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84 MARGINAL WAY

CORE AND SHELL

HEATING PERMIT APPLICATION

CONTENTS:

- Application (copy)
- Mechanical Equipment Summary
- Structural Engineer Letter
- Equipment
    - Boilers
    - Rooftop Units
    - Roof-Mounted Air Handler
    - Package Chiller
    - Circulators
    - Unit Heaters
    - Fans
    - Boiler Venting
- Applicable Blueprints (loose)

Presented by: Thayer Corporation
1400 Hotel Road
Auburn, Maine 04210

Date: April 2, 2008

FILL IN AND SIGN WITH INK

APPLICATION FOR PERMIT
HEATING OR POWER EQUIPMENT

To the INSPECTOR OF BUILDINGS, PORTLAND, ME.

The undersigned hereby applies for a permit to install the following heating, cooking or power equipment in accordance with the Laws of Maine, the Building Code of the City of Portland, and the following specifications:

Location / CBL 94 Marginal Way Use of Building Office Date 4/2/08

Name and address of owner of appliance Atlantic Bayside Trust
50 Portland Pier, Suite 400 Portland, ME 04101

Installer's name and address Thayer Corporation 1400 Hotel Road, Auburn, ME
Telephone (207) 782-4197

Location of appliance:
- ☐ Basement
- ☐ Floor
- ☐ Attic
- ☑ Roof

Type of Fuel:
- ☑ Gas
- ☐ Oil
- ☐ Solid

Appliance Name: Buderus

U.L. Approved ☑ Yes ☐ No

Will appliance be installed in accordance with the manufacture's installation instructions? ☑ Yes ☐ No

IF NO Explain:

The Type of License of Installer:
- ☐ Master Plumber #
- ☐ Solid Fuel #
- ☐ Oil #
- ☑ Gas # PNT 1043
- ☐ Other

Type of Chimney:
- ☐ Masonry Lined
  Factory built
- ☑ Metal
  Factory Built U.L. Listing # 1738
- ☐ Direct Vent
  Type / UL#

Type of Fuel Tank
- ☐ Oil
- ☑ Gas

Size of Tank N/A

Number of Tanks N/A

Distance from Tank to Center of Flame N/A **feet.**

Cost of Work: $ 1,117,314

Permit Fee: $ 11,203.14

Approved

Fire:

Ele.:

Bldg.:

Approved with Conditions

☐ See attached letter or requirement

Inspector's Signature

Date Approved

Signature of Installer Andrew Kent - Project Engineer

White - Inspection Yellow - File Pink - Applicant's Gold - Assessor's Copy

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Inspector of Buildings
City of Portland
389 Congress Street
Portland, ME 04101

April 2, 2008

Re: 84 Marginal Way Core and Shell Mechanical Summary

Dear Inspector,

Following is information in support of our application for the Heating Permit for the office building project at 84 Marginal Way. The summary below will provide a narrative of the basic mechanical systems we are installing in the building core and shell only. We hope that this information will be of assistance to you as you review our application.

Mechanical Summary

The system scheduled for installation on this project is a variable air volume with hydronic system that will consist of the following:

Boiler Plant

The boiler plant is located in the penthouse on the 11th level of the building. Cast-iron sectional natural gas fired boilers will be located in the boiler room and be vented via a Category IV manufactured system through the roof. A sidewall combustion air intake louver sized for the combined maximum firing rate of the boilers will provide the necessary combustion air. A sidewall louver will be provided for relief of heat in the boiler room. Also located in the boiler room are circulators and associated hydronic components.

Package Rooftop Units

A total of (5) roof-mounted packaged gas-fired rooftop units will provide heating, cooling, ventilation, and relief air for the office and common areas. Units will be equipped with direct digital controls and receive operating instructions from the building management system. Rooftop units will configured in a variable air volume arrangement with airflow monitoring stations and duct smoke detectors on the supply and return duct systems. The units will supply variable air volume boxes with reheat coils throughout the building (provided and installed by others).

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www.thayercorp.com

THAYER CORPORATION

April 2, 2008

Roof-Mounted Air Handler

A roof-mounted horizontal discharge air handler will serve the surgical suite for the Intermed Medical Office tenant. The air handler will be fed chilled water from the dedicated roof-mounted packaged chiller and hot water from the building boiler plant. The air handler will be configured in a variable air volume arrangement with airflow monitoring stations and duct smoke detectors on the supply and return duct systems.

Package Chiller

The dedicated air-cooled package chiller is located on the roof in close proximity to the roof-mounted air handler. The unit will provide chilled water to the air handler only. An on board circulator will provide system flow. The chiller will operate in a stand-alone fashion with monitoring and enable/disable signals by the building controls system.

Fans (exhaust)

A total of (3) roof-mounted centrifugal fans provide exhaust for all bathrooms, break rooms/kitchenettes, janitor's closets, and electrical closets. Fans operate continuously and are equipped with variable frequency drives.

Fans (stairwell pressurization)

A total of (2) roof-mounted utility blowers will provide for stairwell pressurization in the event of fire. Stairwells serving the office areas will receive the pressurization. In the event of fire the units will start and operate to provide fresh air to the stairwells in sufficient volume to meet the applicable codes for buildings of this height. The fans will continue to operate until manually de-activated.

Unit Heaters

Hydronic unit heaters are located in the stairwells serving the office areas and will operate as necessary to provide heat to the stairwells.

We hope that this information has given you additional insight into the configuration and execution of the mechanical systems for this project. Please do not hesitate to contact us with any questions or concerns.

Sincerely,

Andrew Kent

Andrew Kent
Project Manager

BECKER
structural engineers, inc.

March 12, 2008

Jared Ballard
Pizzagalli Construction Company
131 Presumpscot Street
Portland, ME 04108

RE: ROOF TOP MECHANICAL EQUIPMENT SUPPORT
84 MARGINAL WAY
PORTLAND, MAINE

Dear Jared:

As requested, this letter is confirmation that the roof structure for the project at 84 Marginal Way in Portland has been designed to support isolated mechanical equipment.

The equipment and the equipment weights were shown on our roof drawing dated 7/30/07. This drawing was submitted to the City of Portland as part of the superstructure permitting process. The equipment included five base building air handling units, two tenant air handling units and several exhaust fans, including fans for stair pressurization.

Please feel free to contact me at (207) 879-1838 if you have any additional questions or comments regarding this issue.

Sincerely,
BECKER STRUCTURAL ENGINEERS

Paul B. Becker, P. E.
President

STATE OF MAINE
PAUL B.
BECKER
NO. 6554
LICENSED
PROFESSIONAL ENGINEER

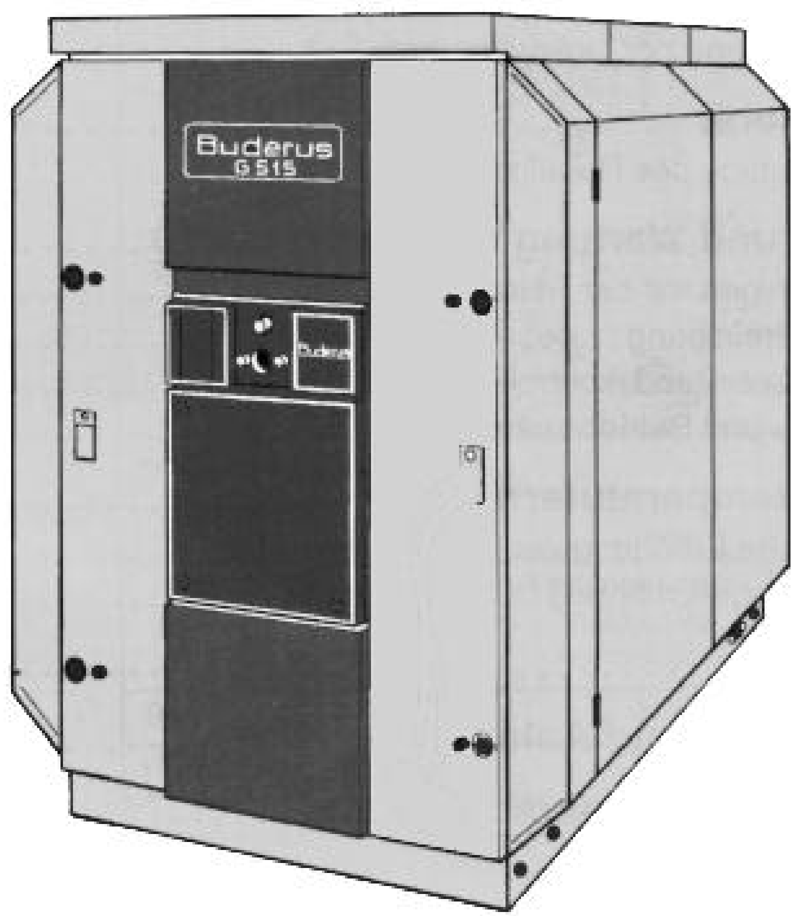
CC: Andy Kent – Thayer Corporation

5645 422-8/97 USA

Buderus
HYDRONIC SYSTEMS

Assembly, Maintenance and Operating Instructions

Buderus G515 Boiler



Save These Instructions !

This assembly, maintenance and operating manual must be kept near the boiler !

TABLE OF CONTENTS

General guidelines

Installation, maintenance and service of this boiler must only be carried out by a qualified contractor. The assembly sequence is essential to reliable operation of the boiler and associated heating system. The boiler can be assembled, hydrostatically tested and operated without boiler insulation and jacket panels. These items can be installed at a later date without disrupting boiler operation.

NOTE: A minimum supply temperature of 122° F must be maintained during burner operation. Controls must be provided that will shut off circulation through the boiler when the supply temperature drops below 122° F. This requirement applies only during burner operation. There is no minimum return water temperature requirement.

All work shall be performed in strict accordance with the requirements of state and local regulating agencies and codes dealing with boiler installations. Initial start-up must be performed by qualified personnel. After start-up the owner or its representative should be instructed about the boiler operation and be given the assembly and maintenance manual.

Boiler cleaning and maintenance must be carried out once annually. This includes an overall check of the heating system. Any discrepancies must be corrected immediately.

NOTE: To perform the hydrostatic pressure test after the boiler is assembled, 2-125 lbs. 4” blanking flanges, 3/4” and 1” plugs and a 3/4” air vent may be needed. These items are *not* furnished with the boiler.

NOTE: This manual is for reference only. The manual does NOT purport to address all design, installation and safety considerations. It is the responsibility of the user of this manual to determine the applicability and safety of each individual application and ensure its compliance with local building codes.

It is expected that the user/installer is a licensed heating contractor with knowledge of accepted industry practices for the installation and maintenance of the equipment and various applications of the equipment involved.

2 Operating Data

Boiler operating ratings

Maximum supply temperature: 248°F (120°F)
Maximum operating pressure: 58 psi (4 bar)

Water quality requirements

Fill water requirement: water with alkalinity < 200 mg/li for initial system filling.

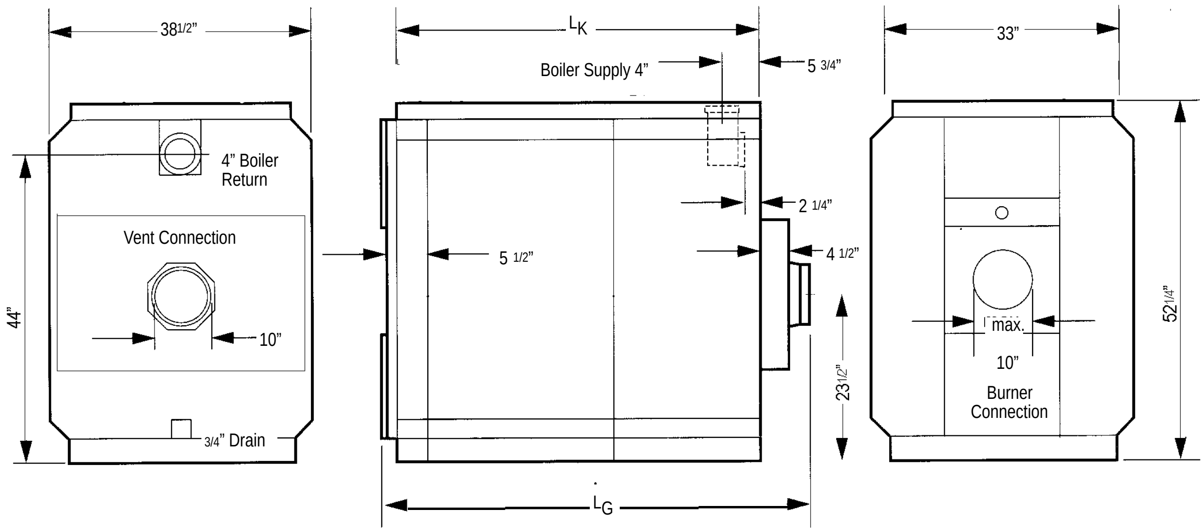
Make-up water requirement: water with alkalinity < 30 mg/li

System water requirements:

pH value (@ 77°F):	9.0 - 10.0
Acid capacity:	3.0 - 50 mg/li
Oxygen (O2):	.01%
Phosphate (P205):	2.5 %
Sodium sulfate (Na2SO3):	1 - 4%

For overall system protection, it is recommended to install a filter and sludge removal system in the boiler return piping.

Any approved (based on application testing at burner manufacturer's facilities) oil or power gas burner can fire into G515 boilers. Burners with low fire start or two stage firing are recommended. The high fire setting on the burner should match the rated output of the boiler to prevent condensation in the heat exchanger. The CO volume percent in undiluted, dry flue gas should not exceed .04% (400 ppm).



Rear View Side View Front View

Table 1: Boiler Dimensions

Gross Output Mbtu/h	818	1009	1200	1391	1582	1773
No. of Sections	7	8	9	10	11	12
Overall Boiler Length (L_G) In.	62 1/4	69	75 3/4	82 1/2	89 1/4	95 3/4
Boiler Block Length (L_K) In.	54 1/2	61	67 1/2	74 1/4	81	87 1/2
Minimum Boiler Width In.	33	33	33	33	33	33
Fire Box Depth In.	45 3/4	52 1/2	59 1/4	66	72 1/2	79 1/4
Fire Box Diameter In.	20 1/4	20 1/4	20 1/4	20 1/4	20 1/4	20 1/4
Fire Box Volume cu. ft.	14.87	17.16	19.46	21.75	24.05	26.31
Dry Weight Lbs.	2731	3059	3505	3864	4188	4541
Water Content Gal.	68.2	77.7	87.2	96.7	106.2	115.7
Operating Weight Lbs.	3300	3707	4233	4671	5074	5506
Vent Connection Size In.	10	10	10	10	10	10
Door Thickness In.	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2

Table 2: Technical Specifications

Gross Output Mbtu/h	818	1009	1200	1391	1582	1773
No. of Sections	7	8	9	10	11	12
Boiler HP	24.5	30.2	35.9	41.6	47.3	53.0
NET IBR Rating Mbtu/h	711	877	1043	1210	1376	1542
Max Input Oil GPH	6.9	8.4	10.0	11.6	13.0	14.6
Max Input Gas Mbtu/h	995	1216	1438	1660	1881	2103
Fire side heating surface sq. ft.	113.9	132.0	150.3	168.5	186.7	204.8
Combustion efficiency Oil %	88.2	88.2	88.1	88.1	88.1	88.1
Combustion efficiency Gas %	85.6	85.5	85.5	85.5	85.4	85.4
Gross stack temp low fire °F	280	280	284	264	266	284
high fire °F	327-361	322-361	322-351	315-340	318-342	327-345
Fire Box Pressure In. WC	.20-.24	.40-.57	.44-.65	.85-1.17	1.0-1.33	.97-1.25

4 Boiler Foundation and Minimum Boiler Clearances

Boiler foundation preparations

It is required that the boiler is placed on a level, smooth concrete base, of sufficient strength. The width of the platform must be 33 1/2”. It is required to cement in either a 4” x 1/4” flat steel plate or a 4” x 2” x 1/4” angle iron, as shown in Figure 2; Table 3 shows dimensions.

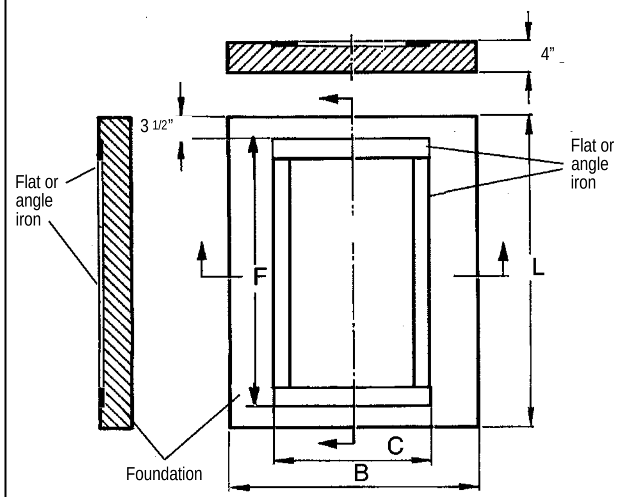


Fig. 2

Table 3: Foundation and support strip lengths

Model	B	L	C	F
515/7	33 1/2	53 1/2	21 1/2	46 3/4
515/8	33 1/2	60 1/4	21 1/2	53 1/2
515/9	33 1/2	67	21 1/2	60 1/4
515/10	33 1/2	73 1/2	21 1/2	67
515/11	33 1/2	80 1/4	21 1/2	73 1/2
515/12	33 1/2	87	21 1/2	80 1/4

Minimum wall clearances

The recommended wall clearances must be observed in order to open the burner door, assemble the boiler and allow sufficient access for boiler maintenance.
(See Figures 3 and 4 for details).

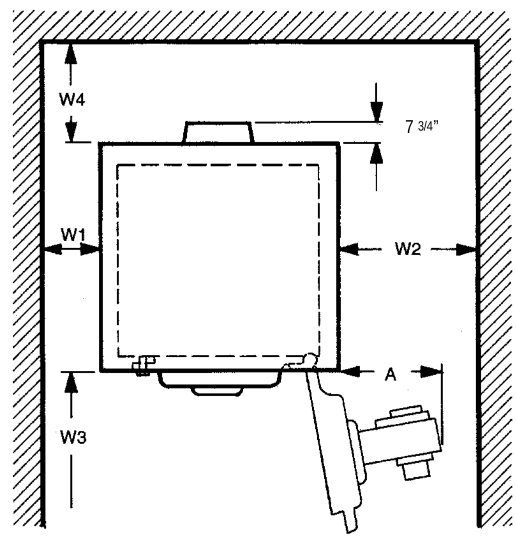


Fig. 3

The burner door is field adjustable to hinge right or left.

Recommended clearances:

Wall clearance W1: minimum 12”.
Wall clearance W2: Burner length A + 4”, minimum 43”.
Wall clearance W3: Boiler length L + 40”.
Wall clearance W4: 1/2 Boiler length + 20”.

Absolute minimum clearances:

Wall clearance W1: minimum 12”.
Wall clearance W2: Burner length A + 4”, minimum 36”.
Wall clearance W3: Boiler length L or minimum 86”.
Wall clearance W4: 36”.

Note: Wall clearance W3 can be reduced to 4 feet for assembled boilers. Boiler cleaning will now require use of segmented brushes.

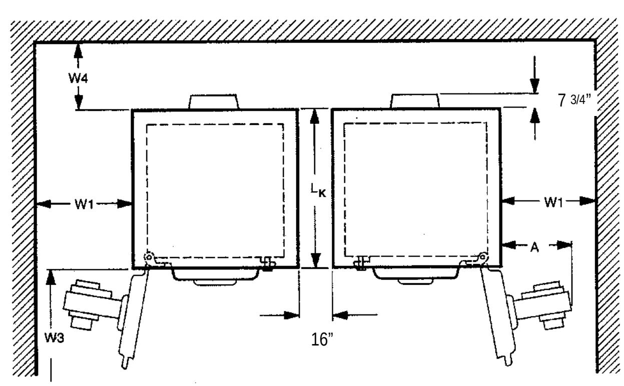


Fig. 4

Assembly Tools/Tools Req'd for Boiler Assembly 5

Assembly tools and auxiliary assembly materials

- ✔ Boiler assembly tool rods size 2.2 (2 pieces)
- ✔ Wooden or rubber mallet
- ✔ Half-round rough file
- ✔ Flat head and Phillips screwdrivers
- ✔ Flat chisel, steel strips for boiler support
- ✔ Metric wrenches sizes 13, 19, 24, 36 and socket size 19 (US equivalent sizes may also be used)
- ✔ Cleaning rags, machine oil, gasoline or paint thinner, level, steel wire brush, tape measure, chalk.

Boiler assembly tool components

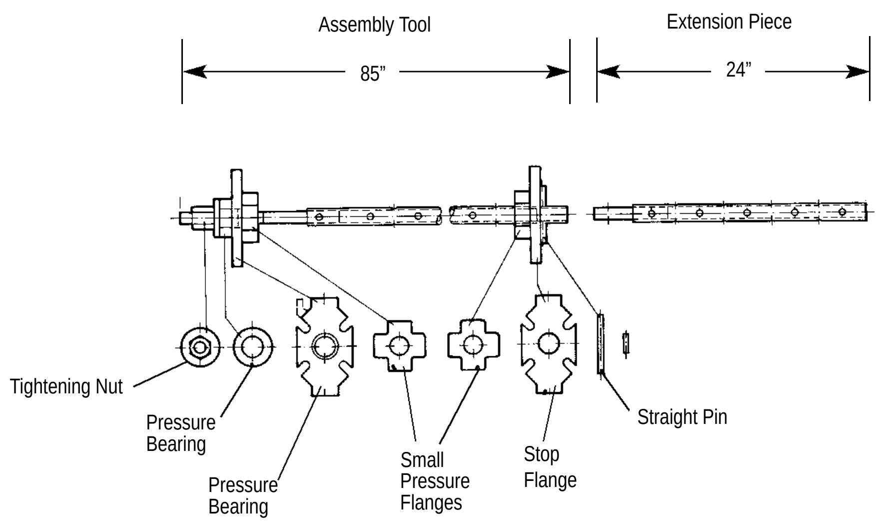


Table 4. Assembly tool requirements

No. of Sections	Assembly Tool	Extension Piece	Total tool Length (ft)
7-10	1	0	7
11-12	1	1	9

6 Boiler Assembly

Boiler block sectional arrangement

The boiler is always assembled starting with the rear section and finishing with the front section.

The arrow markings on the sections must point to the rear (Fig. 5) and use the sequence in Table 5.

Model	No. of Front Section	No. of Midsections	No. of Rear Section
515/7	1	5	1
515/8	1	6	1
515/9	1	7	1
515/10	1	8	1
515/11	1	9	1
515/12	1	10	1

Table 5: Boiler section arrangement

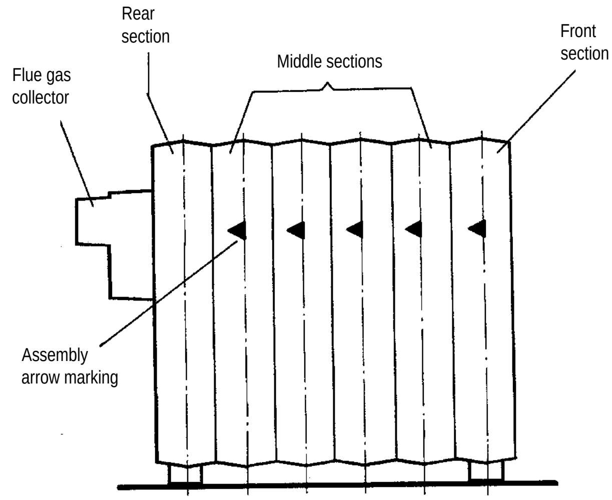


Fig. 5

Assembly of individual boiler sections

- Remove the nuts and washers from the rear and front sections prior to boiler assembly.
- Note the arrow marking on each section. These arrows are located on the top left and right of each section and must point to the rear during boiler assembly (Fig. 5).
- Assemble the boiler on a smooth hard surface with flat steel plates underneath to permit easy sliding of sections.
- Position and align the rear section upright in final location and secure it from falling over (Fig. 6).
- To reduce the risk of injuries, support the boiler section or secure it with an overhead lifting device.

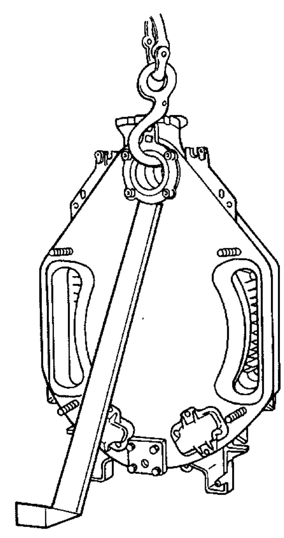


Fig. 6

Boiler Assembly 6

CAUTION: The work area must be well ventilated during boiler assembly .

WARNING: Keep Haftgrund 181 away from flame ! Do not smoke during assembly ! *Do not* pour Haftgrund 181 down open drains !

- File off any burrs from the nipple ports (Fig. 7).

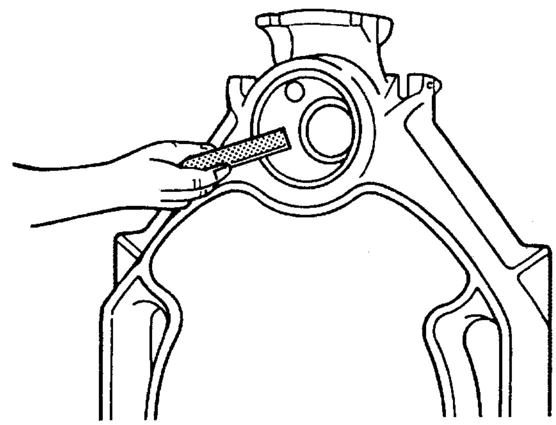


Fig. 7

- Clean the sealing surfaces of the nipple ports with a rag soaked in thinner or gasoline. Wipe dry.
- Evenly coat the nipple port sealing surfaces with the orange sealing compound (Leinolmennige) using the brush provided (Fig. 8).

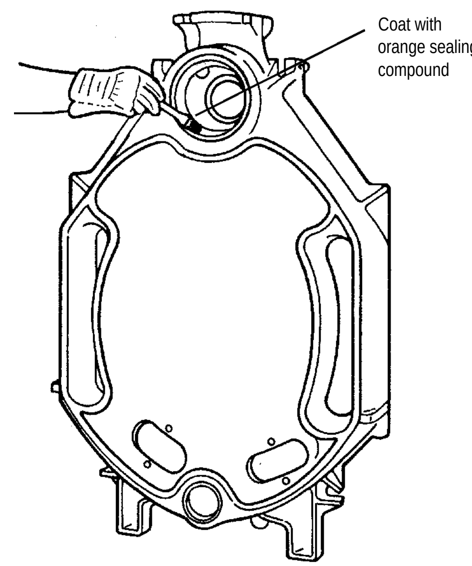


Fig. 8

- Clean the sealing grooves for sealing the flue side of the boiler using an abrasive rag or steel wire brush. Make sure surfaces are dry, clean and free of any oily residues.
- Apply the Buderus Haftgrund Primer 181 to all sealing grooves using a small paint brush (Fig. 9).
- The sealing of the flueway of each section is achieved with the sealing cord. The sealing cord can be installed 5 to 15 minutes after the application of the primer.

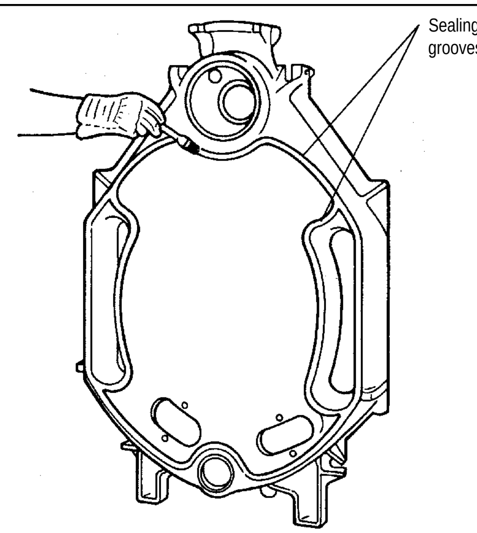


Fig. 9

6 Boiler Assembly

• Insert the elastic sealing cord ("Dichtschnur") into the sealing groove only on the front side of the rear section. Start at the top and press lightly to adhere to the Primer 181 (Fig. 10).

