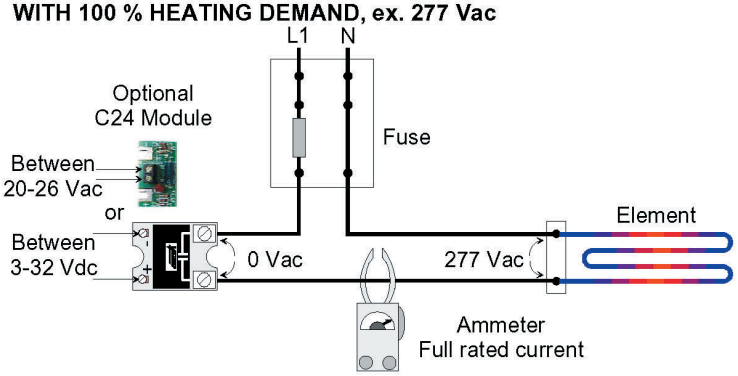
Tutco Heaters, All Power Modules

- Install the ammeter on the line voltage input wire of heater.
- This is your primary source of information to know if the heater is operative or not.
- A multimeter set in Ohms cannot be used to confirm that the high voltage contact of a power module is closed.
- You cannot confirm R820 power module operation unless a load is applied

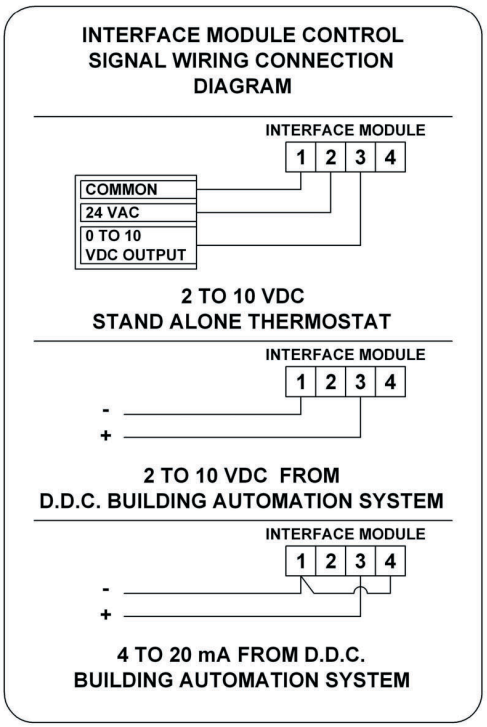
NO DEMAND, ex. 277 Vac