• Unroll sealing cord and remove paper backing during installation. Cut sealing cord to length with a pair of scissors or knife. Butt sealing cord ends tightly together or overlap cord ends 1" for proper sealing.

• Clean a set of push nipples with a rag soaked in thinner. Wipe dry. A set consists of the 7 1/8" x 2 3/4" top nipple and the 3 1/4" x 2" bottom nipple.

• Evenly coat slightly over half the width of the outer surface of each push nipple with the orange sealing compound.

• Insert the coated side of the nipples in the ports.

• Set nipples in place by tapping evenly with a rubber or wooden mallet. Make sure the nipples remain perfectly aligned with the boiler section (Fig. 11).

NOTE: *If a burr occurred during nipple insertion, file it off immediately !*

• Finish coating the outer surface of the push nipples with orange sealing compound.

• Clean and coat nipple ports of intermediate section with orange sealing compound. Also clean flueway sealing grooves.

This completes the preparation of the joint between the rear section and the first intermediate section.

Check: 1. Both push nipples installed evenly with the rear section and nipples and ports fully coated with orange sealing compound.
2. Sealing cord is properly installed in all sealing grooves.

• Position intermediate section in front of rear section and hang from upper nipple. It may be necessary to lift up the intermediate section at the bottom with a bar. Arrow markings must point to the rear.

• After aligning ports with push nipples, tap against the intermediate section with the mallet to seat it on the push nipples from the rear section (Fig. 12).

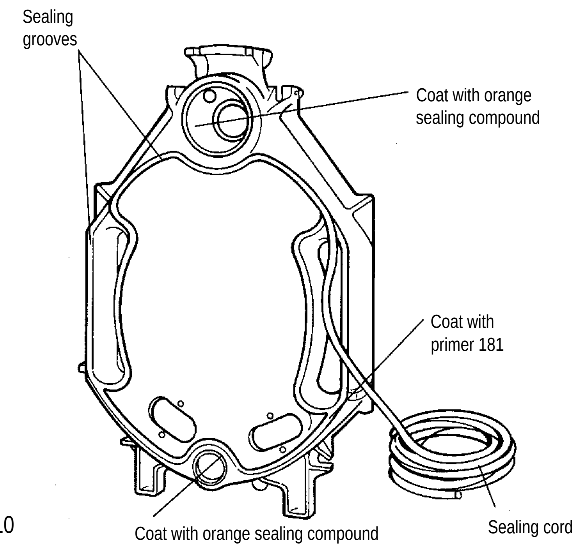


Fig. 10

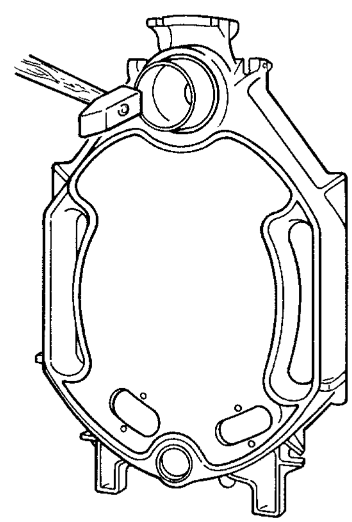


Fig. 11

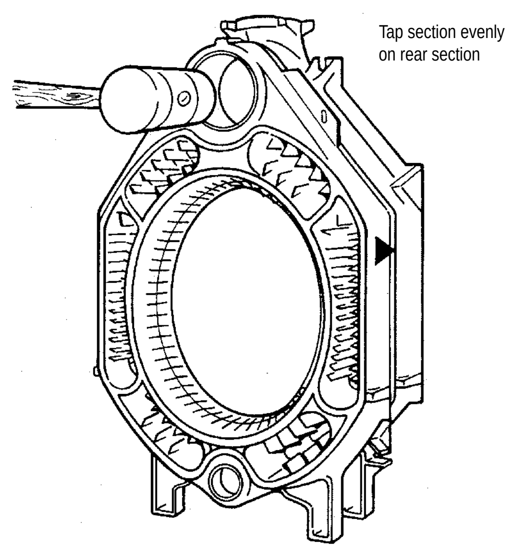


Fig. 12

Pull sections together with boiler assembly tool

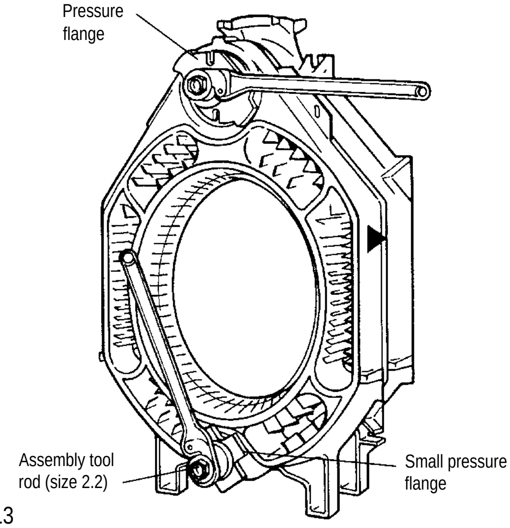


Fig. 13

- Place assembly rods through upper and lower ports as shown (Fig. 13).
- Slide small pressure flange on each end of the lower assembly rod.
- Thread the pressure flanges on the rods.
- Slide stop flange on upper rod, insert straight pins on both rods.
- Lock flanges on assembly rods with straight pins in place by hand tightening assembly tools.
- Ensure that the tools are centered in the ports by having flanges properly located.
- Use socket wrenches provided to draw sections together evenly. Stop tightening when boiler sections abut metal to metal. Unscrew assembly tools.

NOTE: Inspect seating to ensure nipples ar e seated square. Never draw more than one section at a time to avoid damage to the nipples and ports.

- Repeat boiler assembly procedure for subsequent sections as detailed on pages 9-11.

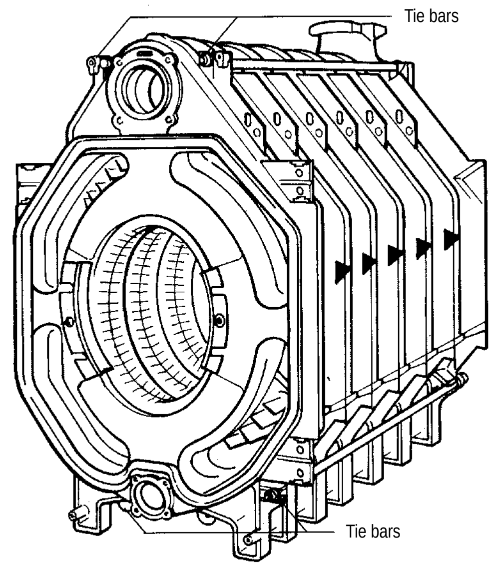


Fig. 14

NOTE: After the boiler block has been drawn together, loosen the tools, but do not remo ve.

- Install tie bars in the cast iron slots on the left and right sides of the upper and lower nipple ports (Fig. 14).
- Slide one spring assembly on each tie bar at the front section. Do not disassemble the spring assemblies ! Place a washer and nut at both ends of each tie bar.
- Hand tighten each nut first; then tighten the tie bar nuts on one end by 1 to 1 1/2 turns with a wrench.
- Level the boiler horizontally and vertically using the provided section foot wedges. Now, remove the assembly tools.

7 Hydrostatic Test

Hydrostatic Test

Preparing for the hydrostatic test

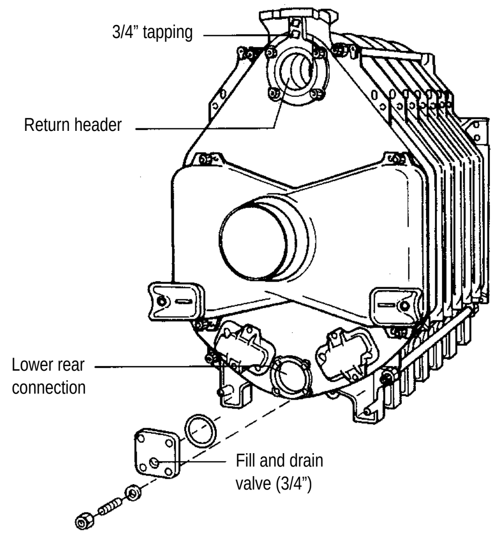


Fig. 15

- A pop-off relief valve is recommended on cold water feed line to prevent over pressurization.
- Install return header pipe per instructions on page 13.
- Seal the front ports with blank flanges and gaskets.
- Install return header with gasket provided (Fig. 15).
- Install supply header at the top of the rear section. See Chapter 10, page 23 for details. Install a temporary air vent (not provided) in one tapping.
- Blank off return and supply headers. (Blank flanges and gaskets not provided).
- Install fill/drain at the lower rear connection (Fig. 15).
- Install long shank well into 3/4" tapping of rear section.
- Fill the boiler. Vent the boiler at the air vent until water appears. Close the vent and pressurize the boiler.
- The assembled boiler shall be subjected to a hydrostatic test pressure not less than $1^{1/2}$ times the maximum allowable working pressure. The maximum test pressure shall not exceed the required test pressure by more than 10 psi.
- If a nipple port connection is leaking, bleed off test pressure, drain water through the fill/drain valve, remove the four tie and the return header pipe rods.
- Split the boiler at the leaking joint by driving chisels at the top and bottom between the sections (Fig. 16).
- Remove old nipples and clean ports as shown on page 9. Reinstall flue scaling material. Material can be reused. Reassemble per instructions on pages 10-12.

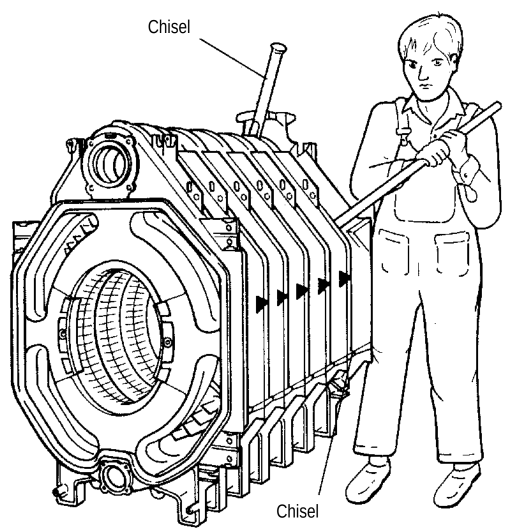


Fig. 16

NOTE: *Always use all new nipples when reassembling the boiler*

- Repeat the hydrostatic test to ensure no leaks.
- Install relief valve after the hydrostatic test.

Flue gas collector installation

- The pliable sealing rope is factory installed in the collector.
- Check for damage prior to installation.
- Place the flue gas collector on the studs and tighten with washers and nuts provided to ensure a gas tight seal (Fig. 17).

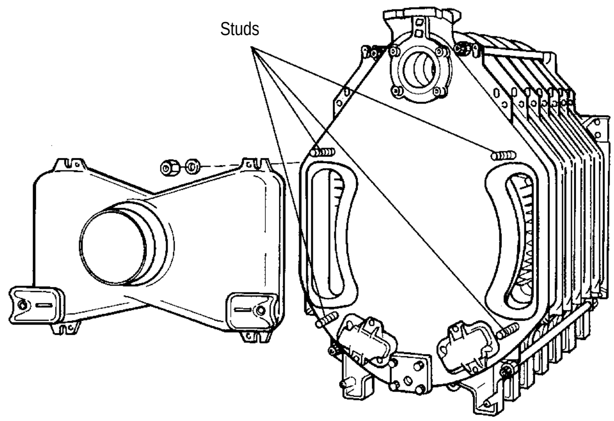


Fig. 17

Installation of rear section clean out co vers

- Install sealing ropes into grooves around cleaning covers.
- Place cleaning cover on studs provided (Fig. 18). Secure with washers and nuts provided to ensure a gas tight seal.

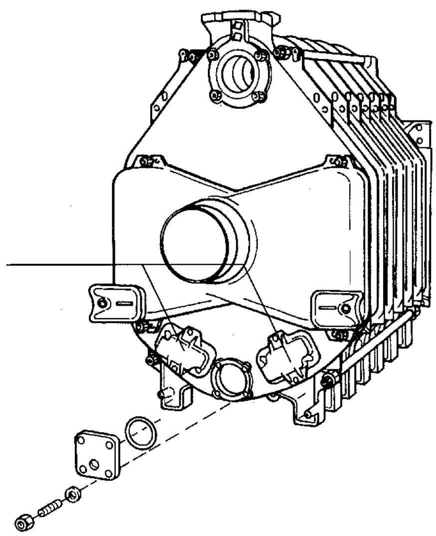


Fig. 18

Installation of return header pipe

- Place gasket over return header pipe (Fig. 19).
- Insert the return header pipe into upper port from the front of the boiler (Fig. 19).
- The tab on the header pipe must be aligned with the recess in the front boiler section. This locks the header pipe into proper position and ensures that the outlet openings are positioned correctly to provide optimum water distribution.
- Install blank flange on studs and secure with nuts and washers.

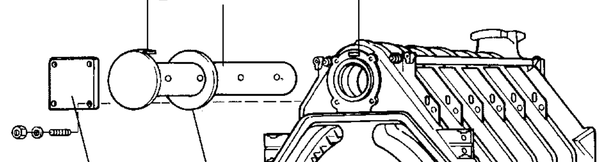


Fig. 19

8 Installation of Boiler Components

Flue gas blocking plates at front section

- Flue gas adjustment plates or ribs are factory installed on the front section with Allen head screws (Fig. 20).

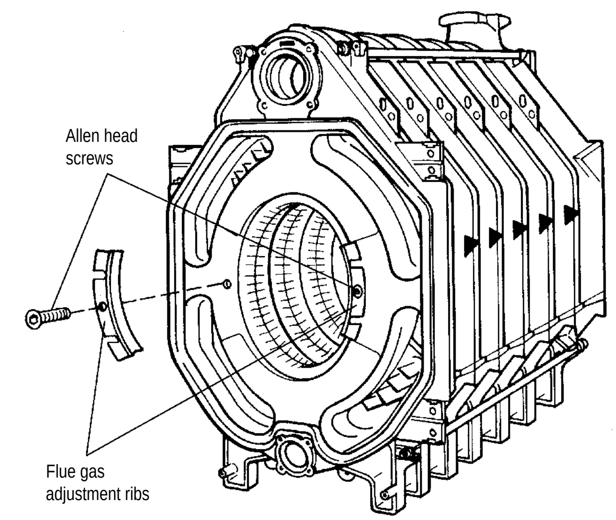


Fig. 20

Flue gas baffle plates

- Flue gas baffle plates are factory installed in an assembled boiler. Remove corrugated card board from baffle plates and insert plates as shown in Figure 21.

NOTE: The G515/12 boiler model does not have flue gas baffle plates.

No. of Sections	No.	Length in Inches	Installation Location for Flue Gas Baffles
7-10	1	26 3/4	Top Right
7-10	1	26 3/4	Top Left
7-10	1	26 3/4	Bottom Right
7-10	1	26 3/4	Bottom Left
11	1	16 3/4	Top Right
11	1	16 3/4	Top Left
11	1	16 3/4	Bottom Right
11	1	16 3/4	Bottom Left

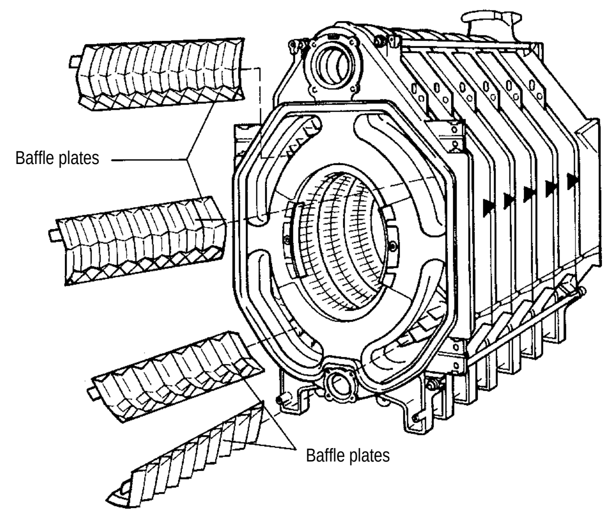


Fig. 21

Burner Door

- Attach sealing rope to front section by applying several drops of glue (P/N 422841) every 6” in the sealing grooves surrounding the combustion chamber and the outer area of the front section (Fig. 22).
- Insert the permanent pliable sealing rope in the grooves on the front section around the combustion chamber and the outer area.
- The burner door hinge supports are factory installed on the right side. Remove and mount them on the opposite side with (2) M12x55 bolts for a left hanging door.
- Mount the door hinges to the proper side of the door. (Fig. 22).
- Hang the burner door on the door hinge supports.

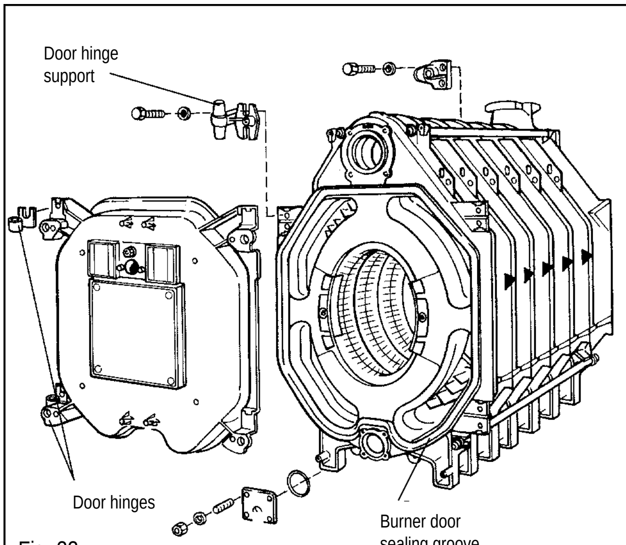


Fig. 22

- Mount the two door strike plates on the front section, with (2) M12x55 bolts each on the opposite side from the door hinge supports (Fig. 23). The strike plates must always be pointing towards the center of the boiler.

- The strike plates change position with the door hinge supports when the burner door is to swing the other way.

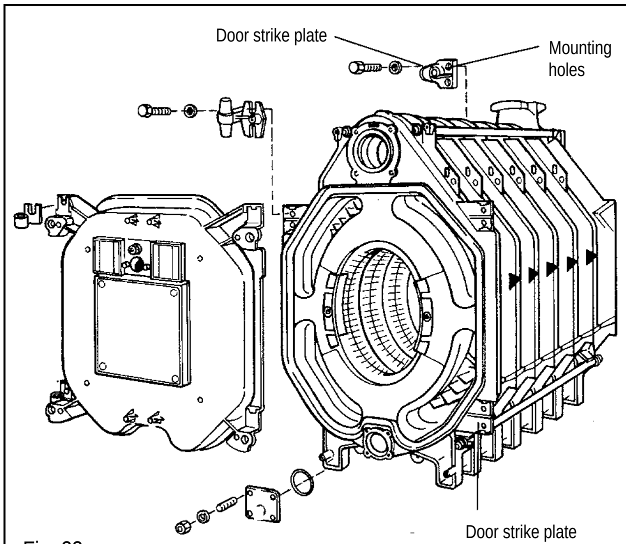


Fig. 23

- Hang and close burner door and tighten evenly with the (4) M16x140 burner door bolts (Fig. 24).

- Cut and drill the burner mounting plate according to burner specifications. (The burner plate can be cut by Buderus Hydronic Systems per specifications submitted with the boiler order).

- Mount burner mounting plate to burner door. Seal with 1/2” diameter sealing rope.

- Cut burner door insulation material to conform to burner tube diameter.

- Mount burner per manufacturers instructions.

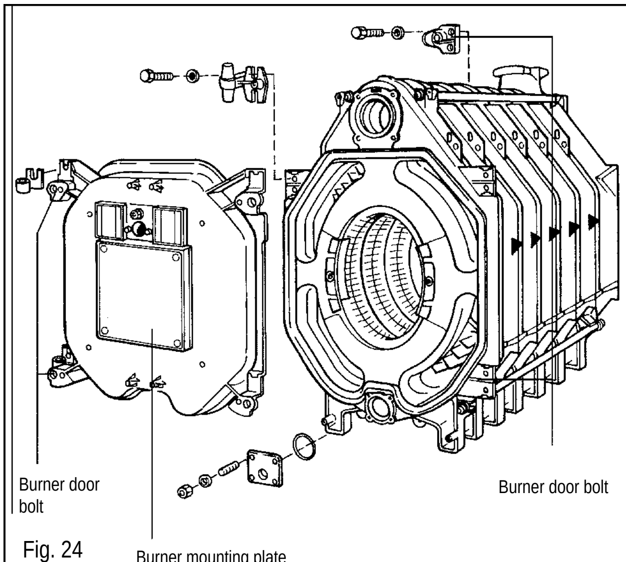


Fig. 24

Fill burner door with insulation per instructions below.

- Cover burner tube and sight glass port with paper to prevent filling these areas.

- Mix insulating cement with water to pulp consistency.

- Fill any spaces between burner door insulation and burner tube with the insulating cement (Fig. 25).

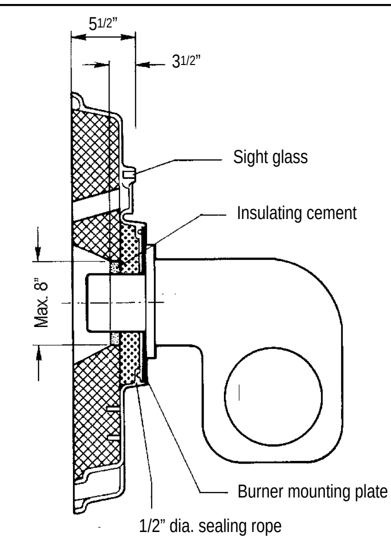


Fig. 25

9 Installation of Insulation & Boiler Jacket Panels

Location of support brackets for jacket panels

Support brackets are mounted on the front and rear sections. Intermediate brackets are located as measured from the front section per schedule below.

No. of Sections	7	8	9	10	11	12
Location of Bracket(s)	4	4	5	5	4,7	4,8

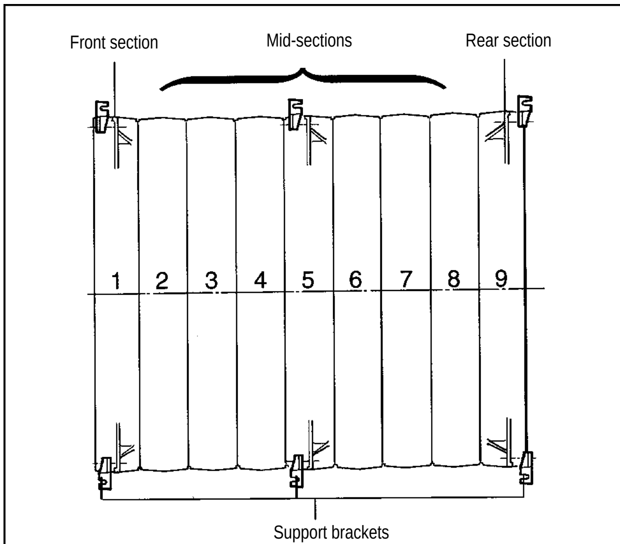


Fig. 27 Top view: 9-Section boiler with support brack-

Details of insulation blankets

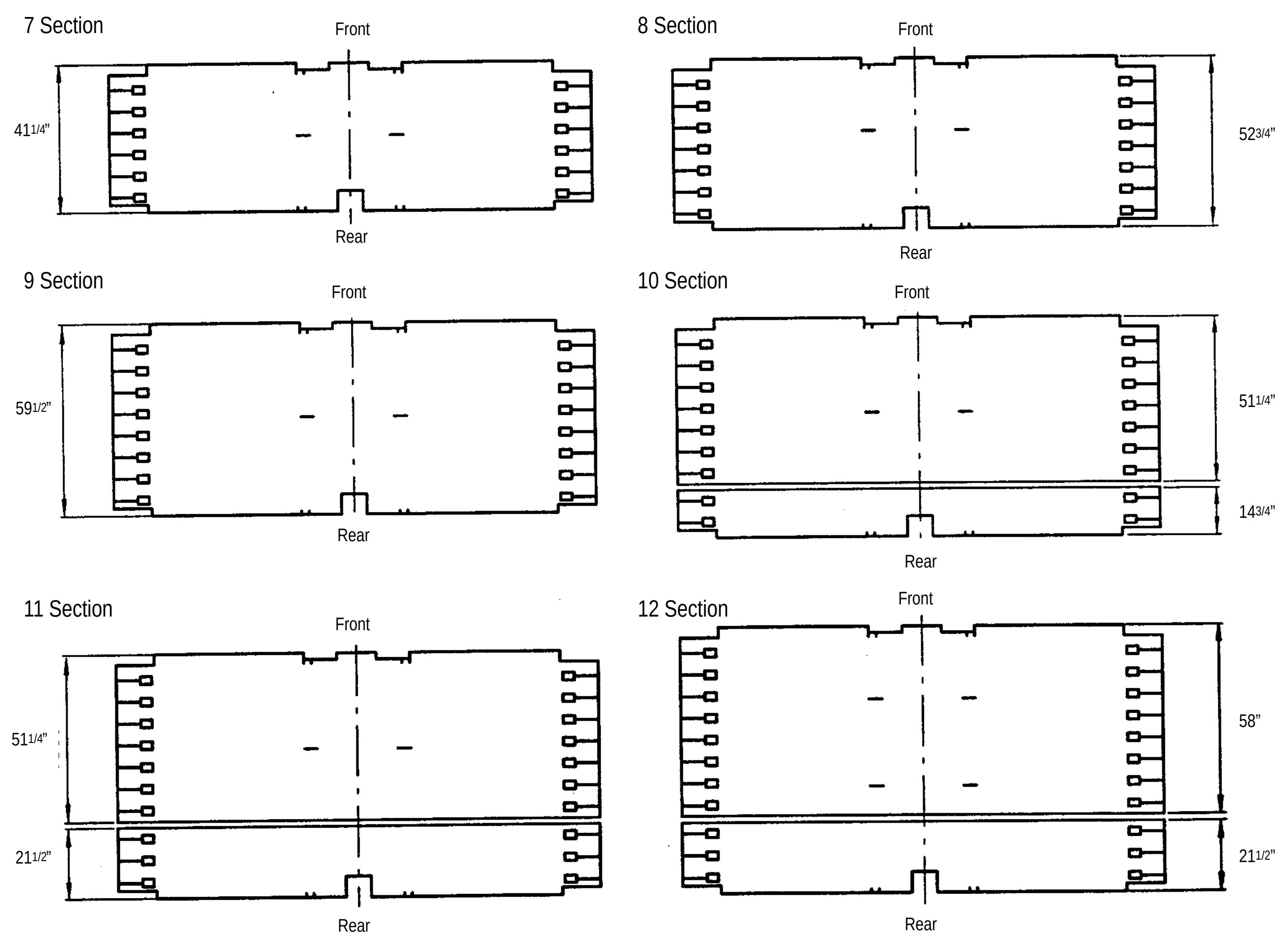


Fig. 28 Arrangement of insulation blankets

- Loosely bolt the support brackets for the jacket to the left and right of the upper ribs as detailed in Fig.'s 27 and 29, and the table on page 16.
- Support brackets for the front and mid section(s) must be mounted on the front side of the casting section. The rear support brackets must be mounted on the rear side. Longitudinal brackets are temporarily installed to locate the support brackets before tightening.
- Screw the top cross brackets to the front and rear sections with M8x16 bolts. The beveled edges must point outward (Fig. 30).
- Place the longitudinal brackets on the support brackets on the front and rear sections (Fig. 30).
- Slide the longitudinal brackets with attached mounting bolts from the front into the recesses of the support brackets, move to the rear and fasten these brackets onto the support brackets. The notched end must face the front of the boiler.
- Push the notched end of the longitudinal brackets behind the front cross bracket. Press the other end up against the rear cross bracket.
- Tighten the support brackets to the boiler sections and mark for later reference.
- Push the middle support brackets up to the longitudinal brackets and secure tightly to section ribs.
- Loosen and remove the longitudinal brackets.
- Install insulation panels according to Fig. 28.
- Press the support brackets through the insulation at the indentations (Fig. 31).
- Fold the insulation under the boiler block (Fig. 31). The boiler feet are positioned in the cut-outs of the insulation.
- Loosely screw the bottom cross brackets (front and rear) to the section feet with M8x16 bolts. The beveled edge on both bottom cross brackets must point outward (Fig. 31).

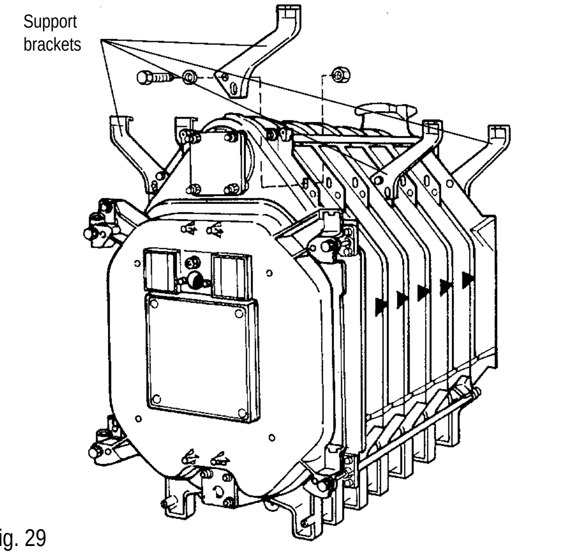


Fig. 29

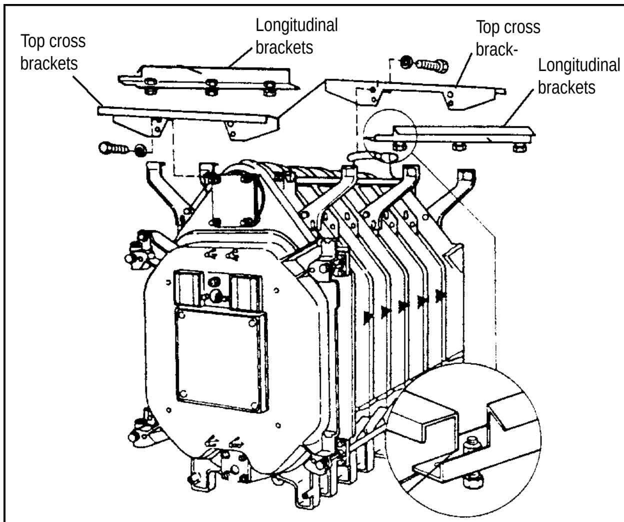


Fig. 30

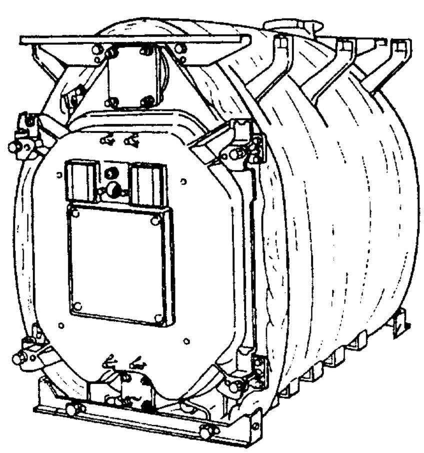


Fig. 31

9 Installation of Insulation & Boiler Jacket Panels

- Place the front insulation piece with the cut-outs pointing up, then fasten it to the block insulation with the two tension springs (Fig.s 32 and 33).

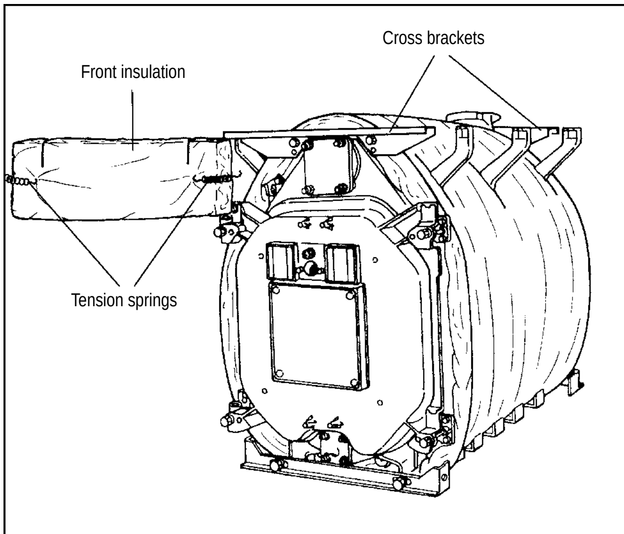


Fig. 32

- Reinstall the longitudinal brackets on the sides as previously matched (Fig. 33).
- Slide longitudinal brackets with the attached mounting bolts from the front into the notches of the support brackets.
- Push the notched end of the longitudinal brackets behind the front cross bracket. Press the other end up against the rear cross bracket.
- Fasten the longitudinal brackets to the support brackets.

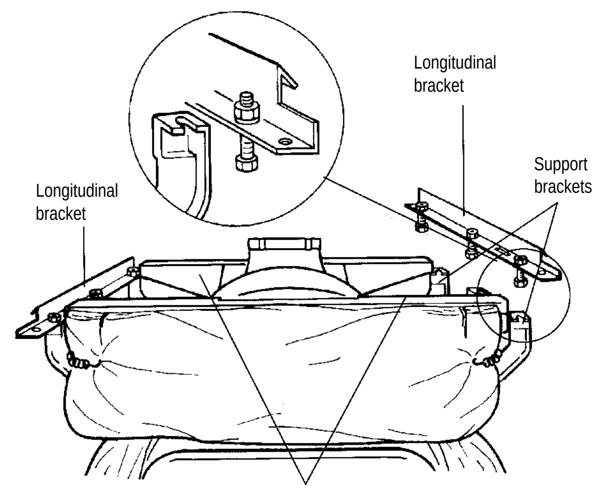


Fig. 33

- Place the rear insulation panel with the boiler return connection cut-out upward over the vent connection as shown (Fig. 34).
- Secure the insulation panel with 4 tension springs to the boiler insulation blanket (Fig. 34).
- Close the slit in the insulation under the vent connector with a tension spring (Fig. 34).

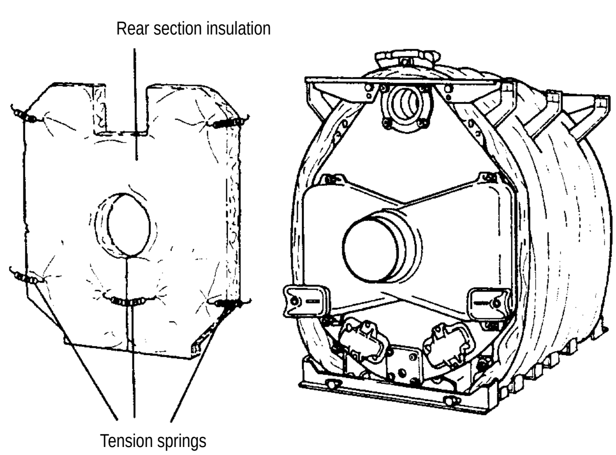


Fig. 34

- Place the bottom side covers with the longer projecting end facing forward, against the lower cross brackets (Fig. 35).
- Screw the bottom side covers to the cross brackets with sheet metal screws (Fig. 35).
- Tighten bolts holding the cross brackets.

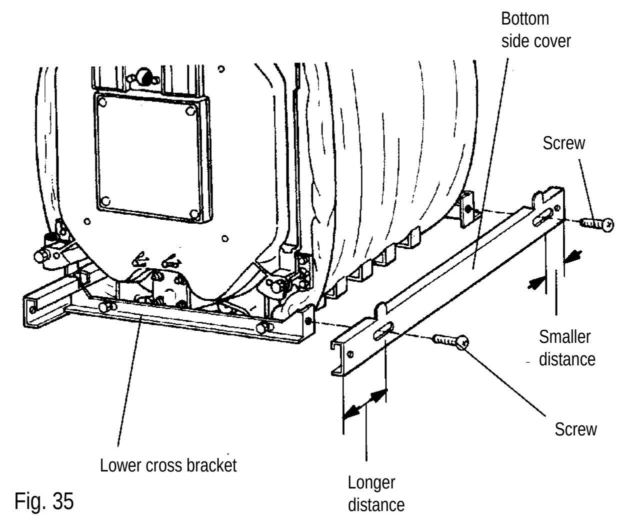


Fig. 35

Jacket Installation

Note: Be careful not to scratch the jacket panels.

- Place the hinge tabs of the side panel flap into the knockouts of the front side panel, and fasten these hinges with sheet metal screws (Fig. 36).
- Attach a tension spring to side panel flap as shown (Fig. 36).
- Repeat procedure for the other side.
- See Figure 38 (page 20) for proper side panel arrangement.

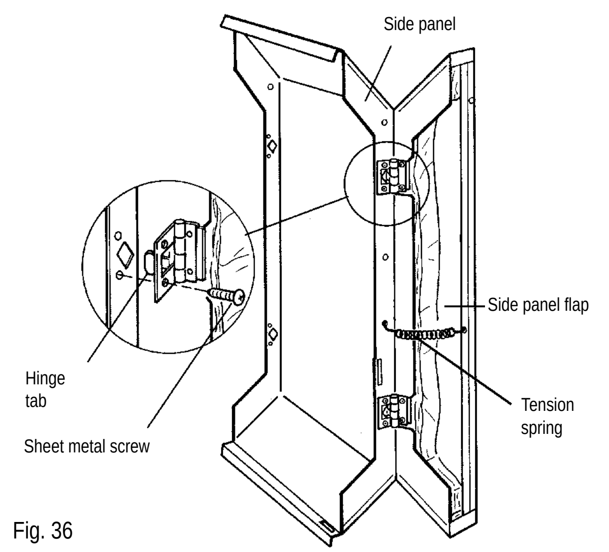


Fig. 36

- Place the bottom of the front side panels in the bent-up clips of the bottom side covers (Fig. 37). Then push the top of these side panels over the beveled edge of the longitudinal brackets. Panel will latch in place.
- Refer to Figure 38 on page 20 for side panel arrangement for different boiler models.
- Mount panels from front to back.

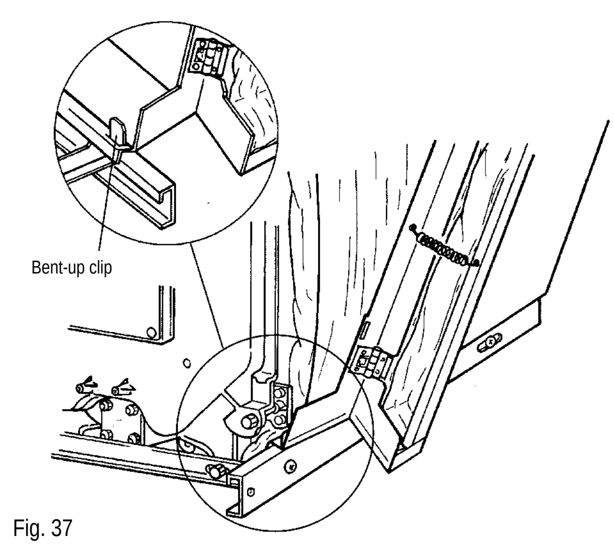


Fig. 37

9 Installation of Insulation & Boiler Jacket Panels

Panel Widths:

A = 24 1/4”
B = 27 1/2”
C = 13 1/2”
Side panel flap = 4 1/4”

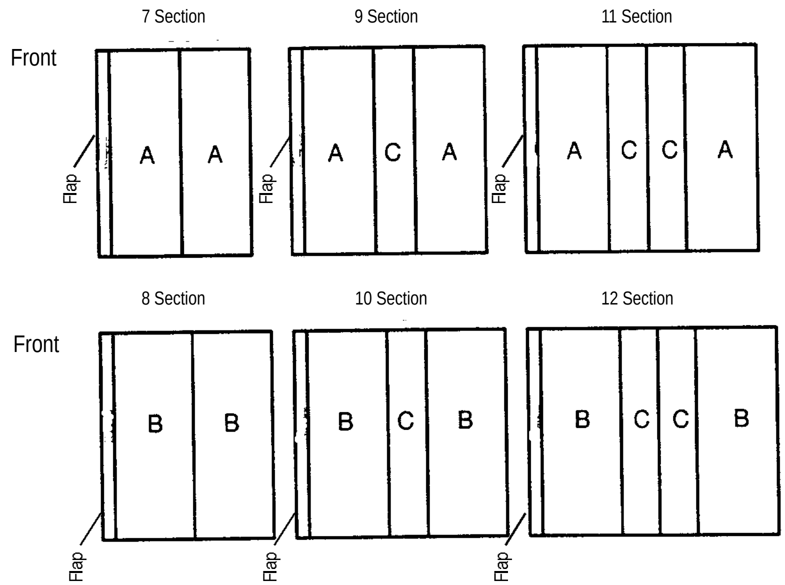


Fig. 38 Arrangement of side panels (front to back).

- Hook the front top cover with both tabs into the front side panels as shown in Figure 39.

- Fasten the front top cover to the longitudinal with two sheet metal screws (Fig. 39).

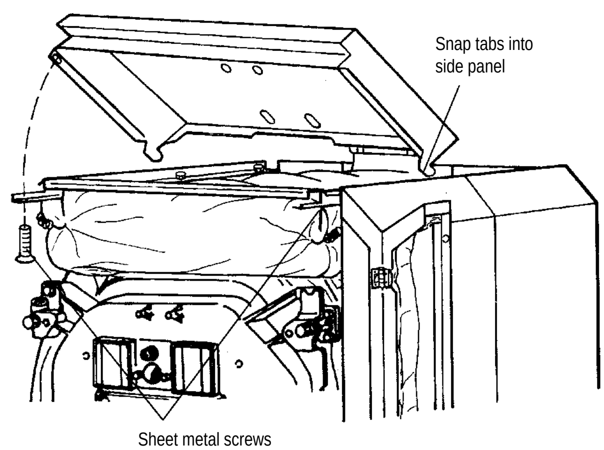


Fig. 39

- Insert the beveled edges of the middle top cover under the front top cover and position between the side panels (Fig. 40).

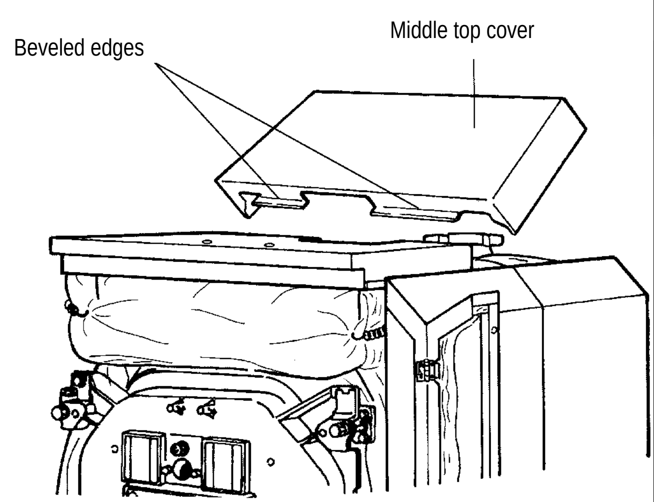


Fig. 40

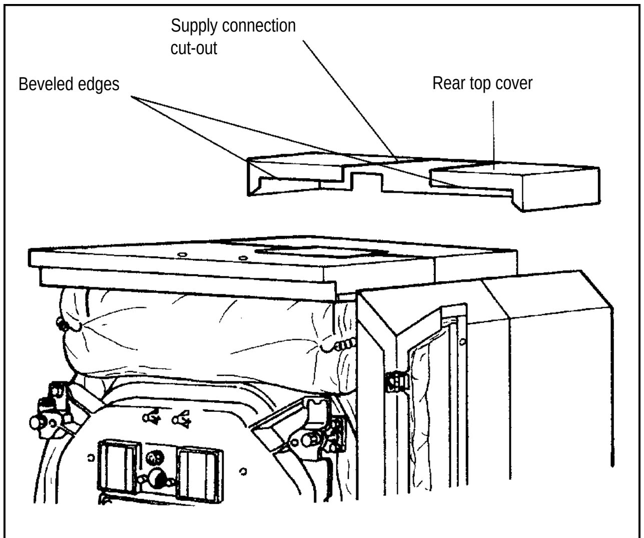


Fig. 41

- Place the rear top cover with the beveled edges and supply cut-out toward the front on top of the side panels (Fig. 41).

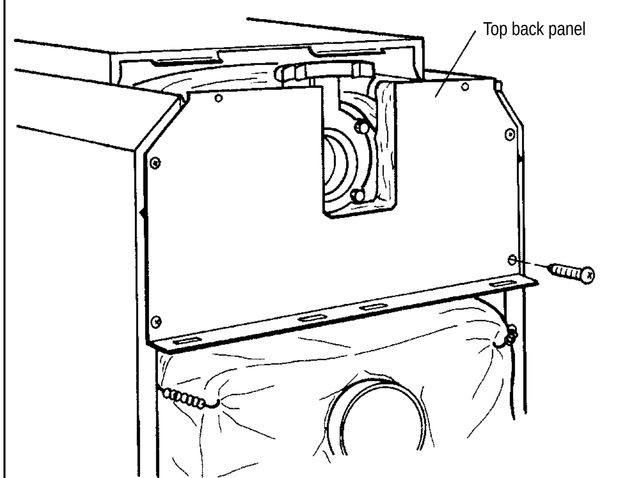


Fig. 42

- Slide the top back panel underneath the rear top cover and attach this panel with four sheet metal screws to the side panels (Fig. 42).

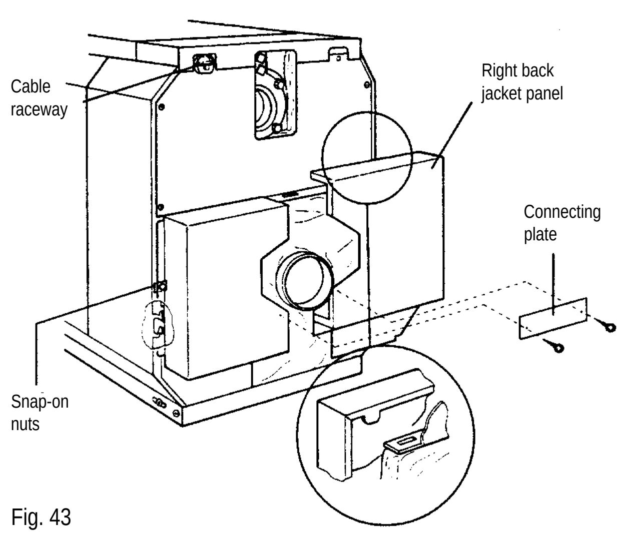


Fig. 43

- Install snap-on nuts in the left and right side panels as shown (Fig. 43).
- Hang the lower right and left back jacket panels into the slots from the beveled edge of the top back panel (Fig. 43).
- Secure with sheet metal screws installed in the snap-on nuts (Fig. 43).
- Attach small connecting plate between both lower back jacket panels with sheet metal screws (Fig. 43).
- Screw cable raceway to the top back panel (Fig. 43).

9 Installation of Insulation & Boiler Jacket Panels

- Slide the front and rear bottom cover plates into the longitudinal bottom covers. The beveled edge must be at the bottom and point towards the boiler (Fig. 44). Secure with sheet metal screws.

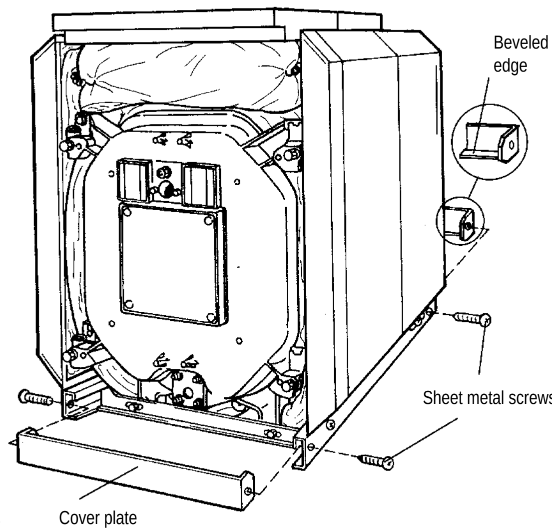


Fig. 44

- Mount the two burner door panels to the burner door with four machine screws (Fig. 45).

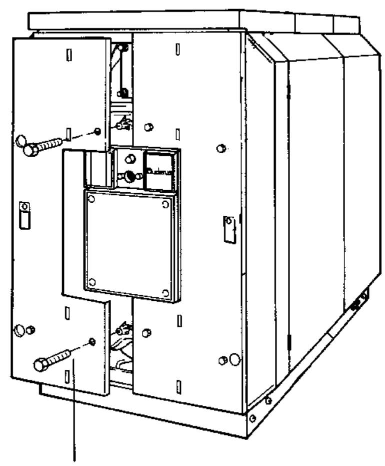


Fig. 45

- Hang the burner door covers into the burner door panels as shown (Fig. 46).

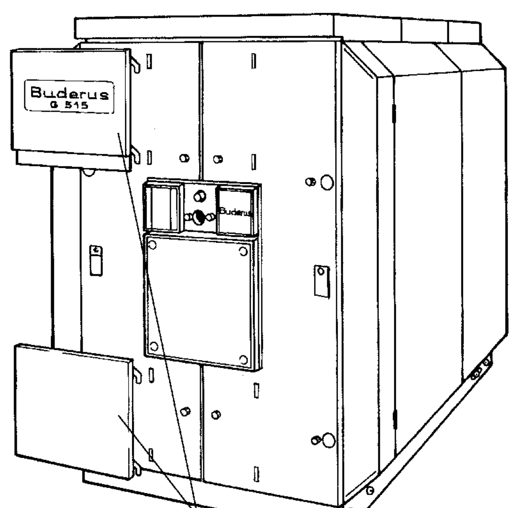


Fig. 46

Installation of supply header and controls

- Refer to Figure 47 for details.
- Fasten supply header with supplied bolts and gasket to supply connection in desired orientation.
- Install low water cut-off probe and P&T gauge in appropriate tappings.

* Install relief valve after performing the hydrostatic test.

- Pipe the relief valve discharge to a floor drain in accordance with local code requirements.
- Install required number of 3/4” immersion wells in supply header tappings.

NOTE: If Buderus Ecomatic is used, install Ecomatic well in designated tapping.

- Install the L4006E1109 manual reset high limit in rear boiler tapping.
- Install the supply temperature control aquastat (if required) in the 3/4” Ecomatic well tapping or other 3/4” tapping.
- Install L4006A1058 operating aquastat in another 3/4” immersion well. (Install second L4006A1058 aquastat for LHL burner operation).
- Plug all unused tappings.

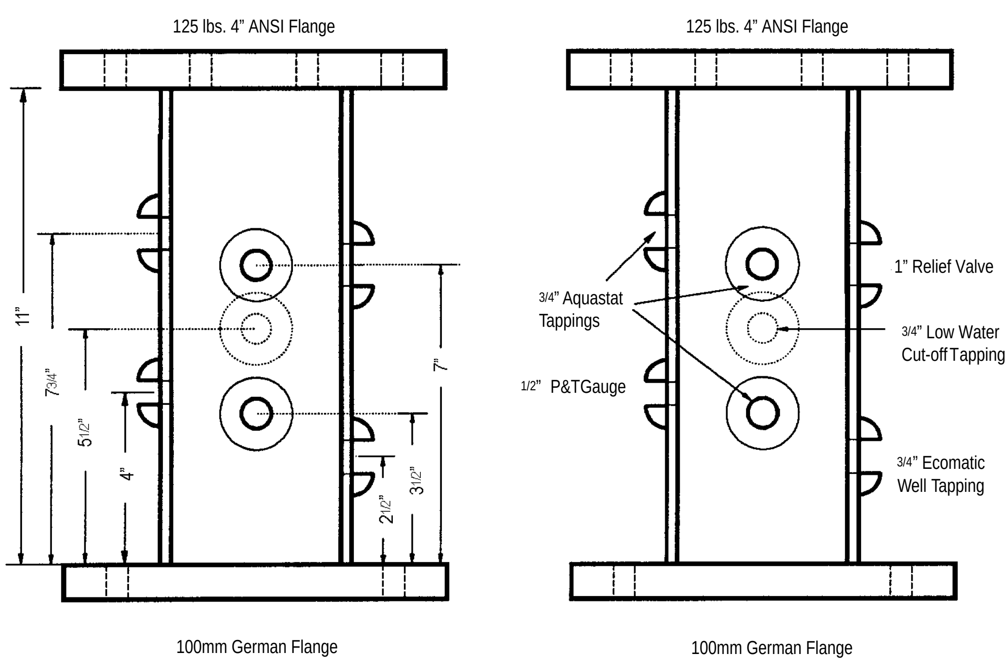


Fig. 47

Maintenance of boiler

Check burner operation on a regular basis. Verify efficiency of boiler and ensure soot free operation. Inspect flue way passages.

Clean boiler annually.

Cleaning brushes are available from Buderus Hydronic Systems.

Boiler cleaning with brushes

- Disconnect electricity. (Disconnect main system switch and padlock open to prevent the burner from being energized during service).
- Disconnect fuel supply and electrical wires to the burner.
- Remove the four bolts from the burner door (Fig. 48).

* Swing open burner door.

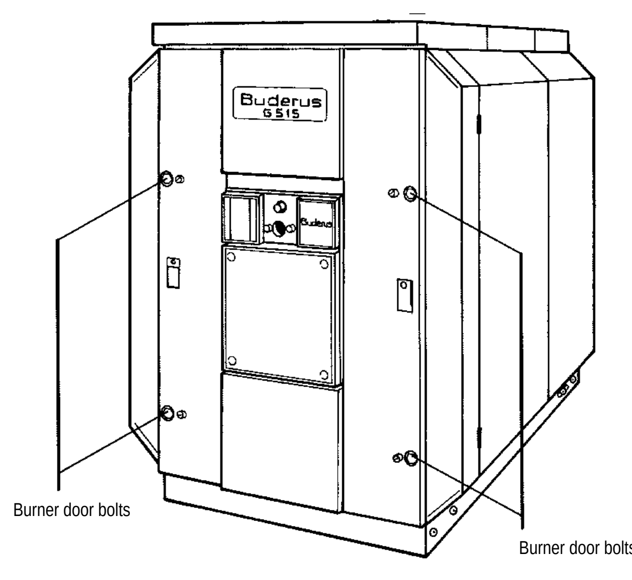


Fig. 48

- Remove flue gas baffle plates from secondary heat exchanger as shown (Fig. 49).

NOTE: The G515/12 model boiler does NOT have flue gas baffle plates.

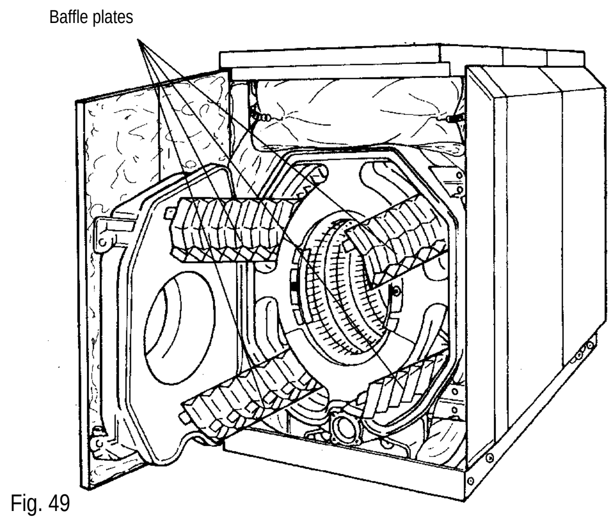


Fig. 49

- Remove the screws from the small connecting plate at the lower back of the boiler. Remove the connecting plate (see Fig. 43).
- Remove screws from lower back jacket panels, tilt panels upward and remove (see Fig. 43).
- Remove tension spring assemblies below vent connection, lift the insulation upward to expose clean-out cover, and fasten with springs as shown (Fig. 50).
- Remove clean-out covers from back section and flue gas collector.