WITH 100 % HEATING DEMAND, ex. 277 Vac



| TUTCO HEATER INTERFACE |

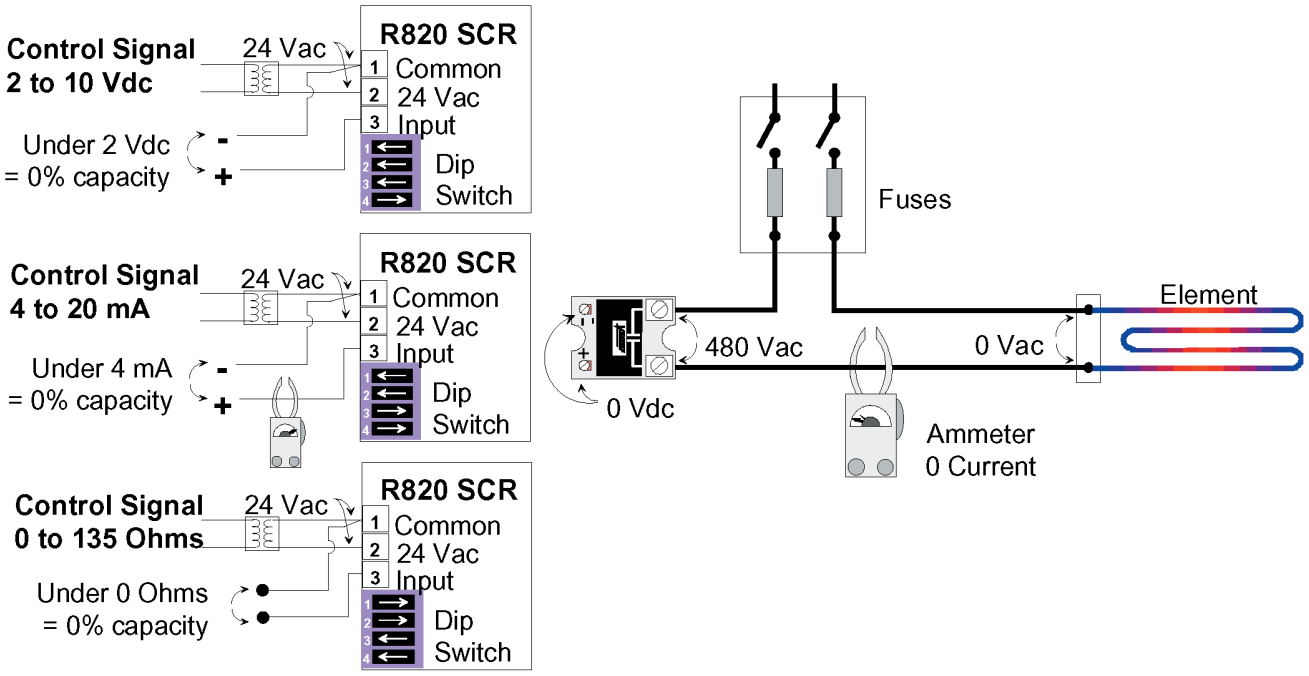


PROPORTIONAL HEAT CONTROL

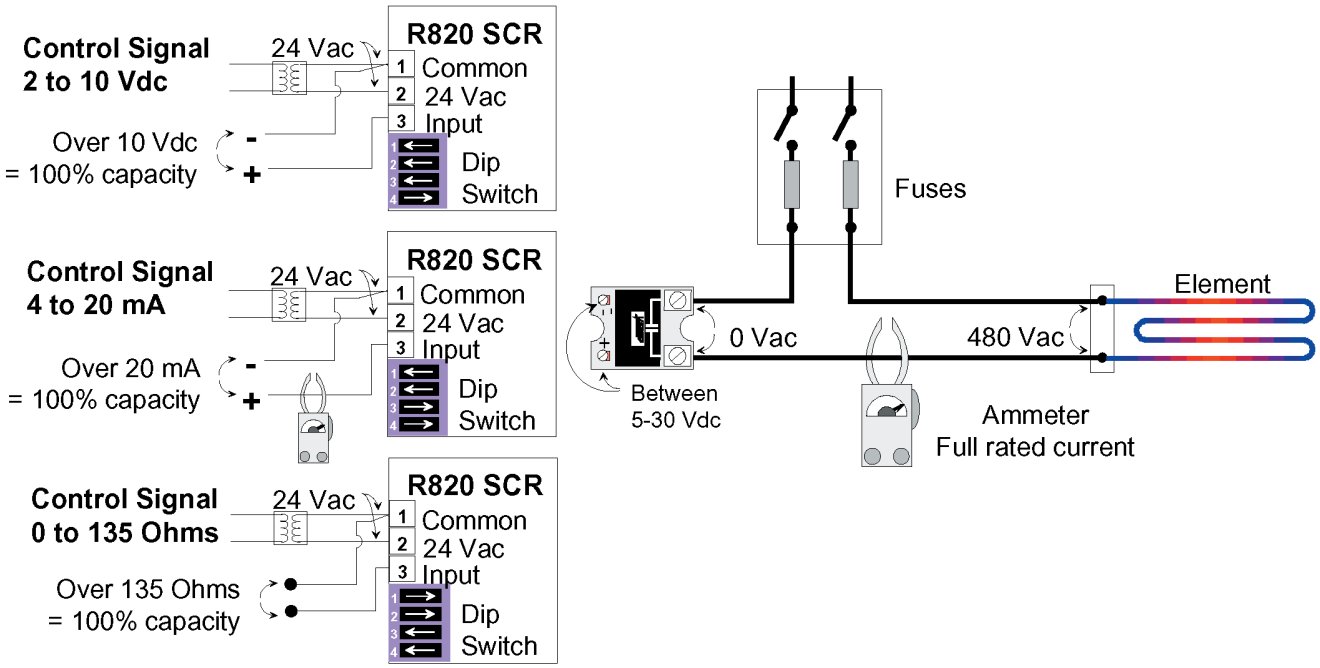
(SSR) TROUBLESHOOTING GUIDE

Tutco Heaters, R820 SCR's

NO DEMAND, ex. 480 Vac



WITH 100 % HEATING DEMAND, ex. 480 Vac

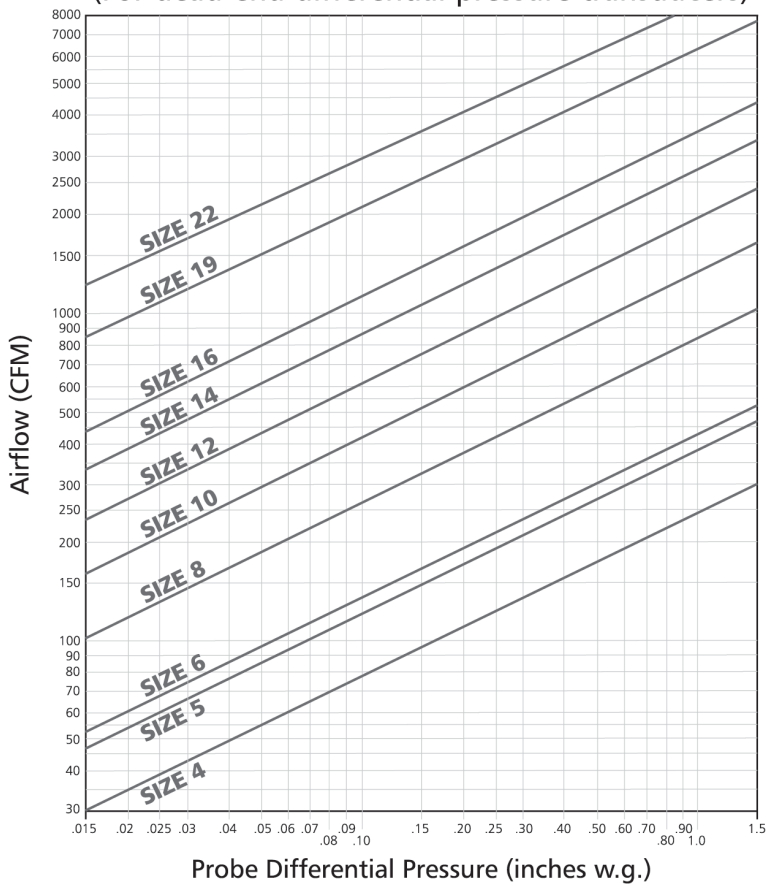


CALIBRATION CHARTS

FlowStar™ Calibration Chart

(For dead-end differential pressure transducers)

Model TSS



NOTE: Maximum and minimum CFM limits are dependent on the type of controls that are utilized. Refer to the table below for specific values. When DDC controls are furnished by others, the CFM limits are dependent on the specific control vendor that is employed. After obtaining the differential pressure range from the control vendor, the maximum and minimum CFM limits can be obtained from the chart above (many controllers are capable of controlling minimum setpoint down to .015" w.g.).