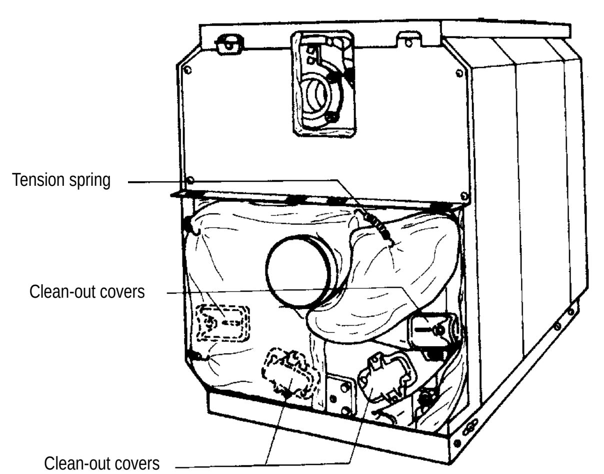


Fig. 50

- The required brushes necessary for cleaning are as shown (Fig. 51).

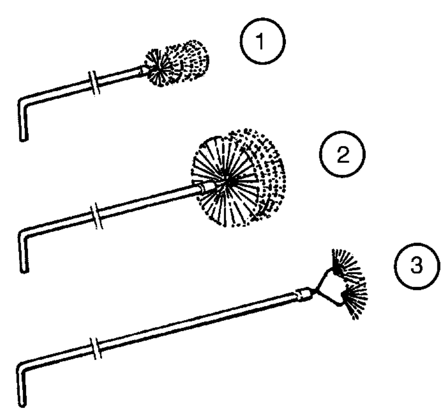


Fig. 51

- Brush top secondary heat exchanger passages with brushes #1 and #2 (Fig. 52).
- Clean the rear wall of the combustion chamber with brush #3.
- Clean sides of combustion chamber with brush #2.
- Remove deposits and soot from flue collector.
- Brush the lower flue passages from the front and rear with brush #2 (Fig. 53).
- Remove all deposits and soot from combustion chamber and passages.
- Check integrity of sealing ropes of clean-out covers and burner door. Replace sealing ropes if damaged or hardened by contacting Buderus Hydronic Systems.
- Insert flue gas baffles. See page 14 for details. The 515/12 does not have baffles.
- Reinstall clean-out covers and secure burner door. Tighten bolts and screws evenly. Reinstall back jacket panels.

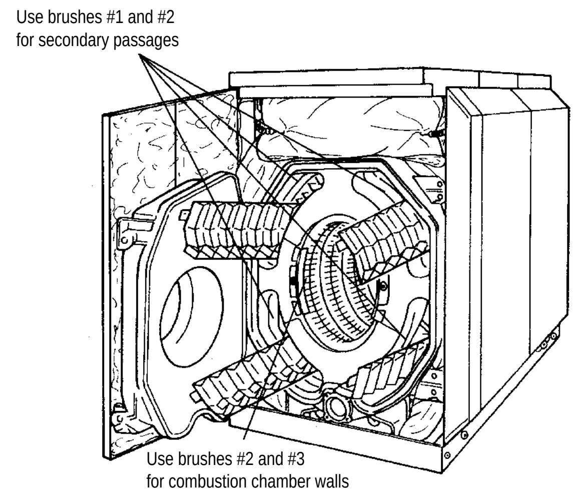


Fig. 52

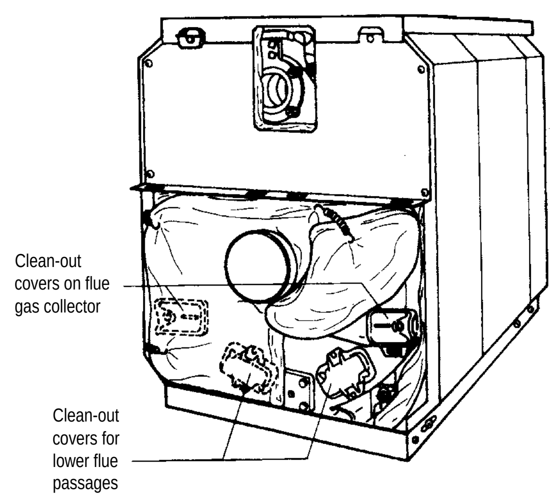


Fig. 53

Wet cleaning procedur e

- Follow the above procedure for accessing the boiler to perform a wet cleaning of the boiler. Follow cleaning agent instructions.

Water level control

- Maintain water pressure within the required levels.
- Verify system water level; add water and vent as needed. Automatically add water to system and vent during operation. Determine and correct problem if continuous make-up water must be added to the system.

Note: Continuous make-up water indicates a leak in the system. This causes corrosive damage to all system components and must be solved immediately.

Warranty voided if problem is not corrected.

Fill and make-up water requirements

- Fill and make-up water must comply with the requirements listed on page 4.

Increasing the stack temperatur e

- Disconnect the boiler from operation as described previously.

Maximum increase in stack temperatur e

- Remove both flue gas blocking plates in the front section with an Allen wrench (Fig. 54).

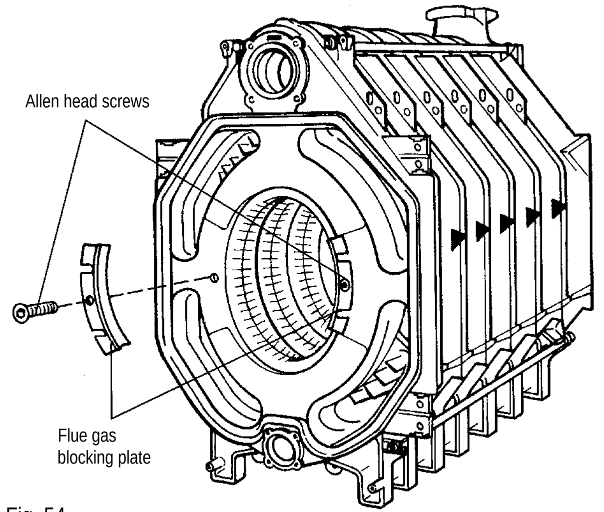


Fig. 54

Gradual increase in stack temperatur e

- Remove both flue gas blocking plates in the front section with an Allen wrench (Fig. 54).
- Place the blocking plates on a solid support and remove one or more segments at the notch with a hammer and chisel (Fig. 55).
- Install the remaining plates back into the front section.
- Remove additional segments to further increase the stack temperature.
- Do not reinstall blocking plates for maximum temperature increase.

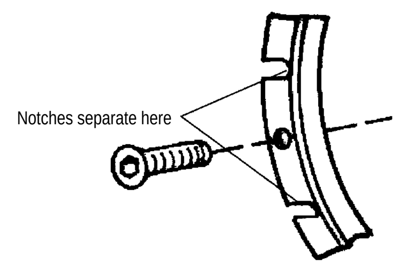


Fig. 55

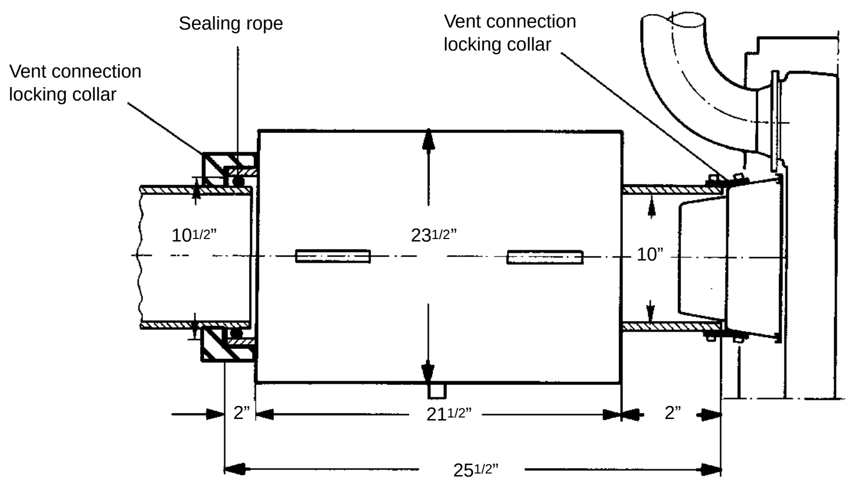


Fig. 56 Muffler Assembly

Components not in stock. Allow 4-6 weeks for delivery.

Table 6. Shipping Component Reference Table

Boiler Model	G515/7	G515/8	G515/9	G515/10	G515/11	G515/12
Back, Front Sections & Burner Door	1	1	1	1	1	1
Mid Sections	5	6	7	8	9	10
Jacket Pack A 5078600	1		1		1	
Jacket Pack B 5078602		1		1		1
Jacket Pack C 5078604			1	1	2	2
Insulation	5078440	5078442	5078444	5078446	5078448	5078450
Accessory Box	5621792	5621794	5621796	5621798	5621800	5621801
Flue Collector	5321792	5321792	5321792	5321792	5321792	5321792
Mounting Parts	5621780	5621782	5621784	5621786	5621788	5621790
Tie Bars	5127540	5127542	5127544	5127546	5127548	5127550
Supply & Return Headers & Controls	1	1	1	1	1	1

Brief description of individual shipping components

Skid 1: Front and rear sections and burner door.

Skid 2: Required number of mid-sections.

Jacket packs A and B: Hardware components for boiler jacket installation.

Jacket pack C: Middle sections of the side panels needed for the larger boiler models.

Accessory box: All hardware components needed to assemble the boiler. Boiler blanking flanges and gaskets are found here.

Mounting parts box: Return distribution pipe and the full boiler length brackets needed for boiler jacket installation.

Tie bars: Bundle of 4 threaded rods to hold sections together.

Header and control box: Supply and return headers with optionally ordered control components.

15 Supply Temperature Control

Supply temperature control

An “Open-On-Rise” aquastat is required to interrupt water circulation through the boiler to prevent the supply temperature from dropping below 122°F during burner operation. The aquastat is to temporarily stop operation of the main system pump (or individual boiler pumps in case of a multiple boiler installation).

Refer to Figure 57 for a typical control schematic for a single boiler with supply temperature control. Control components can be furnished by Buderus Hydronic Systems, Inc.; relay, burner and circulator operating controls can not be provided.

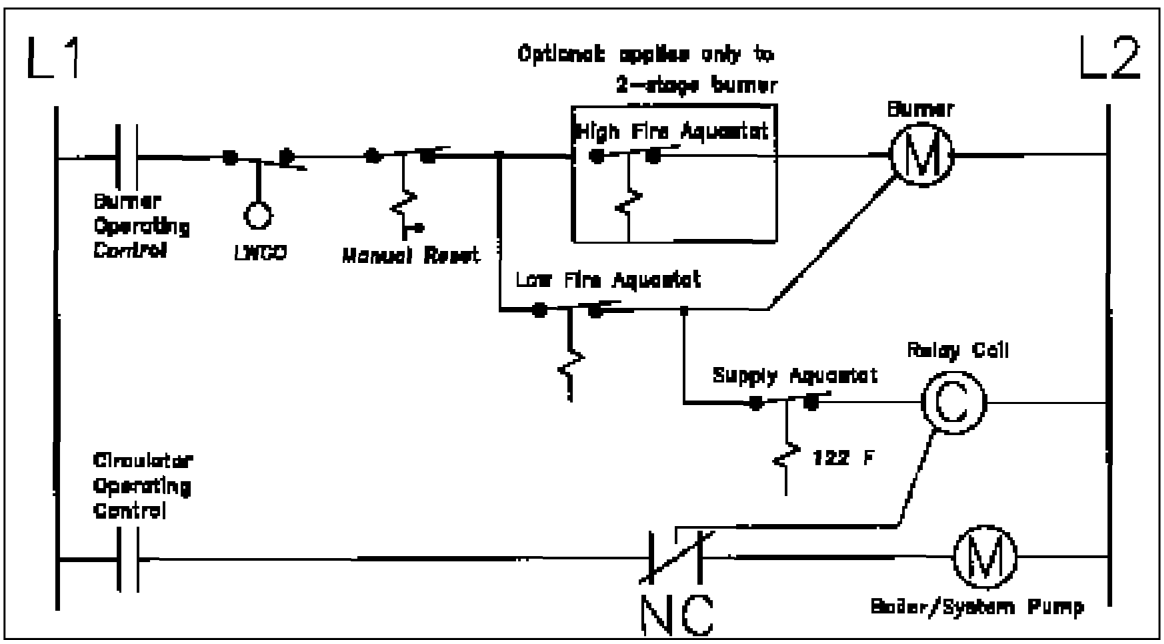


Fig. 57 Typical Control Schematic

Heating Contractor:

PRODUCTS MANUFACTURED BY

BBT Thermotechnik GmbH
35573 Wetzlar
www.buderus.de

Buderus

BBT North America Corporation
50 Wentworth Avenue
Londonderry, NH 03053
Tel: 603-552-1100 ● Fax: 603-584-1681
www.buderus.net

Single Package Gas Heating and Electric Cooling Units with Direct Spark Ignition and *Comfort*Link™ Controls

Installation Instructions

CONTENTS

GENERAL

This installation instruction contains basic unit installation information, including installation of thermostats and remote temperature sensors.

For additional information and service instructions, refer to the Controls and Troubleshooting literature also enclosed in this literature packet.

The 48ZT,ZW units are equipped with standard integral economizer and high-capacity power exhaust.

The 48Z6,Z8 units are equipped with factory-installed return/exhaust fans.

The Staged Gas Control (SGC) option adds the capability to control the rooftop unit's gas heating system to a specified Supply Air Temperature Set Point for purposes of tempering a cool mixed-air condition.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

**FOR YOUR SAFETY
WHAT TO DO IF YOU SMELL GAS**

Do not try to light any appliance. Do not touch any electrical switch; do not use any phone in your building. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information, consult a qualified installer, service agency, or the gas supplier.

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⚠ CAUTION

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

INSTALLATION

Jobsite Survey — Complete the following checks before installation.

1. Consult local building codes and the NEC (National Electrical Code) (ANSI/NFPA [American National Standards Institute/National Fire Protection Association] 70) for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

⚠ CAUTION

Do not lift unit with forklift truck. Move unit with overhead rigging only.

Unit Placement — Inspect unit for transportation damage. File claim with transportation agency.

Provide clearance around and above unit for airflow, safety, and service access. Do not restrict top (area above condenser fans) in any way. Allow at least 6 ft on all sides for rated performance, code compliance, and service.

Check unit dimensional drawings for unit arrangement and minimum performance and service clearances.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air.

On units equipped with power exhaust option, high velocity air is exhausted out the hood. Unit should be positioned with at least 10 ft clearance between the exhaust hood and any obstruction. Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Level by using unit frame as a reference. Physical data is shown in Tables 1A-6.

Roof Mount — Check building codes for weight distribution requirements. Unit weight is shown in Tables 1A-1C and 2. Unit may be mounted on class A, B, or C roofing material.

ROOF CURB — Assemble and install as described in instructions shipped with the accessory. Accessory roof curb and information required to field fabricate a roof curb is shown in Fig. 1-5. Install insulation, cant strips, roofing and counter flashing as required. For unit condensate drain to function properly, curb must be level or within tolerances shown in Fig. 1-5.

STEEL BEAMS — If roof curb is not used, support unit with steel beams along its entire length and then support steel as required. As a minimum, unit must be supported across its width at each lifting lug location.

Slab Mount — Provide a level concrete slab that extends beyond unit cabinet at least 6 inches. Make a slab 8 in. thick with 4 in. above grade. Use gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow. Ensure that slab is of sufficient height to allow for condensate trap of 4 in. on sizes 030-070 or 7 in. on sizes 075-105.

Curb Gasketing

SIZE 030-050 UNITS — After ductwork has been connected to the roof curb, attach adhesive-backed gasketing on all end rails, cross rails, and duct rails. Be sure all joints and corners of gasket are square and flush to prevent possible water leaks. Follow all applicable building codes.

SIZE 055-105 UNITS — After ductwork has been connected to the roof curb, apply gasket material ($^1/_2$-in. thick x 1$^1/_2$-in. wide neoprene) where indicated.

Single-Thickness Gasketing (See Fig. 6-8 for Item Numbers) — Apply gasketing in the following places:

1. Along both side rails (1) — 2 places, full length
2. Along return air end rail (2) — 1 place
3. Around Return Air internal duct flange (3) — 1 or 2 places
4. Around Supply Air internal duct flanges (4) — 3 places

Double-Thickness Gasketing (See Fig. 6 and 8 and Detail A-A) — Locate a line 9$^3/_4$-in. from the supply air end of the accessory curb. Apply a double-thickness of gasket material along with line per detail A-A.

NOTE: Do not apply gasket material along the outside edge of the curb (area “X”). This pan area of the curb extends out beneath the end of the unit’s air handler section; applying gasket here develops a potential water trap area on top of the curb.

Condenser Section Roof Curb (See Fig. 7) — Apply single-thickness gasket along both side rails (5).

Field-Fabricated Ductwork

⚠ WARNING

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90-degree turn in the supply and return ductwork between the unit and the conditioned space. If a 90-degree elbow cannot be installed, then a grille of sufficient strength and density should be installed to prevent objects from falling into the conditioned space. Failure to follow these instructions could result in personal injury or property damage due to falling objects.

The 48ZG,ZN,ZT,ZW,Z6,Z8 units are designed for vertical supply/return only. Field-fabricated ductwork must be attached to the roof curb, on to the support steel, prior to the final rigging and installation of the unit. Supply and return duct dimensions are shown in Fig. 1-3.

To attach ductwork to roof curb, insert duct approximately 10 to 11 in. up into roof curb. Connect ductwork to 14-gage roof curb material with sheet metal screws driven from inside the duct.

Secure all ducts to the building structure, using flexible duct connectors between roof curbs and ducts as required. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier. Outlet grilles must not lie directly below unit discharge. The return duct must have a 90-degree elbow before opening into the building space if the unit is equipped with power exhaust.

Design supply duct strong enough to handle expected static pressures.

Rigging — Do not drop unit; keep upright. Use spreader bars over unit to prevent sling or cable damage. Sheets of plywood placed along the condenser coils will provide additional protection. All lifting lugs MUST be used when lifting unit. Level by using unit frame as a reference. See Fig. 9-13 for information. Unit and accessory weights are shown in Tables 1A-1C and 2. Weight distribution and center of gravity can be found in Fig. 14.

→ Table 1A — Physical Data (48ZG,ZN030-105)

BASE UNIT	48ZG,ZN030		48ZG,ZN035	
NOMINAL CAPACITY (tons)	30		35	
OPERATING WEIGHT (lb)	Standard Chassis	Extended Chassis	Standard Chassis	Extended Chassis
Base Unit				
Low Heat	5640	6140	5766	6266
High Heat	5770	6270	5895	6395
With Economizer				
Low Heat	5941	6441	6066	6566
High Heat	6070	6570	6195	6695
COMPRESSORS	Semi-Hermetic			
Quantity...Type	2...06D		1...06D, 1...06E	
Oil Charge (pints)	8		8, 14	
Capacity Steps (%)				
CV	50,100		43,100	
VAV	17,33,50,67,83,100		14,28,42,57,71,86,100	
Number of Refrigerant Circuits	2		2	
REFRIGERANT	R-22			
Operating Charge (lb), Ckt 1/Ckt 2				
Standard Evaporator Coil	29.0/29.0		29.0/30.5	
Standard Evaporator with HGBP	31.0/29.0		31.0/30.5	
Alternate High-Capacity Evaporator Coil	N/A		N/A	
Alternate High-Capacity Evaporator with HGBP	N/A		N/A	
CONDENSER COILS	$^3/_8$-in. Tube Diameter			
Quantity	2		2	
Rows...Fins/in.				
Aluminum	3...15.0		3...15.0	
Copper (Optional)	3...13.7		3...13.7	
Total Face Area (sq ft)	37.5		37.5	
EVAPORATOR COILS				
Quantity	1			
Total Face Area (sq ft)	32.1			
Refrigerant Feed Device...No. per Circuit	TXV...1			
Standard Evaporator Coils	$^1/_2$ in. Tube Dia		$^1/_2$ in. Tube Dia	
Rows...Fins/in.	3...15.0		4...15.0	
Fin Type	Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched	
Alternate, High-Capacity Evaporator Coils	N/A		N/A	
Rows...Fins/in.	N/A		N/A	
Fin Type	N/A		N/A	
Tube Type	N/A		N/A	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	1	2	1	2
Input (MBtuh)	325	650	325	650
Output (MBtuh)	263	527	263	527
Temperature Rise Range (F)	10-40	25-55	10-40	25-55
Efficiency (%)	81	81	81	81
Burner Orifice Diameter				
Quantity (in. ...drill no.)	7 (.1285...30)	14 (.1285...30)	7 (.1258...30)	14 (.1258...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (min...max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Firing Stages	2	2	2	2
Number of Gas Valves	1	2	1	2
CONDENSER FANS	Propeller Type			
Quantity...Diameter (in.)	2...30		2...30	
Nominal Cfm	18,600		18,600	
Motor Hp...Rpm	1.0...1140		1.0...1140	
SUPPLY FAN	Centrifugal 25 x 25 in.			
Nominal Cfm	10,500		10,500	
Maximum Allowable Cfm	15,000		15,000	
Maximum Allowable Rpm	900		900	
Shaft Diameter at Pulley (in.)	$1^{11}/_{16}$		$1^{11}/_{16}$	

SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)				
Motor Hp	7.5	10	15	20	25
Motor Frame Size	213T	215T	254T	256T	284T
Efficiency at Full Load (%)					
High Efficiency	88.5	89.5	91.0	91.0	91.7
Premium Efficiency	91.7	91.7	93.0	93.6	93.6
Fan Pulley Pitch Diameter (in.)	13.7	13.7	13.7	13.7	13.7
Motor Pulley Pitch Diameter (in.)	3.4	4.3	4.9	5.5	6.5
Resulting Fan Speed (rpm)	438	549	626	703	830
Belts Quantity...Type	2...BX60	2...5VX630	2...5VX630	2...5VX630	2...5VX650
Center Distance Range (in.)	17.74-14.30	17.74-14.30	17.63...14.01	17.63...14.01	16.63...12.87

	48ZG,ZN030		48ZG,ZN035	
OPTIONAL POWER EXHAUST	Centrifugal, 18 x 15 in. (Any motor available on any unit)			
Quantity...Motor Hp	2...3.0	2...5.0	2...7.5	2...10
Motor Frame Size — High Eff	56HZ	184T	213T	215T
Prem Eff	182T	184T	213T	215T
Efficiency at Full Load (%) High/Premium	81.0/88.5	87.5/89.5	88.5/91.7	89.5/91.7
Fan Pulley Pitch Diameter (in.) — High Eff	11	10.4	12	12
Prem Eff	11.0	10.4	12	12
Motor Pulley Pitch Diameter Range (in.) — High Eff	4.1-3.1	4.7-3.7	6.0-4.8	7.0-5.8
Prem Eff	4.1-3.1	4.7-3.7	6.0-4.8	7.0-5.8
Motor Pulley Pitch Diameter Factory Setup (in.)	4.1	4.2	5.4	6.4
Blower Shaft Diameter at Pulley (in.)	$1^7/_{16}$	$1^7/_{16}$	$1^7/_{16}$	$1^7/_{16}$
Fan Rpm Range	500-656	621-785	717-882	854-1000
Factory Setup Fan Rpm	656	703	800	927
Maximum Allowable Rpm	1000	1000	1000	1000
Belts Quantity...No. — High Eff	1...BX71	1...BX71	1...BX77	1...BX79
Prem Eff	1...BX71	1...BX71	1...BX77	1...BX79
Center Distance Range (in.)	23.62...26.50	23.62...26.50	23.62...26.50	23.62...26.50
FILTERS				
Standard Efficiency Throwaway (Standard)	8...20 x 25 x 2		8...20 x 25 x 2	
Quantity...Size (in.)	8...20 x 20 x 2		8...20 x 20 x 2	
Medium Efficiency (30%) Pleated (Optional)	8...20 x 25 x 2		8...20 x 25 x 2	
Quantity...Size (in.)	8...20 x 20 x 2		8...20 x 20 x 2	
High Efficiency (90%) Bag Filters with High Velocity Prefilters (Optional) Quantity...Size (in.)				
Bag Filter	6...20 x 24 x 22 6...20 x 20 x 22		6...20 x 24 x 22 6...20 x 20 x 22	
Prefilter	12...16 x 20 x 2 3...20 x 24 x 2		12...16 x 20 x 2 3...20 x 24 x 2	
OUTSIDE AIR SCREENS				
Standard Hood (25%) Quantity...Size (in.)	None		None	
OPTIONAL ECONOMIZER FILTER	Aluminum Frame, Permanent			
Quantity...Size (in.)	5...20 x 20 x 2 2...20 x 25 x 1		5...20 x 20 x 1 2...20 x 25 x 1	

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

→ Table 1A — Physical Data (48ZG,ZN030-105) (cont)

BASE UNIT	48ZG,ZN040		48ZG,ZN050	
NOMINAL CAPACITY (tons)	40		50	
OPERATING WEIGHT (lb)	Standard Chassis	Extended Chassis	Standard Chassis	Extended Chassis
Base Unit				
Low Heat	6540	7040	6581	7081
High Heat	6670	7170	6710	7210
With Economizer				
Low Heat	6841	7341	6881	7381
High Heat	6970	7470	7010	7510
COMPRESSORS	Semi-Hermetic			
Quantity...Type	2...06E		2...06E	
Oil Charge (pints)	14		19, 14	
Capacity Steps (%)				
CV	50,100		57,100	
VAV	25,50,75,100		18,37,56,63,81,100	
Number of Refrigerant Circuits	2		2	
REFRIGERANT	R-22			
Operating Charge (lb), Ckt 1/Ckt 2				
Standard Evaporator Coil	40.0/40.0		41.5/39.0	
Standard Evaporator with HGBP	42.0/40.0		43.5/39.0	
Alternate High-Capacity Evaporator Coil	50.0/51.0		49.0/49.0	
Alternate High-Capacity Evaporator with HGBP	52.0/51.0		51.0/49.0	
CONDENSER COILS	$^{3}/_{8}$-in. Tube Diameter			
Quantity	2		2	
Rows...Fins/in.				
Aluminum	3...15.0		3...15.0	
Copper (Optional)	3...13.7		3...13.7	
Total Face Area (sq ft)	50.0		50.0	
EVAPORATOR COILS				
Quantity	2			
Total Face Area (sq ft)	45.5			
Refrigerant Feed Device...No. per Circuit	TXV...2			
Standard Evaporator Coils	$^{1}/_{2}$ in. Tube Dia		$^{1}/_{2}$ in. Tube Dia	
Rows...Fins/in.	3...15.0		4...15.0	
Fin Type	Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched	
Alternate, High-Capacity Evaporator Coils	$^{1}/_{2}$ in. Tube Dia		$^{1}/_{2}$ in. Tube Dia	
Rows...Fins/in.	6...16.0		6...16.0	
Fin Type	Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	1	2	1	2
Input (MBtuh)	325	650	325	650
Output (MBtuh)	263	527	263	527
Temperature Rise Range (F)	10-40	25-55	10-40	25-55
Efficiency (%)	81	81	81	81
Burner Orifice Diameter				
Quantity (in. ...drill no.)	7 (.1285...30)	14 (.1285...30)	7 (.1285...30)	14 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (min...max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Firing Stages	2	2	2	2
Number of Gas Valves	1	2	1	2
CONDENSER FANS	Propeller Type			
Quantity...Diameter (in.)	3...30		3...30	
Nominal Cfm	26,000		26,000	
Motor Hp...Rpm	1.0...1140		1.0...1140	
SUPPLY FAN	Centrifugal 25 x 25 in.			
Nominal Cfm	14,000		14,000	
Maximum Allowable Cfm	20,000		20,000	
Maximum Allowable Rpm	900		900	
Shaft Diameter at Pulley (in.)	1$^{11}/_{16}$		1$^{11}/_{16}$	

SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)					
Motor Hp	7.5	10	15	20	25	30*
Motor Frame Size	213T	215T	254T	256T	284T	286T
Efficiency at Full Load (%)						
High Efficiency	88.5	89.5	91.0	91.0	91.7	92.4
Premium Efficiency	91.7	91.7	93.0	93.6	93.6	93.6
Fan Pulley Pitch Diameter (in.)	13.7	13.7	13.7	13.7	13.7	12.5
Motor Pulley Pitch Diameter (in.)	3.4	4.3	4.9	5.5	6.5	6.5
Resulting Fan Speed (rpm)	438	549	626	703	830	910
Belts Quantity...Type	2...BX60	2...5VX630	2...5VX630	2...5VX630	2...5VX650	3...5VX630
Center Distance Range (in.)	17.74-14.30	17.74-14.30	17.63...14.01	17.63...14.01	16.63...12.87	16.63...12.87

OPTIONAL POWER EXHAUST	Centrifugal, 18 x 15 in. (Any motor available on any unit)			
Quantity...Motor Hp	2...3.0	2...5.0	2...7.5	2...10
Motor Frame Size — High Eff	56HZ	184T	213T	215T
Prem Eff	182T	184T	213T	215T
Efficiency at Full Load (%) High/Premium	81.0/88.5	87.5/89.5	88.5/91.7	89.5/91.7
Fan Pulley Pitch Diameter (in.) — High Eff	11	10.4	12	12
Prem Eff	11.0	10.4	12	12
Motor Pulley Pitch Diameter Range (in.) — High Eff	4.1-3.1	4.7-3.7	6.0-4.8	7.0-5.8
Prem Eff	4.1-3.1	4.7-3.7	6.0-4.8	7.0-5.8
Motor Pulley Pitch Diameter Factory Setup (in.)	4.1	4.2	5.4	6.4
Blower Shaft Diameter at Pulley (in.)	1$^{7}/_{16}$	1$^{7}/_{16}$	1$^{7}/_{16}$	1$^{7}/_{16}$
Fan Rpm Range	500-656	621-785	717-882	854-1000
Factory Setup Fan Rpm	656	703	800	927
Maximum Allowable Rpm	1000	1000	1000	1000
Belts Quantity...No. — High Eff	1...BX71	1...BX71	1...BX77	1...BX79
Prem Eff	1...BX71	1...BX71	1...BX77	1...BX79
Center Distance Range (in.)	23.62...26.50	23.62...26.50	23.62...26.50	23.62...26.50

FILTERS	48ZG,ZN040	48ZG,ZN050
Standard Efficiency Throwaway (Standard) Quantity...Size (in.)	8...20 x 25 x 2 8...20 x 20 x 2	8...20 x 25 x 2 8...20 x 20 x 2
Medium Efficiency (30%) Pleated (Optional) Quantity...Size (in.)	8...20 x 25 x 2 8...20 x 20 x 2	8...20 x 25 x 2 8...20 x 20 x 2
High Efficiency (90%) Bag Filters with High Velocity Prefilters (Optional) Quantity...Size (in.)		
Bag Filter	6...20 x 24 x 22 6...20 x 20 x 22	6...20 x 24 x 22 6...20 x 20 x 22
Prefilter	12...16 x 20 x 2 3...20 x 24 x 2	12...16 x 20 x 2 3...20 x 24 x 2
OUTSIDE AIR SCREENS		
Standard Hood (25%) Quantity...Size (in.)	None	None
OPTIONAL ECONOMIZER FILTER	Aluminum Frame, Permanent	
Quantity...Size (in.)	5...20 x 20 x 2 2...20 x 25 x 1	5...20 x 20 x 1 2...20 x 25 x 1

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

*460-3-60 only.

→ Table 1A — Physical Data (48ZG,ZN030-105) (cont)

BASE UNIT	48ZG,ZN055		48ZG,ZN060		48ZG,ZN070	
NOMINAL CAPACITY (tons)	55		60		70	
OPERATING WEIGHT (lb)	Standard Chassis	Extended Chassis	Standard Chassis	Extended Chassis	Standard Chassis	
Base Unit						
Low Heat	8700	9248	9000	9,548	9,420	
High Heat	8820	9368	9120	9,668	9,550	
With Economizer						
Low Heat	9230	9730	9530	10,030	9,950	
High Heat	9350	9850	9650	10,450	10,080	
COMPRESSORS	Semi-Hermetic					
Quantity...Type	2...06E		2...06E		2...06E	
Oil Charge (Pints)	19, 14		19		19	
Capacity Steps (%)						
CV	60,100		50,100		45,100	
VAV	20,40,60,80,100		17,33,50,67,83,100		14,29,43,51,66,71,85,100	
Number of Refrigerant Circuits	2		2		2	
REFRIGERANT	R-22					
Operating Charge (lb), Ckt 1/Ckt 2						
Standard Evaporator Coil	59.0/44.5		61.0/61.0		70.5/64.5	
Standard Evaporator with HGBP	62.0/44.5		64.0/61.0		73.5/64.5	
Alternate High-Capacity Evaporator Coil	72.0/58.0		69.5/69.5		82.5/74.5	
Alternate High-Capacity Evaporator with HGBP	75.0/58.0		72.5/69.5		85.5/74.5	
CONDENSER COILS	$^{3}/_{8}$-in. Tube Diameter					
Quantity	4		4		4	
Rows...Fins/in.						
Aluminum	2...17.0, 3...17.0		3...17.0		3...17.0	
Copper (Optional)	2...15.7, 3...15.7		3...15.7		3...15.7	
Total Face Area (sq ft)	72.4		72.4		108.4	
EVAPORATOR COILS						
Quantity	2					
Total Face Area (sq ft)	61.5					
Refrigerant Feed Device...No. per Circuit	TXV...2					
Standard Evaporator Coils	$^{1}/_{2}$ in. Tube Dia					
Rows...Fins/in.	3...17.0		4...17.0		4...17.0	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Smooth		Smooth		Smooth	
Alternate, High-Capacity Evaporator Coils	$^{1}/_{2}$ in. Tube Dia					
Rows...Fins/in.	6...16		6...16		6...16	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched		Cross Hatched	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	2	3	2	3	2	3
Input (MBtuh)	650	975	650	975	650	975
Output (MBtuh)	527	790	527	790	527	790
Temperature Rise Range (F)	10-40	20-50	10-40	20-50	10-40	20-50
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter						
Quantity (in. ...drill no.)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (min...max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Firing Stages	2	2	2	2	2	2
Number of Gas Valves	2	3	2	3	2	3
CONDENSER FANS	Propeller Type					
Quantity...Diameter (in.)	4...30		4...30		5...30	
Nominal Cfm	40,000		40,000		50,000	
Motor Hp...Rpm	1.0...1140		1.0...1140		1.0...1140	
SUPPLY FAN	Centrifugal 25 x 25 in.					
Nominal Cfm	17,500		21,000		24,500	
Maximum Allowable Cfm	25,000		30,000		30,000	
Maximum Allowable Rpm	800		800		800	
Shaft Diameter at Pulley (in.)	$1^{11}/_{16}$		$1^{11}/_{16}$		$1^{11}/_{16}$	
SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)					
Motor Hp	15		20	25	30	40
Motor Frame Size	254T		256T	284T	286T	S324T
Efficiency at Full Load (%)						
High Efficiency	91.0		91.0	91.7	92.4	93.0
Premium Efficiency	93.0		93.6	93.6	93.6	94.5
Fan Pulley Pitch Diameter (in.)	13.7		13.7	13.7	15.5	16.1
Motor Pulley Pitch Diameter (in.)	4.5		5.1	5.5	5.9	6.7
Resulting Fan Speed (rpm)	575		651	703	711	740
Belts Quantity...Type	2...5VX1230		2...5VX1230	2...5VX1230	2...5VX1230	3...5VX1250
Center Distance Range (in.)	48.25-44.00		48.25-44.00	48.50-44.25	48.50-44.25	48.25-44.00
OPTIONAL POWER EXHAUST	Centrifugal, 15 x 15 in. (Any motor available on any unit)					
Quantity...Motor Hp	2...5		2...7.5		2...10	
Motor Frame Size	184T		213T		215T	
Efficiency at Full Load (%) High/Premium	87.5/89.5		88.5/91.7		89.5/91.7	
Resulting Fan Rpm	740		820		920	
Maximum Allowable Rpm	1000		1000		1000	
FILTERS						
Standard Efficiency Throwaway (Standard) Quantity...Size (in.)	12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2	
Medium Efficiency (30%) Pleated (Optional) Quantity...Size (in.)	12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2	
High Efficiency (90%) Bag Filters with High Velocity Prefilters (Optional) Quantity...Size (in.)						
Bag Filter	6...24 x 24 x 22 6...24 x 20 x 22		6...24 x 24 x 22 6...24 x 20 x 22		6...24 x 24 x 22 6...24 x 20 x 22	
Prefilter	6...24 x 24 x 2 6...20 x 24 x 2		6...24 x 24 x 2 6...20 x 24 x 2		6...24 x 24 x 2 6...20 x 24 x 2	
OUTSIDE AIR SCREENS						
Standard Hood (25%) Quantity...Size (in.)	4...25 x 16 x 1 2...20 x 16 x 1		4...25 x 16 x 1 2...20 x 16 x 1		4...25 x 16 x 1 2...20 x 16 x 1	
OPTIONAL ECONOMIZER FILTER	Aluminum Frame, Permanent					
Quantity...Size (in.)	12...16 x 25 x 1 2...16 x 20 x 1		12...16 x 25 x 1 2...16 x 20 x 1		12...16 x 25 x 1 2...16 x 20 x 1	

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

Table 1A — Physical Data (48ZG,ZN030-105) (cont)

BASE UNIT	48ZG,ZN075		48ZG,ZN090		48ZG,ZN105	
NOMINAL CAPACITY (tons)	75		90		105	
OPERATING WEIGHT (lb)						
Base Unit without Economizer						
Low Heat/High Heat	10,270/10,445		10,480/10,655		11,210/11,385	
With Economizer						
Low Heat/High Heat	10,800/10,975		11,010/11,185		11,740/11,915	
COMPRESSOR	Semi-Hermetic					
Number	2		2		4	
Circuit (No. Cyl)	A (6)	B (6)	A (6)	B (6)	A1 (6), A2 (4)	B1 (6), B2 (4)
Model 06E	-275	-299	-299	-299	-275, -250	-275, -250
Oil Charge (pints)	19	19	19	19	19, 14	19, 14
Capacity Steps (%)						
CV	43,100		50,100		50,100	
VAV	14,29,43,51,66,86,100		17,33,50,67,83,100		20,30,40,50,60,60,70,80,80,90,100	
Number of Refrigerant Circuits	2		2		2	
REFRIGERANT	R-22					
Operating Charge (lb), Ckt 1/Ckt 2						
Standard Evaporator Coil	70.5/64.5		64.0/64.0		68.0/68.0	
Standard Evaporator with HGBP	73.5/64.5		67.0/64.0		71.0/68.0	
Alternate High-Capacity Evaporator Coil	83.0/75.0		76.0/76.0		79.5/79.5	
Alternate High-Capacity Evaporator with HGBP	86.0/75.0		79.0/76.0		82.5/79.5	
CONDENSER COILS	$^{3}/_{8}$-in. Tube Diameter					
Quantity	4		4		4	
Rows...Fins/in.						
Aluminum	3...17.0		3...17.0		3...17.0	
Copper (Optional)	3...15.7		3...15.7		3...15.7	
Fin Type	Double Wavy		Lanced, Sine-wave		Lanced, Sine-wave	
Tube Type	Smooth		Cross-Hatched		Cross-Hatched	
Total Face Area (sq ft)	108.4		108.4		108.4	
EVAPORATOR COILS						
Quantity	2					
Total Face Area (sq ft)	61.5					
Refrigerant Feed Device...No. per Circuit	TXV...2					
Standard Evaporator Coils	$^{1}/_{2}$ in. Tube Dia		$^{3}/_{8}$ in. Tube Dia		$^{3}/_{8}$ in. Tube Dia	
Rows...Fins/in.	4...17.0		4...17.0		4...17.0	
Fin Type	Double Wavy		Lanced, Sine Wave		Lanced, Sine Wave	
Tube Type	Smooth		Cross Hatched		Cross Hatched	
Alternate, High-Capacity Evaporator Coils	$^{1}/_{2}$ in. Tube Dia					
Rows...Fins/in.	6...16		6...16		6...16	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched		Cross Hatched	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	2	3	2	3	2	3
Input (MBtuh)	650	975	650	975	650	975
Output (MBtuh)	527	790	527	790	527	790
Temperature Rise Range (F)	10-40	20-50	10-40	20-50	10-40	20-50
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter						
Quantity (in. ...drill no.)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (Min...Max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Number of Gas Valves	2	3	2	3	2	3
CONDENSER FAN	Propeller Type					
Quantity...Diameter (in.)	5...30		6...30		6...30	
Nominal Cfm	50,000		60,000		60,000	
Motor Hp (ea)...rpm	1.0...1140		1.0...1140		1.0...1140	
STANDARD SUPPLY FAN	Forward Curved Centrifugal 36 x 30 in.					
Nominal Cfm	24,500		29,750		35,000	
Maximum Allowable Cfm	30,000		34,000		40,000	
Maximum Allowable Rpm	670		670		670	
Shaft Diameter at Pulley (in.)	$1^{11}/_{16}$		$1^{11}/_{16}$		$1^{11}/_{16}$	

STANDARD SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)			
Motor Hp	30	40	50	60
Motor Frame Size	S268T	S324T	S36T	S364T
Efficiency at Full Load (%)				
High Efficiency	92.4	93.0	93.0	93.6
Premium Efficiency	93.6	94.5	94.5	95.4
Fan Pulley Pitch Diameter (in.)	18.5	18.5	18.5	18.5
Motor Pulley Pitch Diameter (in.)	5.3	5.7	6.5	7.1
Resulting Fan Rpm	501	539	615	672
Belts Quantity...Type	3...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320
Center Distance Range (in.)	47.88-45.01	47.64-44.76	47.42-44.52	47.42-44.52

ALTERNATE, AIRFOIL FAN	Airfoil		
Nominal Airflow (cfm)	24,500	29,750	35,000
Maximum Allowable Airflow (cfm)	30,000	34,000	40,000
Maximum Allowable Wheel Speed (rpm)	1846	1846	1846
Shaft Diameter at Pulley (in.)	$2^{11}/_{16}$	$2^{11}/_{16}$	$2^{11}/_{16}$

ALTERNATE SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)				
Motor Hp	30	40	50	60	75
Motor Frame Size	S268T	S324T	S36T	S364T	365T
Efficiency at Full Load (%)					
High Efficiency	92.4	93.0	93.0	93.6	94.1
Premium Efficiency	93.6	94.5	94.5	95.4	95.4
Fan Pulley Pitch Diameter (in.)	9.7	10.2	8.9	8.9	10.8
Motor Pulley Pitch Diameter (in.)	7.5	8.7	8.1	8.7	11.1
Resulting Fan Rpm	1353	1493	1593	1711	1799
Belts Quantity...Type	2...5VX1150	2...5VX1180	3...5VX1150	3...5VX1150	3...5VX1230
Center Distance Range (in.)	42.96...45.82	42.96...45.57	42.96...45.57	42.45...45.35	42.45...45.35

→ Table 1A — Physical Data (48ZG,ZN030-105) (cont)

BASE UNIT	48ZG,ZN075	48ZG,ZN090	48ZG,ZN105
OPTIONAL POWER EXHAUST	Centrifugal, 18 x 15 in. (Any motor available on any unit.)		
Quantity...Motor Hp	2...5	2...7.5	2...10
Motor Frame Size	184T	213T	215T
Efficiency at Full Load (%)			
High Efficiency	87.5	88.5	89.5
Premium Efficiency	89.5	91.7	91.7
Fan Pulley Pitch Diameter (in.)	10.6	10.6	10.6
Motor Pulley Pitch Diameter (in.)	4.5	5.0	5.6
Shaft Diameter at Pulley (in.)	$1^{7}/_{16}$	$1^{7}/_{16}$	$1^{7}/_{16}$
Resulting Fan Rpm	740	820	920
Maximum Allowable Rpm	1000	1000	1000
FILTERS			
Standard Efficiency Throwaway (Standard)	12...20 x 25 x 2	12...20 x 25 x 2	12...20 x 25 x 2
Quantity...Size (in.)	12...20 x 20 x 2	12...20 x 20 x 2	12...20 x 20 x 2
30% and 65% Pleated (Optional)	12...20 x 25 x 2	12...20 x 25 x 2	12...20 x 25 x 2
Quantity...Size (in.)	12...20 x 20 x 2	12...20 x 20 x 2	12...20 x 20 x 2
OUTSIDE AIR SCREENS			
Standard Hood (25%) Quantity...Size (in.)	4...25 x 16 x 1 2...20 x 16 x 1	4...25 x 16 x 1 2...20 x 16 x 1	4...25 x 16 x 1 2...20 x 16 x 1
OPTIONAL ECONOMIZER FILTER	Aluminum Frame, Permanent		
Quantity...Size (in.)	12...16 x 25 x 1 2...16 x 20 x 1	12...16 x 25 x 1 2...16 x 20 x 1	12...16 x 25 x 1 2...16 x 20 x 1

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

Table 1B — Physical Data (48Z6,Z8075-105)

BASE UNIT	48Z6,Z8075		48Z6,Z8090		48Z6,Z8105	
NOMINAL CAPACITY (tons)	75		90		105	
OPERATING WEIGHT (lb)						
Base Unit without Economizer						
Low Heat/High Heat	11,740/11,915		11,950/12,125		12,680/12,855	
With Economizer						
Low Heat/High Heat	12,270/12,445		12,480/12,655		13,210/13,385	
COMPRESSOR	Semi-Hermetic					
Number	2		2		4	
Circuit (No. Cyl)	A (6)	B (6)	A (6)	B (6)	A1 (6), A2 (4)	B1 (6), B2 (4)
Model 06E	-275	-299	-299	-299	-275, -250	-275, -250
Oil Charge (pints)	19	19	19	19	19, 14	19, 14
Capacity Steps (%)						
CV	43,100		50,100		50,100	
VAV	14,29,43,51,66,71,86,100		17,33,50,67,83,100		20,30,40,50,60,70,80,90,100	
Number of Refrigerant Circuits	2		2		2	
REFRIGERANT	R-22					
Operating Charge (lb), Ckt 1/Ckt 2						
Standard Evaporator Coil	70.5/64.5		64.0/64.0		68.0/68.0	
Standard Evaporator with HGBP	73.5/64.5		67.0/64.0		71.0/68.0	
Alternate High-Capacity Evaporator Coil	83.0/75.0		76.0/76.0		79.5/79.5	
Alternate High-Capacity Evaporator with HGBP	86.0/75.0		79.0/76.0		82.5/79.5	
CONDENSER COILS	$^{3}/_{8}$-in. Tube Diameter					
Quantity	4		4		4	
Rows...Fins/in.						
Aluminum	3...17.0		3...17.0		3...17.0	
Copper (Optional)	3...15.7		3...15.7		3...15.7	
Fin Type	Double Wavy		Lanced, Sine-wave		Lanced, Sine-wave	
Tube Type	Smooth		Cross-Hatched		Cross-Hatched	
Total Face Area (sq ft)	108.4		108.4		108.4	
EVAPORATOR COILS						
Quantity	2					
Total Face Area (sq ft)	61.5					
Refrigerant Feed Device...No. per Circuit	TXV...2					
Standard Evaporator Coils	$^{1}/_{2}$ in. Tube Dia		$^{3}/_{8}$ in. Tube Dia		$^{3}/_{8}$ in. Tube Dia	
Rows...Fins/in.	4...17.0		4...17.0		4...17.0	
Fin Type	Double Wavy		Lanced, Sine Wave		Lanced, Sine Wave	
Tube Type	Smooth		Cross Hatched		Cross Hatched	
Alternate, High-Capacity Evaporator Coils	$^{1}/_{2}$ in. Tube Dia					
Rows...Fins/in.	6...16		6...16		6...16	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched		Cross Hatched	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	2	3	2	3	2	3
Input (MBtuh)	650	975	650	975	650	975
Output (MBtuh)	527	790	527	790	527	790
Temperature Rise Range (F)	10-40	20-50	10-40	20-50	10-40	20-50
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter						
Quantity (in. ...drill no.)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (Min...Max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Number of Gas Valves	2	3	2	3	2	3
CONDENSER FAN	Propeller Type					
Quantity...Diameter (in.)	5...30		6...30		6...30	
Nominal Cfm	50,000		60,000		60,000	
Motor Hp (ea)...rpm	1.0...1140		1.0...1140		1.0...1140	
STANDARD SUPPLY FAN	Forward Curved Centrifugal 36 x 30 in.					
Nominal Cfm	24,500		29,750		35,000	
Maximum Allowable Cfm	30,000		34,000		40,000	
Maximum Allowable Rpm	670		670		670	
Shaft Diameter at Pulley (in.)	$1^{11}/_{16}$		$1^{11}/_{16}$		$1^{11}/_{16}$	

STANDARD SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit.)			
Motor Hp	30	40	50	60
Motor Frame Size	S268T	S324T	S36T	S364T
Efficiency at Full Load (%)				
High Efficiency	92.4	93.0	93.0	93.6
Premium Efficiency	93.6	94.5	94.5	95.4
Fan Pulley Pitch Diameter (in.)	18.5	18.5	18.5	18.5
Motor Pulley Pitch Diameter (in.)	5.3	5.7	6.5	7.1
Resulting Fan Rpm	501	539	615	672
Belts Quantity...Type	3...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320
Center Distance Range (in.)	47.88-45.01	47.64-44.76	47.42-44.52	47.42-44.52

ALTERNATE, AIRFOIL FAN	Airfoil		
Nominal Airflow (cfm)	24,500	29,750	35,000
Maximum Allowable Airflow (cfm)	30,000	34,000	40,000
Maximum Allowable Wheel Speed (rpm)	1846	1846	1846
Shaft Diameter at Pulley (in.)	$2^{11}/_{16}$	$2^{11}/_{16}$	$2^{11}/_{16}$

ALTERNATE SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit.)				
Motor Hp	30	40	50	60	75
Motor Frame Size	S268T	S324T	S36T	S364T	365T
Efficiency at Full Load (%)					
High Efficiency	92.4	93.0	93.0	93.6	94.1
Premium Efficiency	93.6	94.5	94.5	95.4	95.4
Fan Pulley Pitch Diameter (in.)	9.7	10.2	8.9	8.9	10.8
Motor Pulley Pitch Diameter (in.)	7.5	8.7	8.1	8.7	11.1
Resulting Fan Rpm	1353	1493	1593	1711	1799
Belts Quantity...Type	2...5VX1150	2...5VX1180	3...5VX1150	3...5VX1150	3...5VX1230
Center Distance Range (in.)	42.96...45.82	42.69...45.57	42.69...45.57	42.45...45.35	42.45...45.35

→ Table 1B — Physical Data (48Z6,Z8075-105) (cont)

BASE UNIT	48Z6,Z8075		48Z6,Z8090	48Z6,Z8105
RETURN/EXHAUST FAN	Plenum Fan, 47.13 in. (Any motor available on any unit.)			
Quantity...Motor Hp	1...20	1...25	1...30	1...40
Motor Frame Size	256T	284T	286T	324T
Efficiency at Full Load (%) High/Premium	91/93.6	91.7/93.6	92.4/93.6	93/93.8
Fan Pulley Pitch Diameter (in.)	8.5	9.8	8.5	8.5
Motor Pulley Pitch Diameter (in.)	5.3	6.7	6.1	6.7
Shaft Diameter at Pulley (in.)	$2\frac{15}{16}$	$2\frac{15}{16}$	$2\frac{15}{16}$	$2\frac{15}{16}$
Resulting Fan Rpm	1104	1209	1271	1396
Maximum Allowable Rpm	1447	1447	1447	1447
FILTERS				
Standard Efficiency Throwaway (Standard)	12...20 x 25 x 2		12...20 x 25 x 2	12...20 x 25 x 2
Quantity...Size (in.)	12...20 x 20 x 2		12...20 x 20 x 2	12...20 x 20 x 2
30% and 65% Pleated (Optional)	12...20 x 25 x 2		12...20 x 25 x 2	12...20 x 25 x 2
Quantity...Size (in.)	12...20 x 20 x 2		12...20 x 20 x 2	12...20 x 20 x 2
OPTIONAL ECONOMIZER FILTER	Aluminum Frame, Permanent			
Quantity...Size (in.)	12...16 x 25 x 1 2...16 x 20 x 1		12...16 x 25 x 1 2...16 x 20 x 1	12...16 x 25 x 1 2...16 x 20 x 1

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

Table 1C — Physical Data (48ZT,ZW075-105)

BASE UNIT	48ZT,ZW075		48ZT,ZW090		48ZT,ZW105	
NOMINAL CAPACITY (tons)	75		80		100	
OPERATING WEIGHT (lb)						
Base Unit without Economizer						
Low Heat/High Heat	13,205/13,380		13,415/13,590		14,145/14,320	
COMPRESSOR	Semi-Hermetic					
Number	2		2		4	
Circuit (No. Cyl)	A (6)	B (6)	A (6)	B (6)	A1 (6), A2 (4)	B1 (6), B2 (4)
Model 06E	-275	-299	-299	-299	-275, -250	-275, -250
Oil Charge (pints)	19	19	19	19	19, 14	19, 14
Capacity Steps (%)						
CV	43,100		50,100		50,100	
VAV	14,29,43,51,66,71,86,100		17,33,50,67,83,100		20,30,40,50,60,70,80,90,100	
Number of Refrigerant Circuits	2		2		2	
REFRIGERANT	R-22					
Operating Charge (lb), Ckt 1/Ckt 2						
Standard Evaporator Coil	70.5/64.5		64.0/64.0		68.0/68.0	
Standard Evaporator with HGBP	73.5/64.5		67.0/64.0		71.0/68.0	
Alternate High-Capacity Evaporator Coil	83.0/75.0		76.0/76.0		79.5/79.5	
Alternate High-Capacity Evaporator with HGBP	86.0/75.0		79.0/76.0		82.5/79.5	
CONDENSER COILS	3/8-in. Tube Diameter					
Quantity	4		4		4	
Rows...Fins/in.						
Aluminum	3...17.0		3...17.0		3...17.0	
Copper (Optional)	3...15.7		3...15.7		3...15.7	
Fin Type	Double Wavy		Lanced, Sine-wave		Lanced, Sine-wave	
Tube Type	Smooth		Cross-Hatched		Cross-Hatched	
Total Face Area (sq ft)	108.4		108.4		108.4	
EVAPORATOR COILS						
Quantity	2					
Total Face Area (sq ft)	61.5					
Refrigerant Feed Device...No. per Circuit	TXV...2					
Standard Evaporator Coils	1/2 in. Tube Dia		3/8 in. Tube Dia		3/8 in. Tube Dia	
Rows...Fins/in.	4...17.0		4...17.0		4...17.0	
Fin Type	Double Wavy		Lanced, Sine Wave		Lanced, Sine Wave	
Tube Type	Smooth		Cross Hatched		Cross Hatched	
Alternate, High-Capacity Evaporator Coils	1/2 in. Tube Dia					
Rows...Fins/in.	6...16		6...16		6...16	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Cross Hatched		Cross Hatched		Cross Hatched	
HEATING SECTION	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Number of Heat Exchangers	2	3	2	3	2	3
Input (MBtuh)	650	975	650	975	650	975
Output (MBtuh)	527	790	527	790	527	790
Temperature Rise Range (F)	10-40	20-50	10-40	20-50	10-40	20-50
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter						
Quantity (in. ...drill no.)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)	14 (.1285...30)	21 (.1285...30)
Manifold Pressure (in. wg)	3.3	3.3	3.3	3.3	3.3	3.3
Line Pressure (in. wg) (Min...Max)	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0	5.0...13.0
Number of Gas Valves	2	3	2	3	2	3
CONDENSER FAN	Propeller Type					
Quantity...Diameter (in.)	5...30		6...30		6...30	
Nominal Cfm	50,000		60,000		60,000	
Motor Hp (ea)...rpm	1.0...1140		1.0...1140		1.0...1140	
STANDARD SUPPLY FAN	Forward Curved Centrifugal 36 x 30 in.					
Nominal Cfm	24,500		29,750		35,000	
Maximum Allowable Cfm	30,000		34,000		40,000	
Maximum Allowable Rpm	670		670		670	
Shaft Diameter at Pulley (in.)	$1\frac{11}{16}$		$1\frac{11}{16}$		$1\frac{11}{16}$	