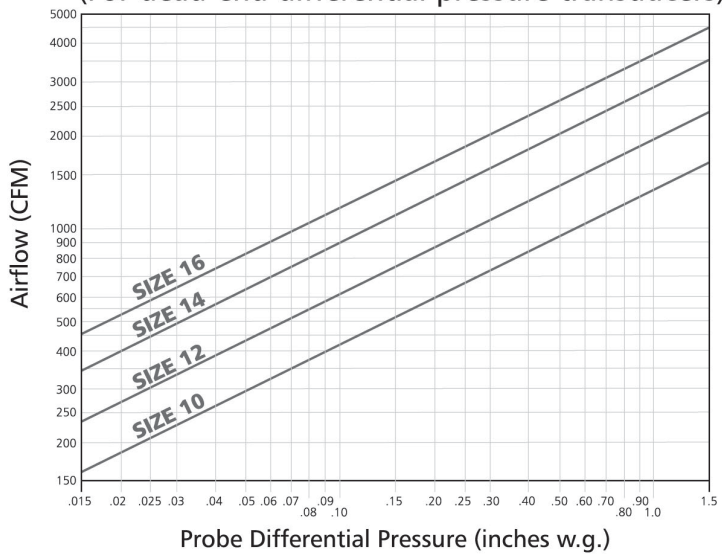
UNIT SIZE	400 SERIES (PNEUMATIC) STANDARD CONTROLLER		7000 SERIES ANALOG ELECTRONIC		DDC CONSIGNMENT CONTROLS *(See Notes Below)*				
					MIN.			MAX.	
	MIN.	MAX.	MIN.	MAX.	Min. transducer differential pressure (in. w.g.)			Max. transducer differential pressure (in. w.g.)	
					0.015	0.03	0.05	1.0	≥1.5
4	43	250	35	250	30	43	55	250	250
5	68	350	50	350	48	65	88	350	350
6	75	490	60	550	53	75	97	435	530
8	145	960	115	1000	105	145	190	840	1000
10	235	1545	185	1600	165	235	305	1355	1600
12	340	2250	285	2300	240	340	440	1975	2300
14	475	3100	390	3100	335	475	615	2750	3100
16	625	4100	520	4100	440	625	805	3595	4100
19	1180	6500	1025	6500	845	1180	1510	6375	6500
22	1730	8000	1450	8000	1260	1730	2200	8000	8000

Notes:

1. Minimum and maximum airflow limits are dependent on the specific DDC controller supplied. Contact the control vendor to obtain the minimum and maximum differential pressure limits (inches w.g.) of the transducer utilized with the DDC controller.
2. Maximum CFM is limited to value shown in General Selection Data.
3. FlowStar™ differential pressure tubing connections: High side indicated by red tubing; Low side indicated by black tubing.

FlowStar™ Calibration Chart

(For dead-end differential pressure transducers)



Model TSL

NOTE: Maximum and minimum CFM limits are dependent on the type of controls that are utilized. Refer to the table below for specific values. When DDC controls are furnished by others, the CFM limits are dependent on the specific control vendor that is employed. After obtaining the differential pressure range from the control vendor, the maximum and minimum CFM limits can be obtained from the chart above (many controllers are capable of controlling minimum setpoint down to .015" w.g.).

UNIT SIZE	400 SERIES (PNEUMATIC) STANDARD CONTROLLER		7000 SERIES ANALOG ELECTRONIC		DDC CONSIGNMENT CONTROLS *(See Notes Below)*				
					MIN.			MAX.	
	MIN.	MAX.	MIN.	MAX.	Min. transducer differential pressure (in. w.g.)			Max. transducer differential pressure (in. w.g.)	
					0.015	0.03	0.05	1.0	≥1.5
10	235	1545	170	1600	170	235	305	1370	1600
12	340	2250	240	2300	240	340	435	1955	2300
14	495	3100	350	3100	350	495	640	2855	3100
16	660	4100	465	4100	465	660	850	3800	4100

Notes:

1. Minimum and maximum airflow limits are dependent on the specific DDC controller supplied. Contact the control vendor to obtain the minimum and maximum differential pressure limits (inches w.g.) of the transducer utilized with the DDC controller.
2. Maximum CFM is limited to value shown in General Selection Data.
3. FlowStar™ differential pressure tubing connections: High side indicated by red tubing; Low side indicated by black tubing.

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