STANDARD SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)			
Motor Hp	30	40	50	60
Motor Frame Size	S268T	S324T	S36T	S364T
Efficiency at Full Load (%)				
High Efficiency	92.4	93.0	93.0	93.6
Premium Efficiency	93.6	94.5	94.5	95.4
Fan Pulley Pitch Diameter (in.)	18.5	18.5	18.5	18.5
Motor Pulley Pitch Diameter (in.)	5.3	5.7	6.5	7.1
Resulting Fan Rpm	501	539	615	672
Belts Quantity...Type	3...5VX1320	4...5VX1320	4...5VX1320	4...5VX1320
Center Distance Range (in.)	47.88-45.01	47.64-44.76	47.42-44.52	47.42-44.52

ALTERNATE, AIRFOIL FAN	48ZT,ZW075	48ZT,ZW090	48ZT,ZW105
	Airfoil		
Nominal Airflow (cfm)	24,500	29,750	35,000
Maximum Allowable Airflow (cfm)	30,000	34,000	40,000
Maximum Allowable Wheel Speed (rpm)	1846	1846	1846
Shaft Diameter at Pulley (in.)	$2\frac{11}{16}$	$2\frac{11}{16}$	$2\frac{11}{16}$

ALTERNATE SUPPLY-FAN MOTOR AND DRIVE	(Any motor available on any unit)				
Motor Hp	30	40	50	60	75
Motor Frame Size	S268T	S324T	S36T	S364T	365T
Efficiency at Full Load (%)					
High Efficiency	92.4	93.0	93.0	93.6	94.1
Premium Efficiency	93.6	94.5	94.5	95.4	95.4
Fan Pulley Pitch Diameter (in.)	9.7	10.2	8.9	8.9	10.8
Motor Pulley Pitch Diameter (in.)	7.5	8.7	8.1	8.7	11.1
Resulting Fan Rpm	1353	1493	1593	1711	1799
Belts Quantity...Type	2...5VX1150	2...5VX1180	3...5VX1150	3...5VX1150	3...5VX1230
Center Distance Range (in.)	42.96...45.82	42.96...45.57	42.96...45.57	42.45...45.35	42.45...45.35

→ Table 1C — Physical Data (48ZT,ZW075-105) (cont)

BASE UNIT	48ZT,ZW075		48ZT,ZW090		48ZT,ZW105
POWER EXHAUST	Centrifugal, 22 x 20 in., 1 11/16 in. shaft diameter (Any motor available on any unit)				
Total Hp	20	30	40	50	60
Quantity...Motor Hp	2...10	2...15	2...20	2...25	2...30
Motor Frame Size	S215T	D254T	S256T	S284T	S286T
Efficiency at Full Load (%)					
High Efficiency	89.5	91	91	91.7	92.4
Premium Efficiency	91.7	93	93.6	93.6	93.6
Fan Sheave Pitch Diameter (in.)	12.4	12.4	11.1	11.1	11.1
Motor Sheave Pitch Diameter (in.)	4.8	5.8	5.9	6.5	6.9
Resulting Fan Rpm	714	841	928	1020	1094
Maximum Allowable Rpm	1175	1175	1175	1175	1175
Belts — Quantity...Type	2...BX93	2...BX93	2...5VX950	2...5VX950	2...5VX950
FILTERS					
Standard Efficiency Throwaway (Standard) Quantity...Size (in.)	12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2
30% and 65% Pleated (Optional) Quantity...Size (in.)	12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2		12...20 x 25 x 2 12...20 x 20 x 2
OUTSIDE AIR SCREENS					
Standard Hood (25%) Quantity...Size (in.)	8...25 x 16 x 1 2...20 x 16 x 1		8...25 x 16 x 1 2...20 x 16 x 1		8...25 x 16 x 1 2...20 x 16 x 1

LEGEND

CV — Constant Volume
HGBP — Hot Gas Bypass
MBtuh — Btuh in Thousands
TXV — Thermostatic Expansion Valve
VAV — Variable Air Volume

Table 2 — Operating Weights of Options and Accessories

OPTION OR ACCESSORY	UNIT SIZE							
	030,035	**040,050**	**055**	**060**	**070**	**075**	**090**	**105**
Roof Curb	450	480	515	515	515	560	560	560
Condenser Section Roof Curb	—	—	540	540	625	625	625	625
Economizer*	300	300	530	530	530	530	530	530
Power Exhaust*	600	600	710	710	710	710	710	710
Barometric Relief	200	200	200	200	200	200	200	200
Return Exhaust Fan*	—	—	—	—	—	1470	1470	1470
High-Efficiency Filters	20	20	20	20	20	—	—	—
Bag Filters	35	35	40	40	40	—	—	—
Hail Guard	120	150	145	145	210	210	210	210
Copper Condenser Coil Fins	180	235	235	235	420	420	420	420
Inlet Guide Vanes	95	95	115	115	115	115	115	115
Variable Frequency Drive								
7.5 hp	65	65	—	—	—	—	—	—
10 hp	65	65	—	—	—	—	—	—
15 hp	110	110	110	110	110	—	—	—
20 hp	111	111	111	111	111	111	111	111
25 hp	190	190	190	190	190	190	190	190
30 hp	190	190	190	190	190	152	152	152
40 hp	—	190	190	190	190	155	155	155
50 hp	—	—	—	—	—	263	263	263
60 hp	—	—	—	—	—	266	266	266
75 hp	—	—	—	—	—	266	266	266
High-Capacity Evaporator Coil	—	300	300	300	300	300	300	300

*Includes hood.

Table 3 — Supply Fan Drive Data

HP	SHAFT DIA	SPEED (rpm)	MOTOR SHEAVE	MOTOR PITCH DIA.	WHEEL SHEAVE	WHEEL PITCH DIA.	QUANTITY ...BELT
Sizes 030-050							
7.5	1 3/8	438	2BK36	3.4	2B5V136	13.6	2...BX60
10	1 3/8	549	2B5V42	4.3	2B5V136	13.7	2...5VX630
15	1 5/8	626	2B5V48	4.9	2B5V136	13.7	2...5VX630
20	1 5/8	703	2B5V54	5.5	2B5V136	13.7	2...5VX630
25	1 7/8	830	2B5V64	6.5	2B5V136	13.7	2...5VX650
30*	1 7/8	910	3B5V64	6.5	3B5V124	12.5	3...5VX630
Sizes 055-070							
15	1 5/8	575	2B5V44	4.5	2B5V136	13.7	2...5VX1230
20	1 5/8	651	2B5V50	5.1	2B5V136	13.7	2...5VX1230
25	1 7/8	703	2B5V54	5.5	2B5V136	13.7	2...5VX1230
30	1 7/8	711	2B5V62	6.3	2B5V154	15.5	2...5VX1250
40	2 1/8	740	3B5V66	6.7	3B5V160	16.1	3...5VX1250
Sizes 075-105 (Forward Curved Fan)							
30	1 7/8	501	3B5V52	5.33	B5V184	18.5	3...5VX1320
40	2 1/8	539	4B5V56	5.74	B5V184	18.5	4...5VX1320
50	2 1/8	615	4B5V64	6.54	B5V184	18.5	4...5VX1320
60	2 3/8	672	4B5V70	7.14	B5V184	18.5	4...5VX1320
Sizes 075-105 (Airfoil Fan)							
30	1 7/8	1353	2B5V74	7.5	2Q5V97	9.7	2...5VX1150
40	2 1/8	1493	2B5V86	8.7	2Q5V103	10.2	2...5VX1180
50	2 1/8	1593	3B5V80	8.1	3R5V90	8.9	3...5VX1150
60	2 3/8	1711	3B5V86	8.7	3R5V90	8.9	3...5VX1150
75	2 3/8	1799	3B5V110	11.1	3R5V109	10.8	3...5VX1230

*Sizes 040,050 only.

NOTE: Part numbers are Browning Manufacturing Corp. reference.

Table 4 — Power Exhaust Fan Drive Data

TOTAL HP	MOTOR QTY...HP	MOTOR SHAFT DIA (in.)	FAN SPEED RPM	MOTOR SHEAVE P/N	MOTOR SHEAVE PITCH DIA (in.)	FAN SHEAVE P/N	FAN SHEAVE PITCH DIA (in.)	BELTS QTY...P/N	CENTER DIST RANGE (in.)
Sizes 030-050									
6*	2...3	7/8	656	1VL44	4.1	BK115	11	1...BX71	23.62-26.50
6†	2...3	1 1/8	656	1VP44L	4.1	BK115	11	1...BX71	23.62-26.50
10**	2...5	1 1/8	785	1VP50L	4.7	BK110	10.4	1...BX71	23.62-26.50
15**	2...7.5	1 3/8	882	1VP65	6.0	BK130	12	1...BX77	23.62-26.50
20**	2...10	1 3/8	1000	1VP75	7.0	BK130	12	1...BX79	23.62-26.50
Sizes 055-105									
10	2...5	1 1/8	740	2P3V45	4.5	2Q3V106	10.6	2...3VX800	26.8-28.5
15	2...7.5	1 3/8	820	2P3V50	5.0	2Q3V106	10.6	2...3VX800	26.8-28.5
20	2...10	1 3/8	920	2P3V56	5.6	2Q3V106	10.6	2...3VX800	26.8-28.5

*High-Efficiency Motor Option.
†Premium-Efficiency Motor Option.
**Applies to both motor options.

NOTE: Part numbers are Browning Manufacturing Corp. reference.

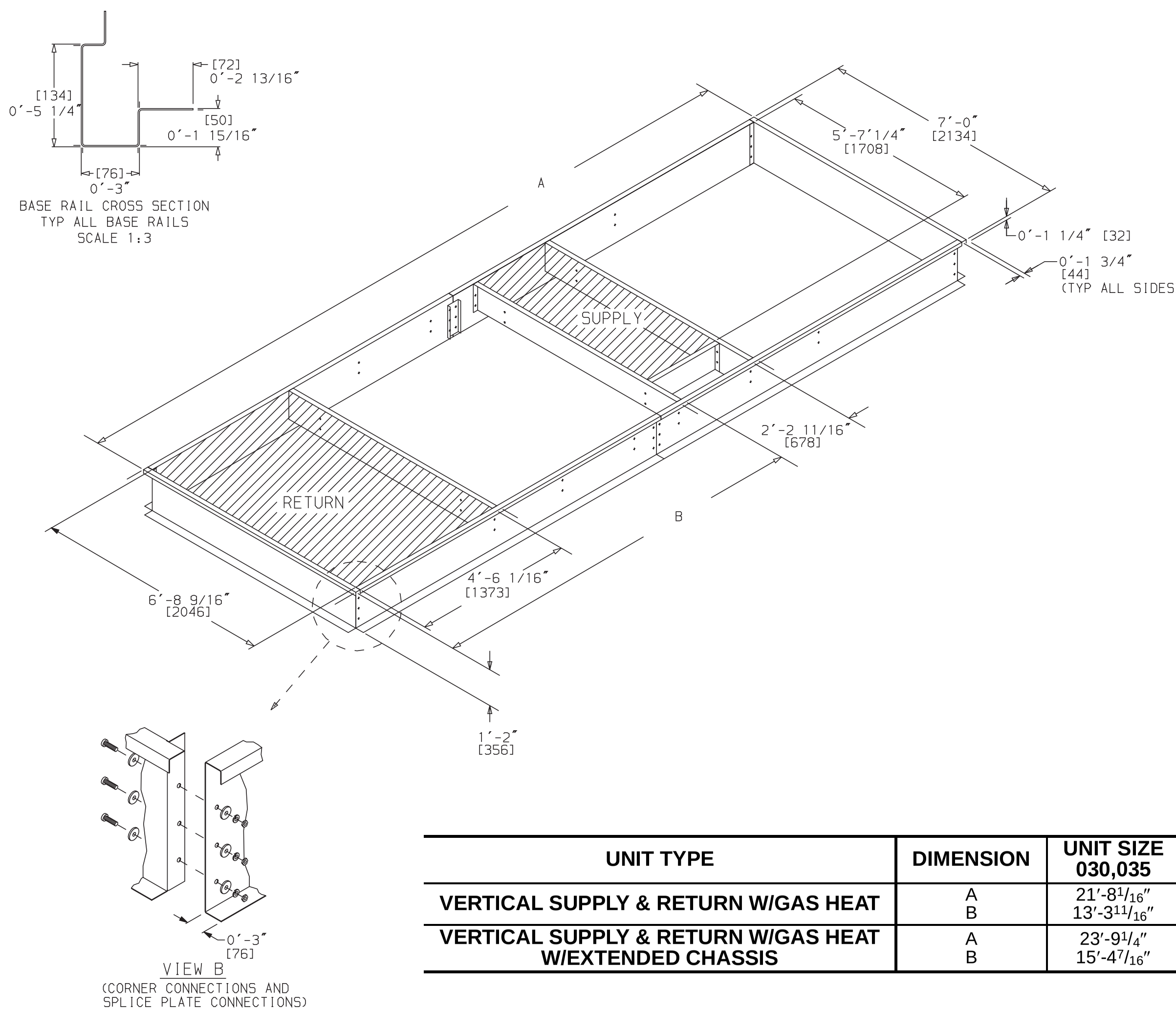
Table 5 — High-Capacity Power Exhaust Fan Drive Data (48ZT,ZW Units)

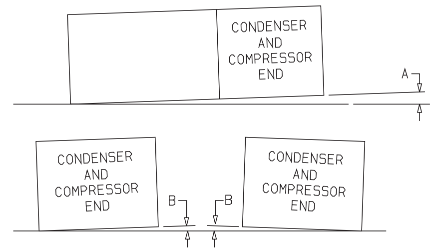
TOTAL HP	MOTOR QTY...HP	MOTOR SHAFT DIA. (in.)	SPEED RPM	MOTOR SHEAVE		BLOWER SHEAVE		QTY...BELT	CENTER DISTANCE RANGE (in.)
				Part Number	Pitch Diameter (in.)	Part Number	Pitch Diameter (in.)		
20	2...10	1.375	714	2B5V48	4.8	2B5V124	12.4	2...BX93	32.8 to 36.7
30	2...15	1.625	841	2B5V58	5.8	2B5V124	12.4	2...BX93	32.6 to 36.5
40	2...20	1.625	928	2B5V58	5.9	2B5V110	11.1	2...5VX950	32.6 to 36.5
50	2...25	1.875	1020	2B5V64	6.5	2B5V110	11.1	2...5VX950	32.5 to 36.3
60	2...30	1.875	1094	2B5V68	6.9	2B5V110	11.1	2...5VX950	32.5 to 36.3

Table 6 — Return/Exhaust Fan Drive Data (48Z6,Z8 Units)

TOTAL HP	MOTOR QTY...HP	MOTOR SHAFT DIA. (in.)	SPEED RPM	MOTOR SHEAVE		BLOWER SHEAVE		QTY...BELT	CENTER DISTANCE RANGE (in.)
				Part Number	Pitch Diameter (in.)	Part Number	Pitch Diameter (in.)		
20	1...20	1.625	1104	3B5V52	5.3	3R5V85	8.5	3...5VX1000	38.1 to 41.0
25	1...25	1.875	1209	3B5V66	6.7	3R5V97	9.8	3...5VX1060	38.9 to 41.8
30	1...30	1.875	1271	3B5V60	6.1	3R5V85	8.5	3...5VX1030	38.9 to 41.8
40	1...40	2.125	1396	3B5V66	6.7	3R5V85	8.5	3...5VX1060	39.9 to 42.8

NOTES:
1. ROOF CURB IS SHIPPED DISASSEMBLED.
2. ROOFCURB: 14 GA.[VA03-56] STL.
3. DIMENSIONS IN [ ] ARE MILLIMETERS.

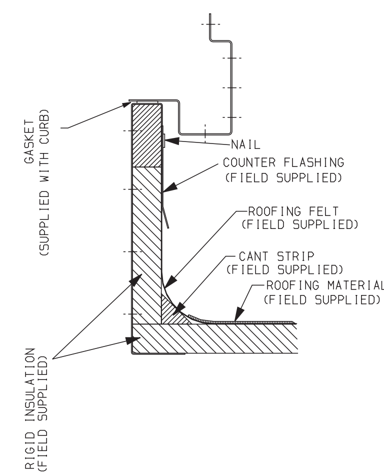




DIMENSIONS*
(degrees and inches)

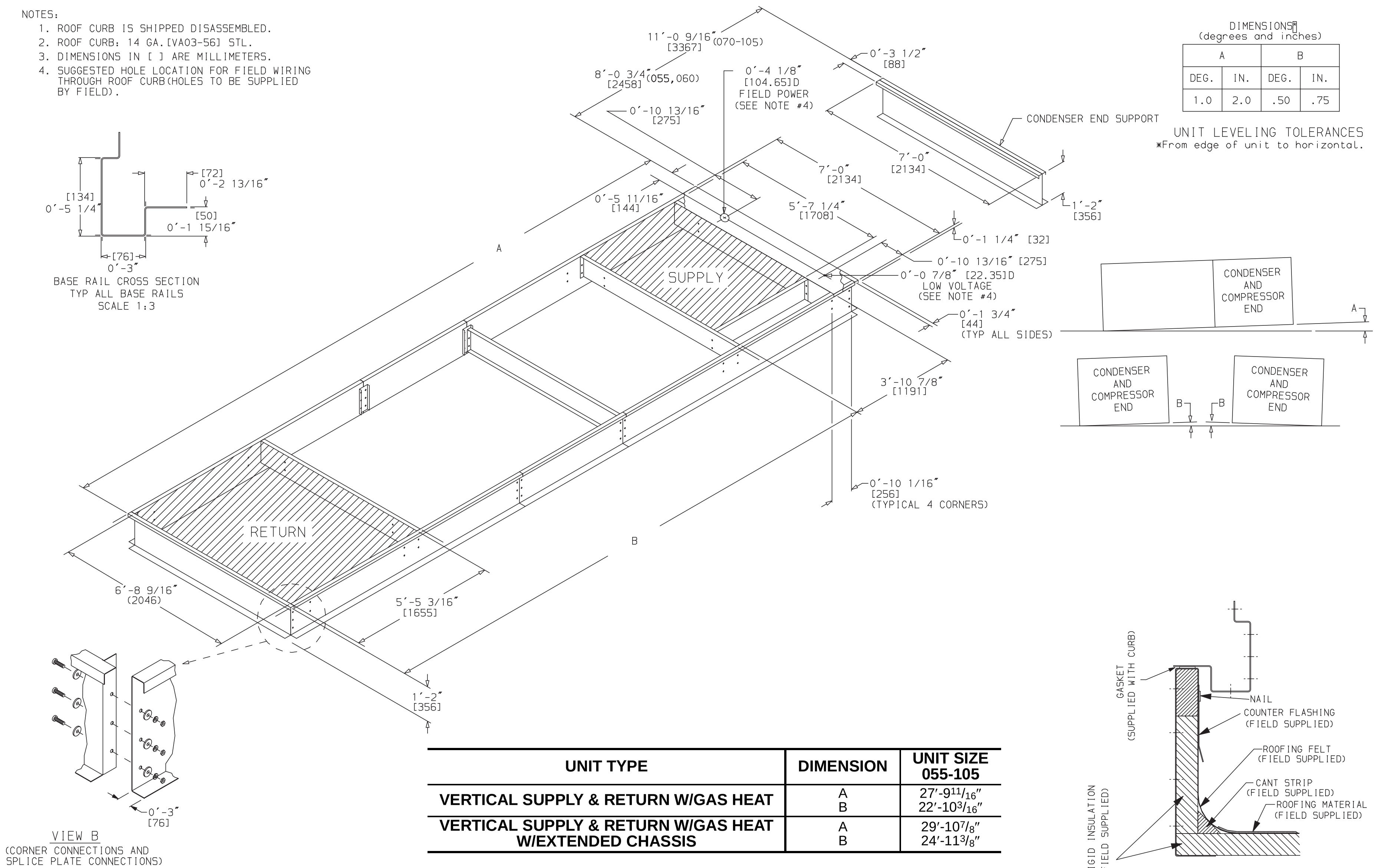
A		B	
DEG.	IN.	DEG.	IN.
1.0	2.0	.50	.75

UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.



UNIT TYPE	DIMENSION	UNIT SIZE 030,035	UNIT SIZE 040,050
VERTICAL SUPPLY & RETURN W/GAS HEAT	A B	21'-8 1/16" 13'-3 11/16"	25'-8 11/16" 16'-0 5/8"
VERTICAL SUPPLY & RETURN W/GAS HEAT W/EXTENDED CHASSIS	A B	23'-9 1/4" 15'-4 7/16"	27'-9 5/16" 18'-1 7/8"

Fig. 1 — Roof Curb; Sizes 030-050

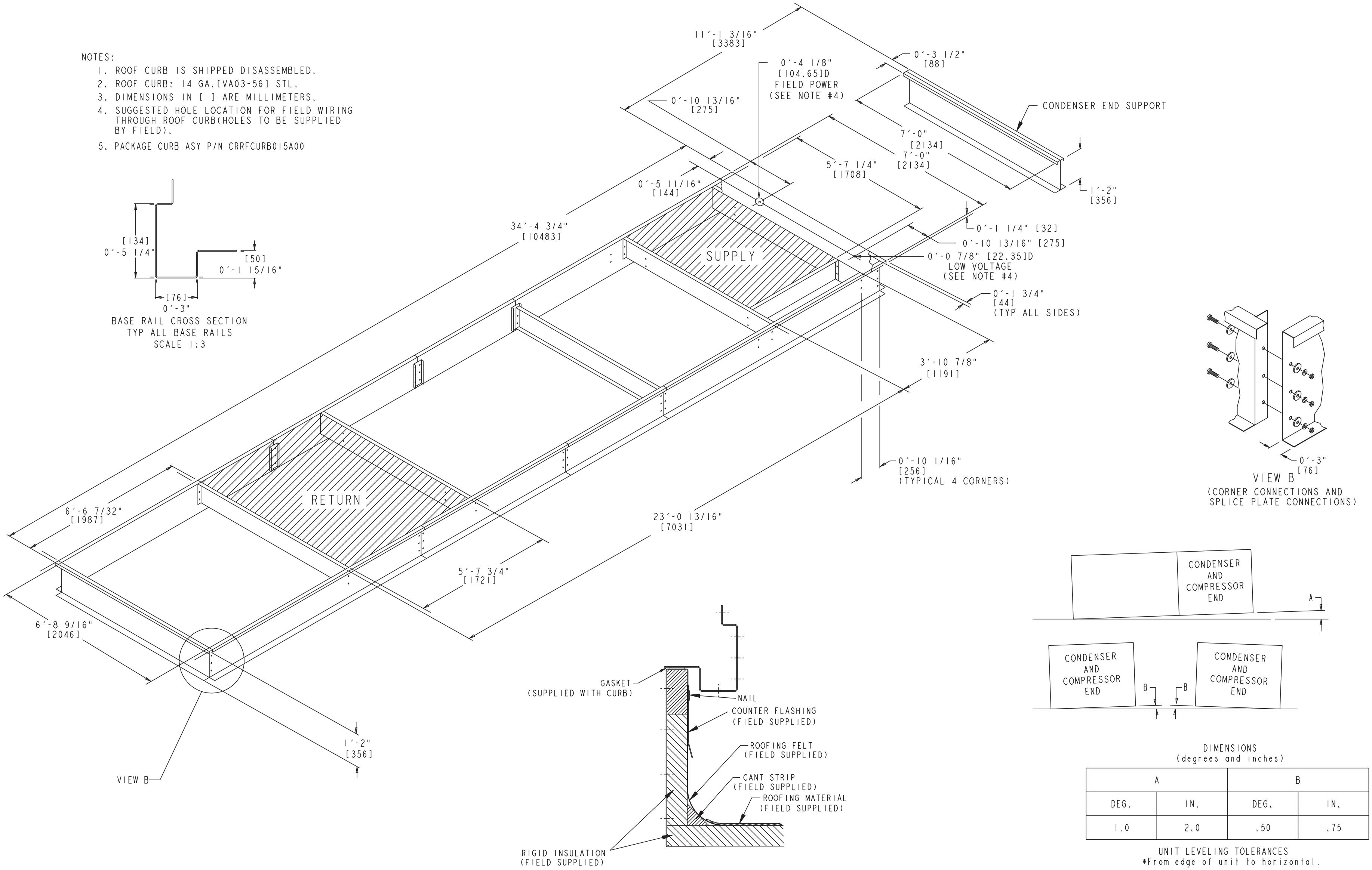


UNIT TYPE	DIMENSION	UNIT SIZE 055-105
VERTICAL SUPPLY & RETURN W/GAS HEAT	A B	27′-9 11/16″ 22′-10 3/16″
VERTICAL SUPPLY & RETURN W/GAS HEAT W/EXTENDED CHASSIS	A B	29′-10 7/8″ 24′-11 3/8″

Fig. 2 — Roof Curb; Sizes 055-070 and Sizes 075-105 without High-Capacity Power Exhaust

NOTES:

1. ROOF CURB IS SHIPPED DISASSEMBLED.
2. ROOF CURB: 14 GA.[VA03-56] STL.
3. DIMENSIONS IN [ ] ARE MILLIMETERS.
4. SUGGESTED HOLE LOCATION FOR FIELD WIRING THROUGH ROOF CURB(HOLES TO BE SUPPLIED BY FIELD).
5. PACKAGE CURB ASY P/N CRRFCURB015A00



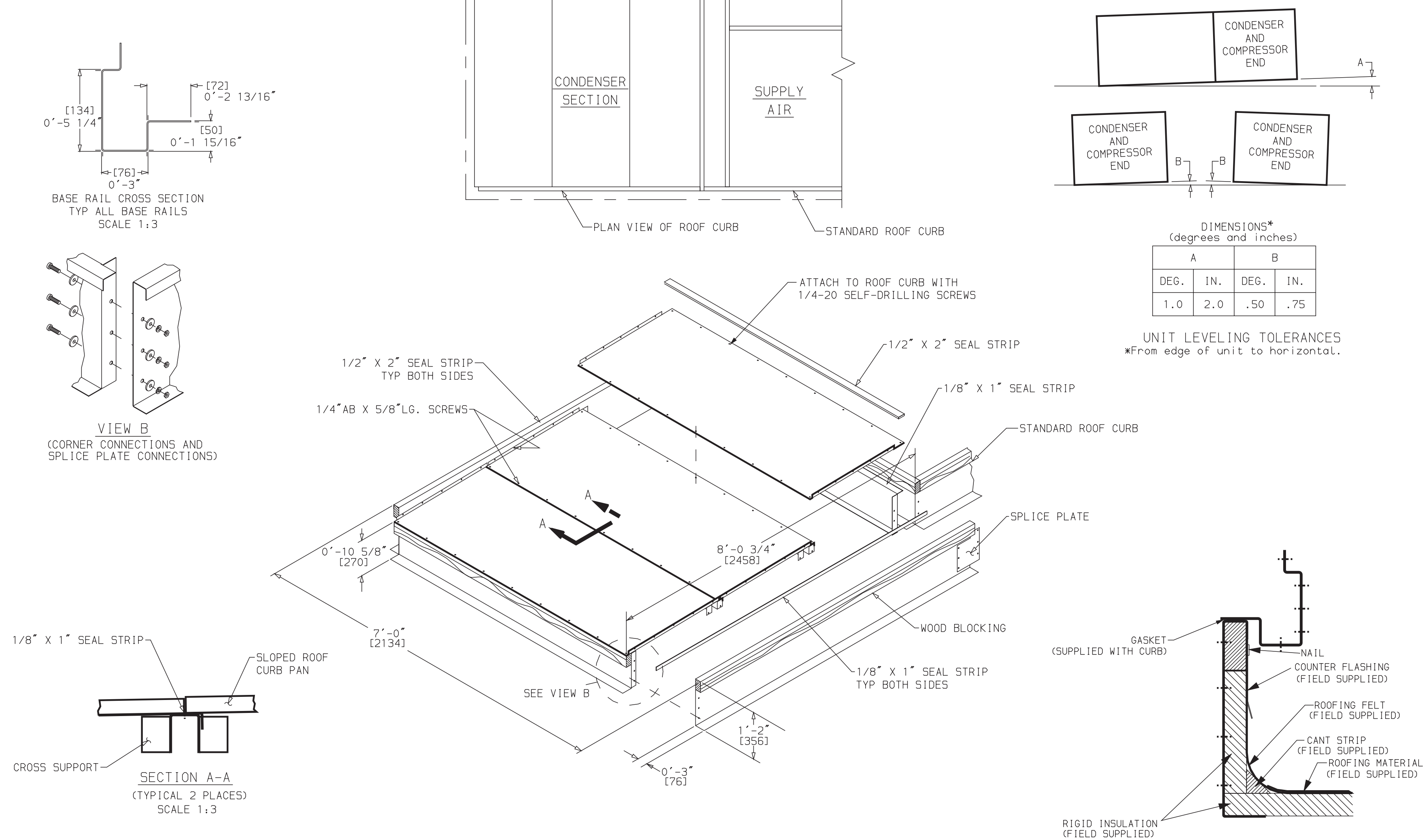
DIMENSIONS
(degrees and inches)

A		B	
DEG.	IN.	DEG.	IN.
1.0	2.0	.50	.75

UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.

Fig. 3 — Roof Curb; Sizes 075-105 with High-Capacity Power Exhaust

NOTES:
1. ROOF CURB ACCESSORY IS SHIPPED DISASSEMBLED.
2. DIMENSIONS IN [ ] ARE MILLIMETERS.
3. ROOF CURB: 14 GA.[VA03-56] STL.
   ROOF CURB PANS: 16 GA.[VA03-56] STL.



DIMENSIONS*
(degrees and inches)

A		B	
DEG.	IN.	DEG.	IN.
1.0	2.0	.50	.75

UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.

Fig. 4 — Condenser Section Roof Curb (Size 055 and 060 Only)

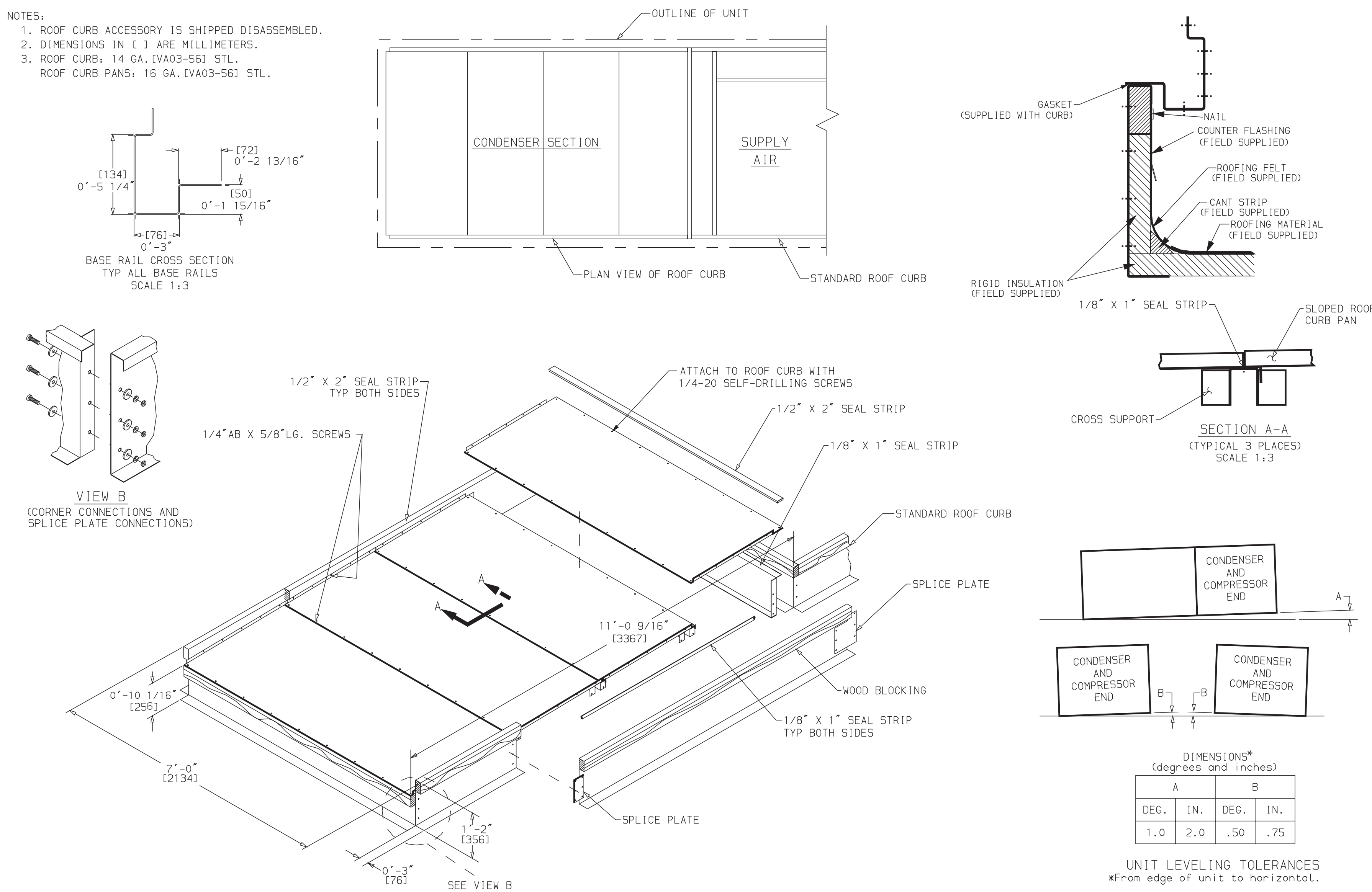


Fig. 5 — Condenser Section Roof Curb (Size 070-105 Only)

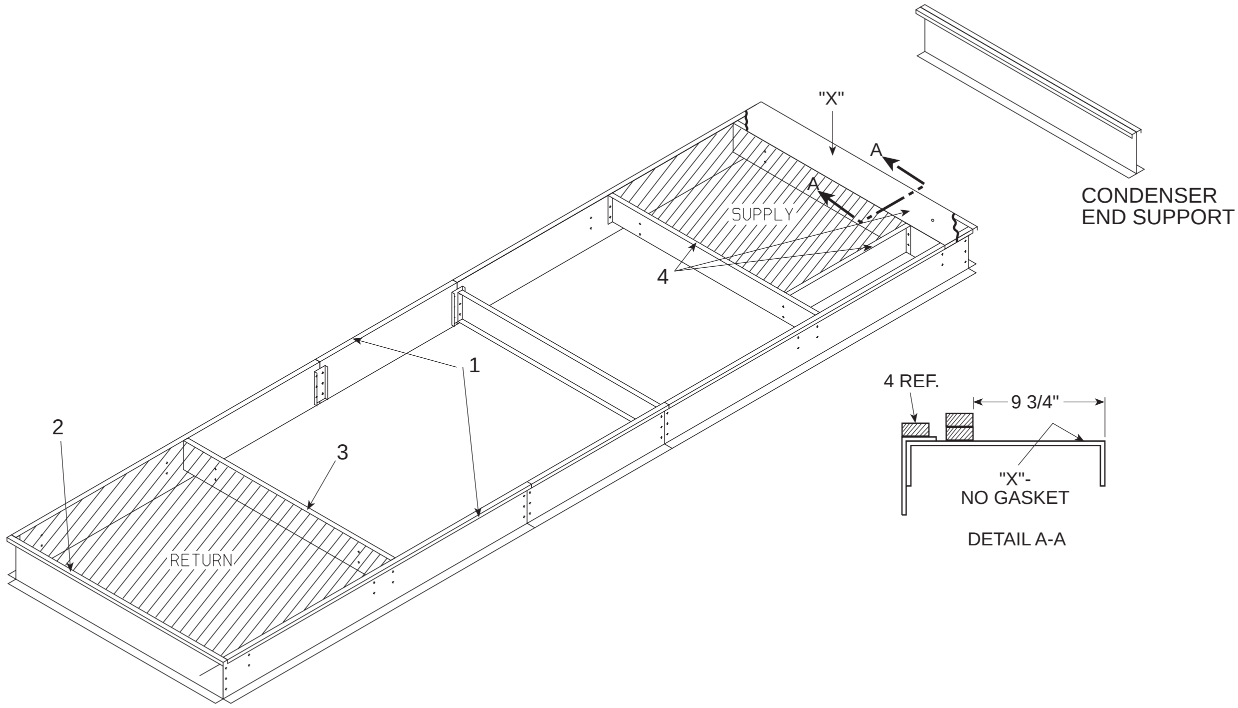


Fig. 6 — Gasket Location on Roof Curb (48ZG,ZN055-105 and 48Z6,Z8075-105 Units)

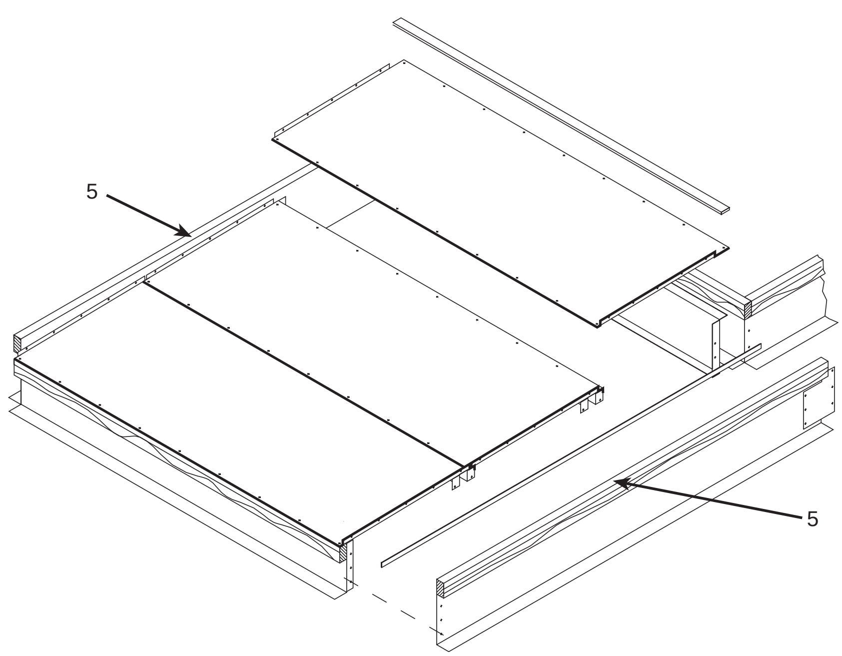


Fig. 7 — Gasket Location — Condenser Section Roof Curb (Size 055-105 Units)

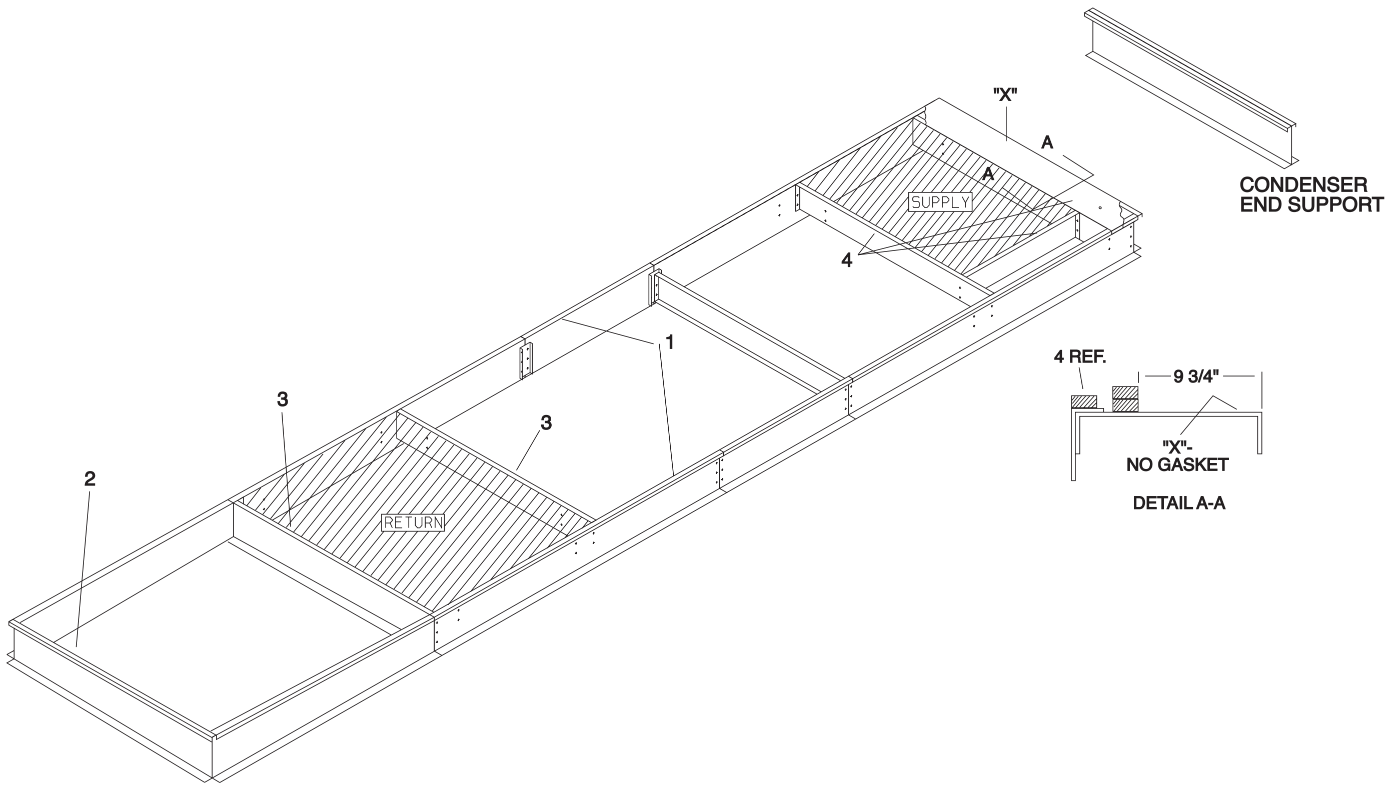
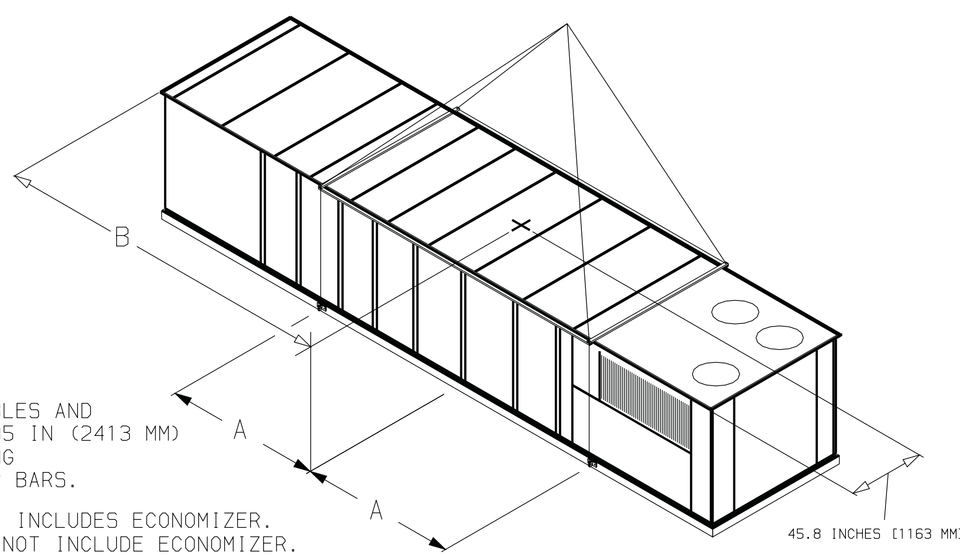


Fig. 8 — Gasket Location on Roof Curb (48ZT,ZW075-105 Units)

⚠ CAUTION

NOTICE TO RIGGERS
1. ALL PANELS MUST BE IN PLACE WHEN RIGGING.
2. DO NOT ATTEMPT TO FORK THESE UNITS.

UNIT	WEIGHT		A		B		ECONOMIZER	
	lb	kg	in.	mm	in.	mm	lb	kg
48Z030	5770	2623	83.23	2114	176.14	4474	300	136
48Z035	5895	2679	83.23	2114	177.99	4521	300	136
48Z040	6670	3032	92.64	2353	205.87	5229	300	136
48Z050	6710	3050	92.64	2353	207.01	5258	300	136



NOTE:
RIG WITH FOUR CABLES AND SPREAD WITH TWO 95 IN (2413 MM) AND TWO "A+A" LONG SUITABLE SPREADER BARS.

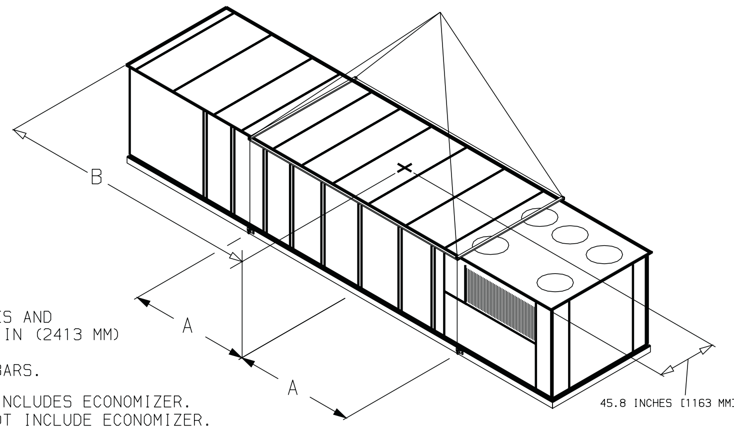
CENTER OF GRAVITY INCLUDES ECONOMIZER.
UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.

Fig. 9 — Rigging Label — Size 030-050 Units (Standard Chassis)

⚠ CAUTION

NOTICE TO RIGGERS
1. ALL PANELS MUST BE IN PLACE WHEN RIGGING.
2. DO NOT ATTEMPT TO FORK THESE UNITS.

UNIT	WEIGHT		A		B		ECONOMIZER	
	lb	kg	in.	mm	in.	mm	lb	kg
48Z055	8,820	4009	128.75	3270	235.0	5969	530	240.9
48Z060	9,120	4145	128.75	3270	235.0	5969	530	240.9
48Z070	9,550	4341	112.50	2858	252.0	6401	530	240.9
48ZG,ZN075	10,445	4738	127.80	3247	260.6	6618	530	240.9
48ZG,ZN090	10,655	4833	127.80	3247	262.4	6666	530	240.9
48ZG,ZN105	11,385	5164	127.80	3247	271.0	6883	530	240.9
48Z6,Z8075	11,915	5405	127.80	3247	260.6	6618	530	240.9
48Z6,Z8090	12,125	5500	127.80	3247	262.4	6666	530	240.9
48Z6,Z8105	12,855	5831	127.80	3247	271.0	6883	530	240.9



NOTE:

RIG WITH FOUR CABLES AND
SPREAD WITH TWO 95 IN (2413 MM)
AND TWO "A+A" LONG
SUITABLE SPREADER BARS.

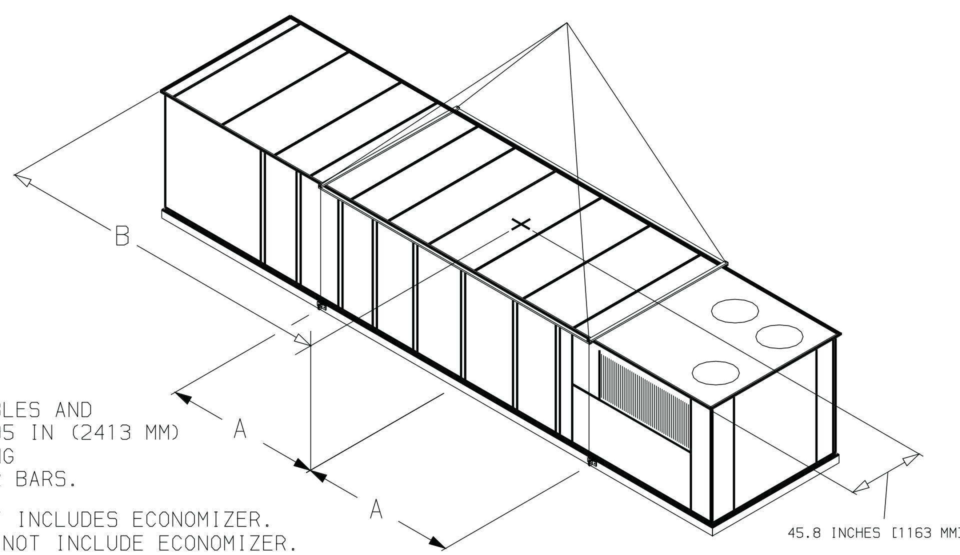
CENTER OF GRAVITY INCLUDES ECONOMIZER.
UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.

Fig. 10 — Rigging Label — Size 055-105 Units (Standard Chassis)

⚠ CAUTION

NOTICE TO RIGGERS
1. ALL PANELS MUST BE IN PLACE WHEN RIGGING.
2. DO NOT ATTEMPT TO FORK THESE UNITS.

UNIT	WEIGHT		A		B		ECONOMIZER	
	lb	kg	in.	mm	in.	mm	lb	kg
48Z030	6270	2844	95.83	2434	192.56	4891	300	136
48Z035	6395	2900	95.83	2434	194.72	4946	300	136
48Z040	7170	3252	105.24	2673	222.44	5650	300	136
48Z050	7210	3270	105.24	2673	223.50	5677	300	136



NOTE:

RIG WITH FOUR CABLES AND
SPREAD WITH TWO 95 IN (2413 MM)
AND TWO "A+A" LONG
SUITABLE SPREADER BARS.

CENTER OF GRAVITY INCLUDES ECONOMIZER.
UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.

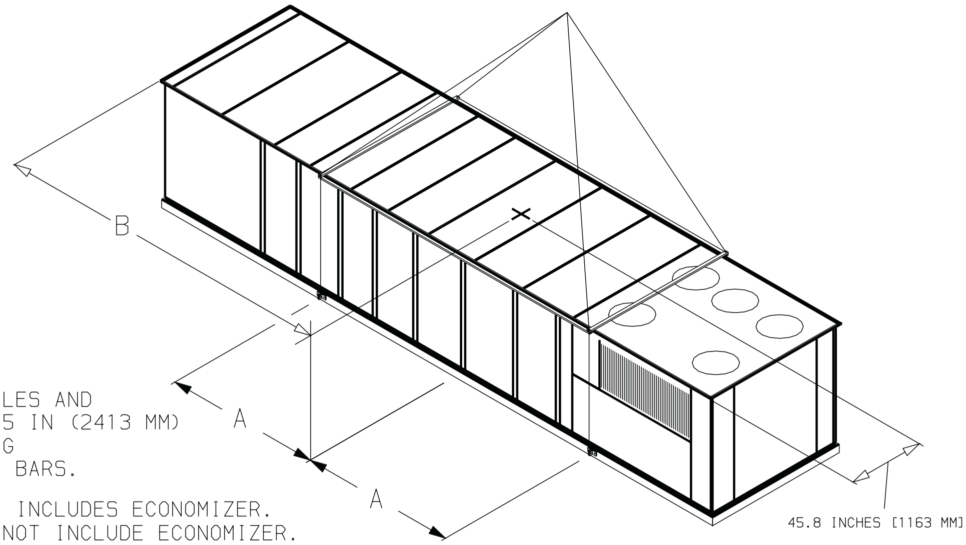
UNIT WEIGHT IS WITHOUT RECLAIM COIL.

Fig. 11 — Rigging Label — Size 030-050 Units (Extended Chassis)

⚠ CAUTION

NOTICE TO RIGGERS
1. ALL PANELS MUST BE IN PLACE WHEN RIGGING.
2. DO NOT ATTEMPT TO FORK THESE UNITS.

UNIT	WEIGHT		A		B		ECONOMIZER	
	lb	kg	in.	mm	in.	mm	lb	kg
48Z055	9548	4330	121.50	3085.5	248.50	6312	530	240.9
48Z060	9668	4385	121.50	3085.5	248.50	6312	530	240.9



NOTE:

RIG WITH FOUR CABLES AND SPREAD WITH TWO 95 IN (2413 MM) AND TWO "A+A" LONG SUITABLE SPREADER BARS.

CENTER OF GRAVITY INCLUDES ECONOMIZER.
UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.

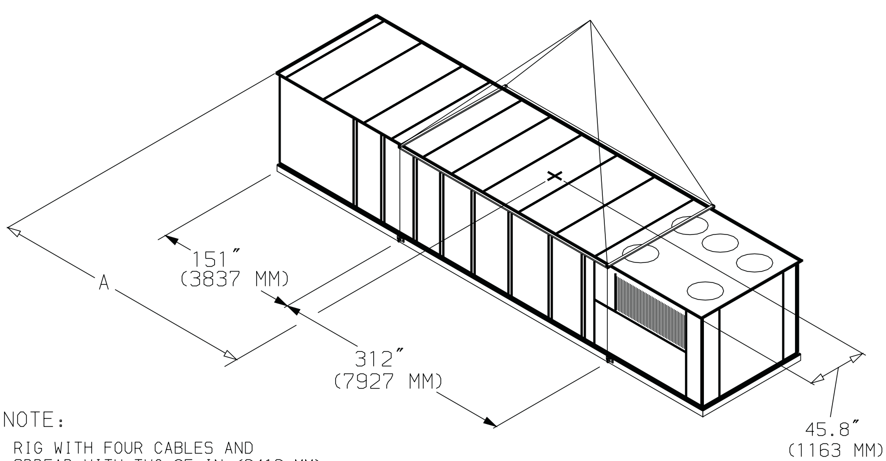
UNIT WEIGHT IS WITHOUT RECLAIM COIL

Fig. 12 — Rigging Label — Size 055,060 Units (Extended Chassis)

⚠ CAUTION

NOTICE TO RIGGERS
1. ALL PANELS MUST BE IN PLACE WHEN RIGGING.
2. DO NOT ATTEMPT TO FORK THESE UNITS.

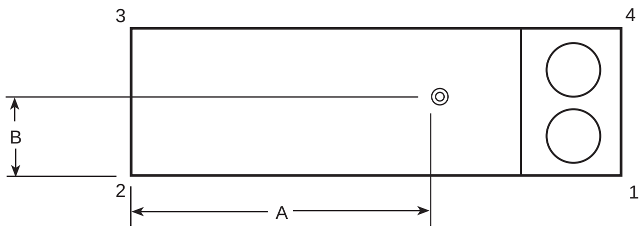
UNIT	WEIGHT		A	
	lb	kg	in.	mm
48Z075	13,380	6069	298.9	7591
48Z090	13,590	6164	300.7	7637
48Z105	14,320	6495	309.9	7873



NOTE:

RIG WITH FOUR CABLES AND SPREAD WITH TWO 95 IN (2413 MM) AND TWO 312 IN (7927 MM) LONG SUITABLE SPREADER BARS.

Fig. 13 — Rigging Label — 48ZT,ZW075-105 Units (High-Capacity Power Exhaust Units)



UNITS 48ZG,ZN	SIZE	CORNER WEIGHTS (lb)				TOTAL (lb)	A	B
		1	2	3	4		ft-in.	ft-in.
VERTICAL SUPPLY AND RETURN/ LOW GAS HEAT	030	1968	1004	1005	1964	5,941	14- 9$^{1}/_{8}$	3-9$^{13}/_{16}$
	035	1851	1184	1142	1889	6,066	14-11	3-9$^{13}/_{16}$
	040	2246	1177	1179	2239	6,841	17- 2$^{7}/_{8}$	3-9$^{13}/_{16}$
	050	2264	1182	1179	2256	6,881	17- 4	3-9$^{13}/_{16}$
	055	2478	2140	2144	2468	9,230	19- 7	3-9$^{13}/_{16}$
	060	2557	2211	2212	2549	9,530	19- 7	3-9$^{13}/_{16}$
	070	2648	2330	2334	2638	9,950	21- 0	3-9$^{13}/_{16}$
	075	2955	2447	2445	2953	10,800	21- 7$^{1}/_{2}$	3-9$^{13}/_{16}$
	090	3035	2471	2471	3033	11,010	21- 9$^{7}/_{16}$	3-9$^{13}/_{16}$
	105	3342	2529	2529	3340	11,740	22- 6	3-9$^{13}/_{16}$
VERTICAL SUPPLY AND RETURN/ HIGH GAS HEAT	030	2000	1037	1038	1995	6,070	14- 8$^{1}/_{8}$	3-9$^{13}/_{16}$
	035	2061	1038	1037	2059	6,195	14-10	3-9$^{13}/_{16}$
	040	2277	1210	1213	2270	6,970	17- 1$^{7}/_{8}$	3-9$^{13}/_{16}$
	050	2301	1206	1205	2297	7,010	17- 3	3-9$^{13}/_{16}$
	055	2510	2168	2172	2500	9,350	19- 7	3-9$^{13}/_{16}$
	060	2587	2242	2237	2584	9,650	19- 7	3-9$^{13}/_{16}$
	070	2683	2361	2365	2672	10,080	21- 0	3-9$^{13}/_{16}$
	075	3015	2474	2472	3013	10,974	21- 8$^{9}/_{16}$	3-9$^{13}/_{16}$
	090	3095	2499	2498	3092	11,184	21-10$^{7}/_{16}$	3-9$^{13}/_{16}$
	105	3405	2554	2554	3401	11,914	22- 7	3-9$^{13}/_{16}$
VERTICAL SUPPLY AND RETURN/ EXTENDED CHASSIS/LOW GAS HEAT	030	2133	1089	1091	2127	6,441	16- 1$^{11}/_{16}$	3-9$^{13}/_{16}$
	035	2198	1087	1087	2194	6,566	16- 3$^{7}/_{8}$	3-9$^{13}/_{16}$
	040	2411	1262	1264	2404	7,341	18- 7$^{1}/_{2}$	3-9$^{13}/_{16}$
	050	2434	1259	1256	2432	7,381	18- 8$^{5}/_{8}$	3-9$^{13}/_{16}$
	055	2617	2251	2255	2607	9,730	20- 9	3-9$^{13}/_{16}$
	060	2698	2320	2325	2687	10,030	20- 9	3-9$^{13}/_{16}$
VERTICAL SUPPLY AND RETURN/ EXTENDED CHASSIS/HIGH GAS HEAT	030	2188	1100	1101	2182	6,570	16- 2$^{3}/_{4}$	3-9$^{13}/_{16}$
	035	2187	1163	1161	2184	6,695	18- 6$^{7}/_{16}$	3-9$^{13}/_{16}$
	040	2454	1284	1287	2446	7,470	18- 7$^{1}/_{2}$	3-9$^{13}/_{16}$
	050	2017	1740	1738	2014	7,510	20- 9	3-9$^{13}/_{16}$
	055	2649	2279	2283	2639	9,850	20- 9	3-9$^{13}/_{16}$
	060	3442	1787	1791	3431	10,450	16- 0$^{9}/_{16}$	3-9$^{13}/_{16}$

UNITS 48ZT,ZW WITH HIGH-CAPACITY POWER EXHAUST	SIZE	CORNER WEIGHTS (lb)				TOTAL (lb)	A	B
		1	2	3	4		ft-in.	ft-in.
VERTICAL SUPPLY AND RETURN/ LOW GAS HEAT, HIGH-CAPACITY POWER EXHAUST	075	3551	3053	3049	3551	13,204	24- 9$^{13}/_{16}$	3-9$^{13}/_{16}$
	090	3629	3080	3075	3630	13,414	24- 1$^{5}/_{8}$	3-9$^{13}/_{16}$
	105	3948	3126	3121	3948	14,144	25- 9$^{1}/_{8}$	3-9$^{13}/_{16}$
VERTICAL SUPPLY AND RETURN/ HIGH GAS HEAT, CV, HIGH-CAPACITY POWER EXHAUST	075	3611	3081	3076	3611	13,380	24-10$^{7}/_{8}$	3-9$^{13}/_{16}$
	090	3691	3106	3102	3691	13,590	25- 0$^{3}/_{4}$	3-9$^{13}/_{16}$
	105	4008	3155	3150	4008	14,320	25- 9$^{15}/_{16}$	3-9$^{13}/_{16}$

UNITS 48Z6,Z8 WITH RETURN/EXHAUST FAN	SIZE	CORNER WEIGHTS (lb)				TOTAL (lb)	A	B
		1	2	3	4		ft-in.	ft-in.
VERTICAL SUPPLY AND RETURN LOW GAS HEAT, RETURN/EXHAUST FAN	075	2802	3002	3008	2868	11,740	19-4	3-9$^{13}/_{16}$
	090	2940	3029	3035	2946	11,950	19-6	3-9$^{13}/_{16}$
	105	3242	3091	3098	3249	12,680	20-2	3-9$^{13}/_{16}$
VERTICAL SUPPLY AND RETURN HIGH GAS HEAT, RETURN/EXHAUST FAN	075	2921	3029	3036	2928	11,914	19-6	3-9$^{13}/_{16}$
	090	2999	3056	3063	3006	12,124	19-7	3-9$^{13}/_{16}$
	105	3304	3116	3123	3311	12,854	20-4	3-9$^{13}/_{16}$

Fig. 14 — Weight Distribution and Center of Gravity

→ **Condensate Drain Connections —** There are a total of five drain connections required on each unit: one primary drain (on right-hand side of the unit) and four secondary drains (two on each side of unit).

PRIMARY DRAIN — The primary drain is a 2-in. NPT pipe connection located on the right-hand side of the unit looking at the unit from the return air end. See Fig. 15-24.

With field-supplied fittings and pipe sections, plumb the primary condensate drain to the 2-in. FPT connector on the base rail. Use a trap height of at least 4-in. for size 030-070 units and 7-in. for size 075-105 units. See Fig. 24 and 25. Install with a height dimensionof at least 2-in. from the top of the exit pipe from the trap section to the bottom of the connector. Apply a bead of RTV or similar sealant around the pipe joint at the connector in the base rail.

SECONDARY DRAINS (Units Installed on Curb) — There are two secondary drain connections on each side of the unit. See Fig. 26. There are secondary drains on each side of the unit in the filter section and one on each side of the unit in the supply fan section. There are labels marking each location on the unit base rail. See Fig. 15-23.

Locate the four 1 1/4-in. drain coupling assemblies and mounting screws (shipped in a bag taped to the basepan in the supply fan section, located behind the access panel marked FAN SECTION). The drain couplings are a 10-gage plate with a 1 1/4 in. half coupling welded to the plate.

At each secondary drain hole location, there is a 1 3/8-in. hole pre-drilled in the bottom of the base rail, surrounded by four 0.20-in. engagement holes. Install a drain coupling assembly using screws provided at each secondary drain hole location. See Fig. 27. Do not attach any drain coupling assemblies in the condenser section base rail.

Using field supplied fittings and pipe sections, assemble U-traps at each secondary drain fitting. See Fig. 28. Provide a minimum size of ½-in. pipe for secondary drains. Use a trap at least 4-in. deep for size 030-070 units and 7-in. deep for size 075-105 units. Apply a bead of RTV or similar sealant around the drain assemblies.

Consult local plumbing codes for direction on joining multiple drain lines. Total size of any combined line does not need to exceed nominal 2-in. size of primary drain connection.

Fill the U-traps at the secondary drain locations prior to unit start-up. Also check the U-traps before each cooling season to ensure the traps are filled and functioning properly.

SECONDARY DRAINS (Units Installed on Steel Beam or Slab) — There are two secondary drain connections required on each side of the unit. See Fig. 26. There are secondary drains on each side of the unit in the filter section and one on each side of the unit in the supply fan section. There are labels marking each location on the unit base rail. See Fig. 15-23. Prior to final positioning of the unit, apply a bead of RTV or similar sealant around each secondary drain hole in the bottom of the unit base rail. Then position the unit into final location.

Locate the four 1 1/4-in. drain coupling assemblies and mounting screws (shipped in a bag taped to the basepan in the supply fan section, located behind the access panel marked FAN SECTION). The drain couplings are a 10-gage plate with a 1 1/4 in. half coupling welded to the plate.

After final positioning of the unit, perform the following procedure:

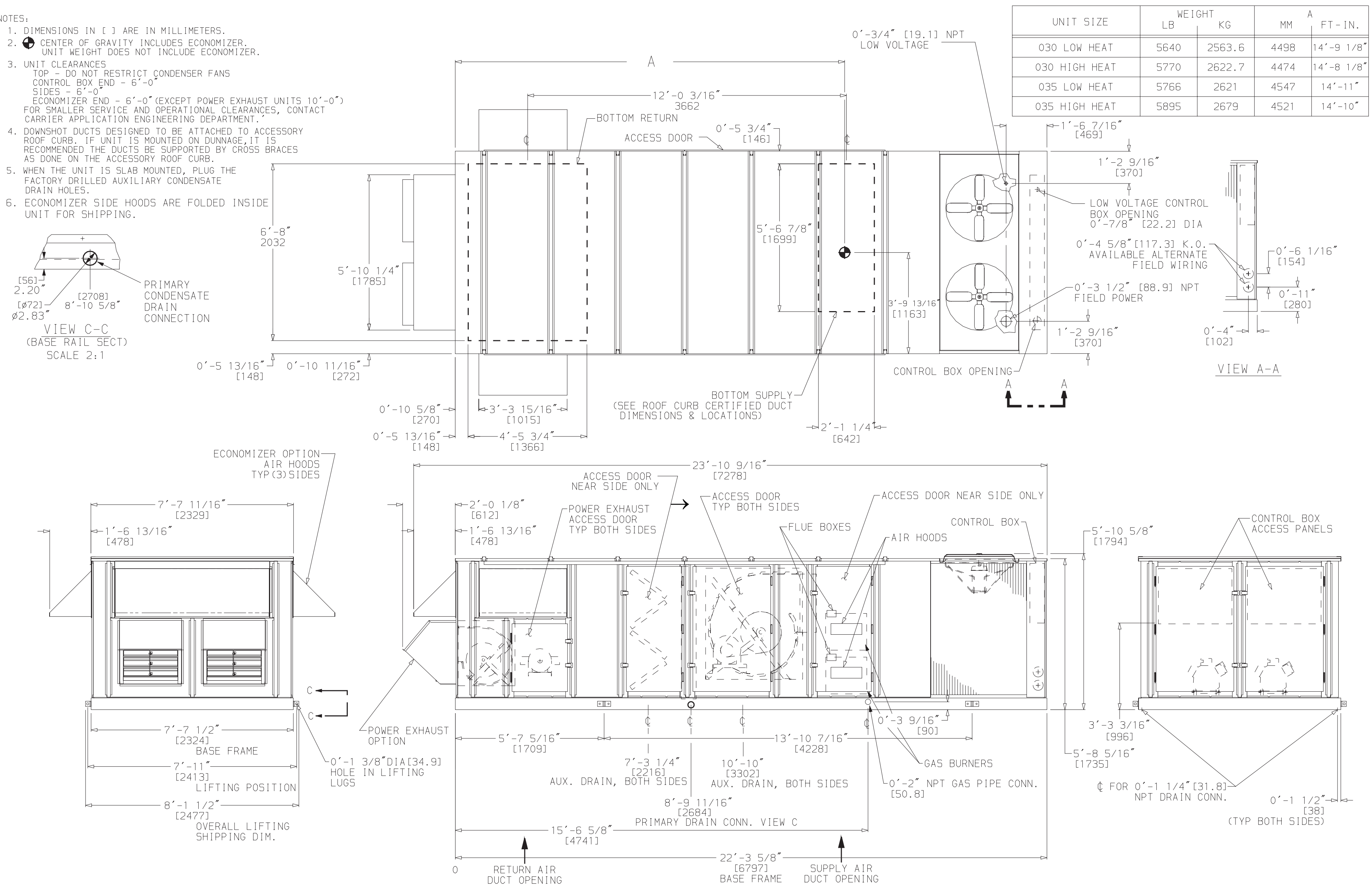
1. At each of the four secondary drain locations (marked with labels on the unit base rail), position the drain coupling assembly in the side of the base rail. Mark the screw holes and the drain hole locations on the base rail.
2. Drill holes for drain outlet (use 1 3/8-in. hole saw) and for the mounting screws (use 3/16-in. drill bit).
3. Install a drain coupling assembly using screws provided at each secondary drain hole location.
4. Using field-supplied fittings and pipe sections, assemble U-traps at each secondary drain fitting. See Fig. 28. Provide minimum size of ½-in. pipe for secondary drains. Use a trap at least 4-in. deep for size 030-070 units and 7-in. deep for size 075-105 units.
5. Apply a bead of RTV or similar sealant around the drain assemblies.

Consult local plumbing codes for direction on joining multiple drain lines. Total size of any combined line does not need to exceed nominal 2-in. size of primary drain connection.

Fill the U-traps at the secondary drain locations prior to unit start-up. Also check the U-traps before each cooling season to ensure the traps are filled and functioning properly.

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0" (EXCEPT POWER EXHAUST UNITS 10'-0")
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT-IN.
030 LOW HEAT	5640	2563.6	4498	14'-9 1/8"
030 HIGH HEAT	5770	2622.7	4474	14'-8 1/8"
035 LOW HEAT	5766	2621	4547	14'-11"
035 HIGH HEAT	5895	2679	4521	14'-10"



→ **Fig. 15 — Base Unit Dimensional Drawing — 48ZG,ZN030,035 (Standard Chassis)**

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6′-0″
   SIDES - 6′-0″
   ECONOMIZER END - 6′-0″ (EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT -IN.
040 LOW HEAT	6540	2972.7	5255	17′-2 7/8″
040 HIGH HEAT	6670	3031.8	5229	17′-1 7/8″
050 LOW HEAT	6581	2991	5283	17′ -4″
050 HIGH HEAT	6710	3050	5258	17′ -3″

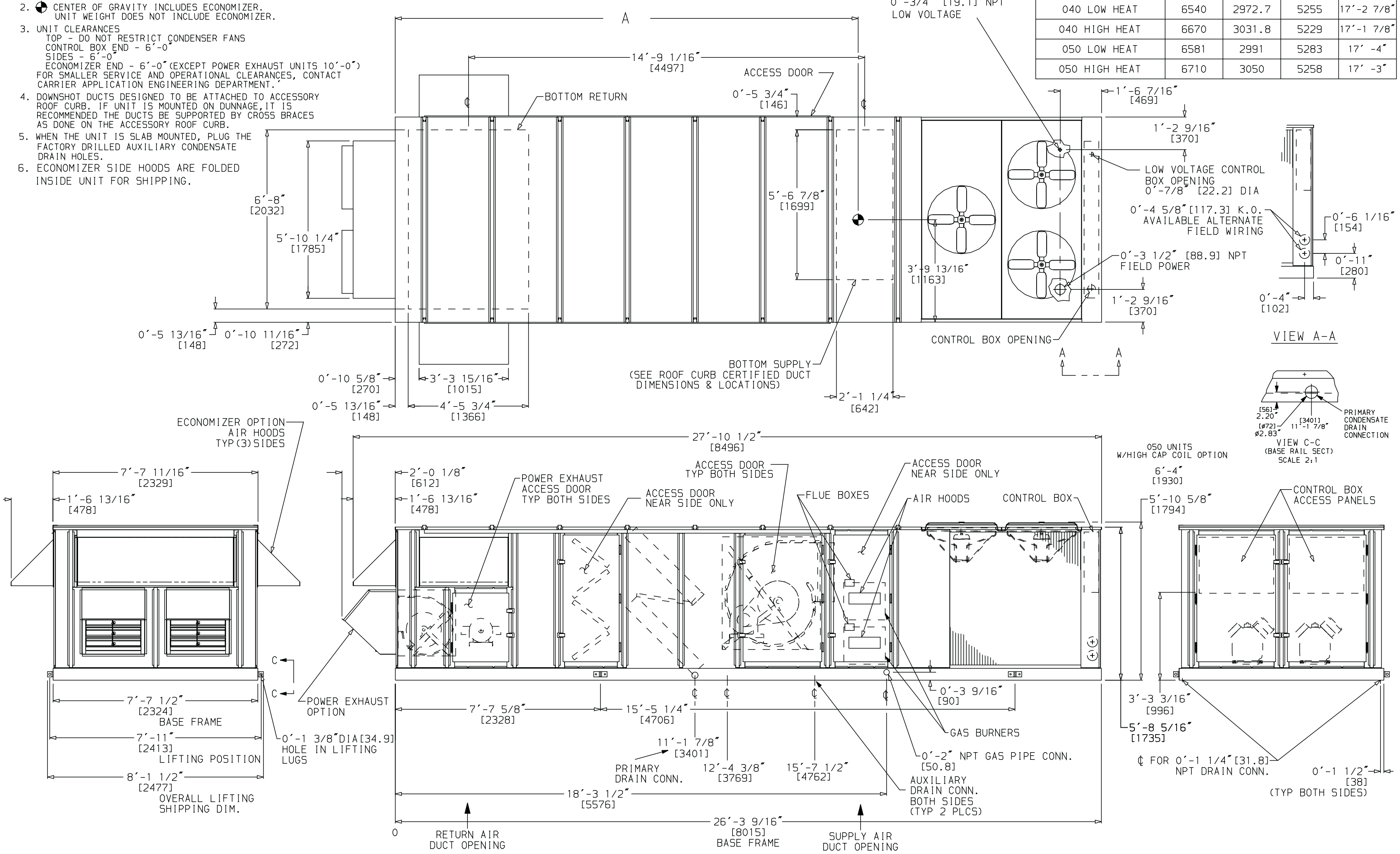
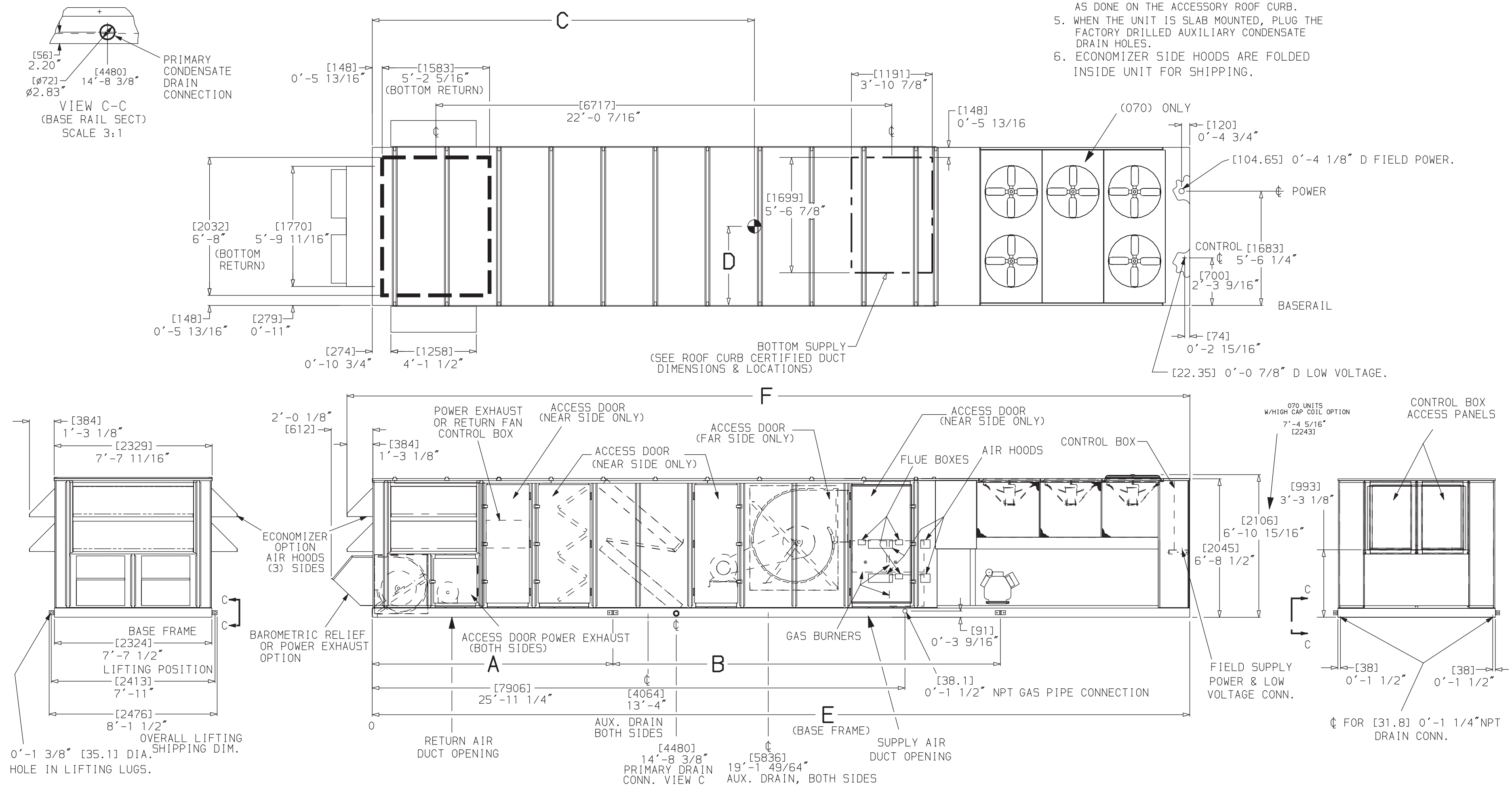


Fig. 16 — Base Unit Dimensional Drawing — 48ZG,ZN040,050 (Standard Chassis)

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT-IN.	B MM	B FT-IN.	C MM	C FT-IN.	D MM	D FT-IN.	E MM	E FT-IN.	F MM	F FT-IN.
055 LOW HEAT	8700	3955	2718	8′-11″	6541	21′-5 1/2″	5969	19′-7″	1163	3′-9 13/16″	11140	36′-6 9/16″	11524	37′-9 11/16″
060 LOW HEAT	9000	4091	2718	8′-11″	6541	21′-5 1/2″	5969	19′-7″	1163	3′-9 13/16″	11140	36′-6 9/16″	11524	37′-9 11/16″
070 LOW HEAT	9420	4282	3543	11′-7 1/2″	5715	18′-9″	6401	21′-0″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
055 HIGH HEAT	8820	4009	2718	8′-11″	6541	21′-5 1/2″	5969	19′-7″	1163	3′-9 13/16″	11140	36′-6 9/16″	11524	37′-9 11/16″
060 HIGH HEAT	9120	4145	2718	8′-11″	6541	21′-5 1/2″	5969	19′-7″	1163	3′-9 13/16″	11140	36′-6 9/16″	11524	37′-9 11/16″
070 HIGH HEAT	9550	4341	3543	11′-7 1/2″	5715	18′-9″	6401	21′-0″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6′-0″
   SIDES - 6′-0″
   ECONOMIZER END - 6′-0″ (EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.



→ **Fig. 17 — Base Unit Dimensional Drawing — 48ZG,ZN055-070 (Standard Chassis)**

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT - IN.	B MM	B FT - IN.	C MM	C FT - IN.	D MM	D FT - IN.	E MM	E FT - IN.	F MM	F FT - IN.
075 LOW HEAT	10270	4658	3544	11′-7 1/2″	6494	21′ 3 5/8″	6592	21′-7 1/2″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
090 LOW HEAT	10480	4754	3544	11′-7 1/2″	6494	21′ 3 5/8″	6641	21′-9 7/16″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
105 LOW HEAT	11210	5085	3544	11′-7 1/2″	6494	21′ 3 5/8″	6861	22′-6 1/8″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
075 HIGH HEAT	10445	4738	3544	11′-7 1/2″	6494	21′ 3 5/8″	6618	21′-8 9/16″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
090 HIGH HEAT	10655	4833	3544	11′-7 1/2″	6494	21′ 3 5/8″	6666	21′-10 7/16″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
105 HIGH HEAT	11385	5164	3544	11′-7 1/2″	6494	21′ 3 5/8″	6883	22′ -7″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6′-0″
   SIDES - 6′-0″
   ECONOMIZER END - 6′-0″ (EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.

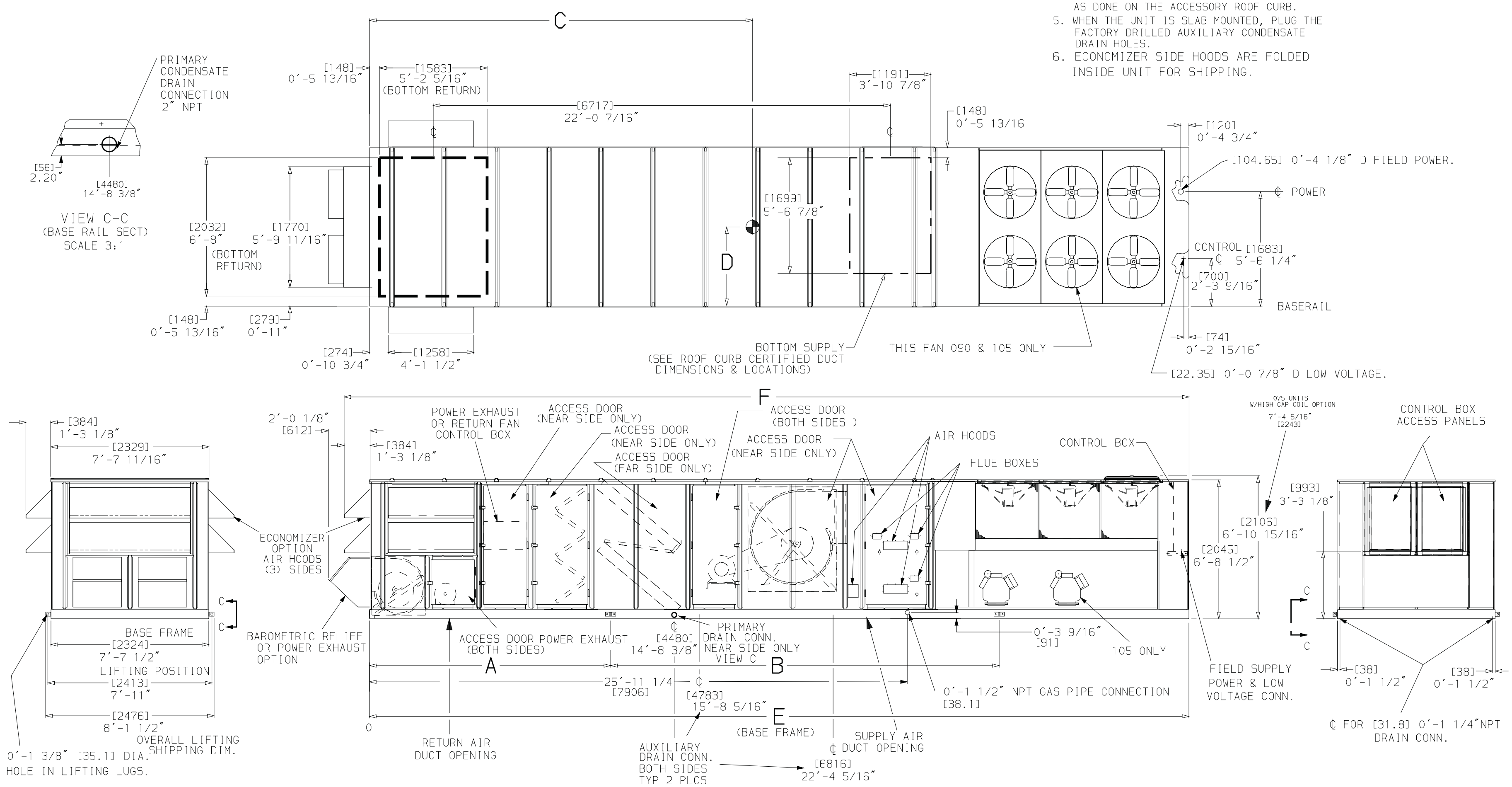
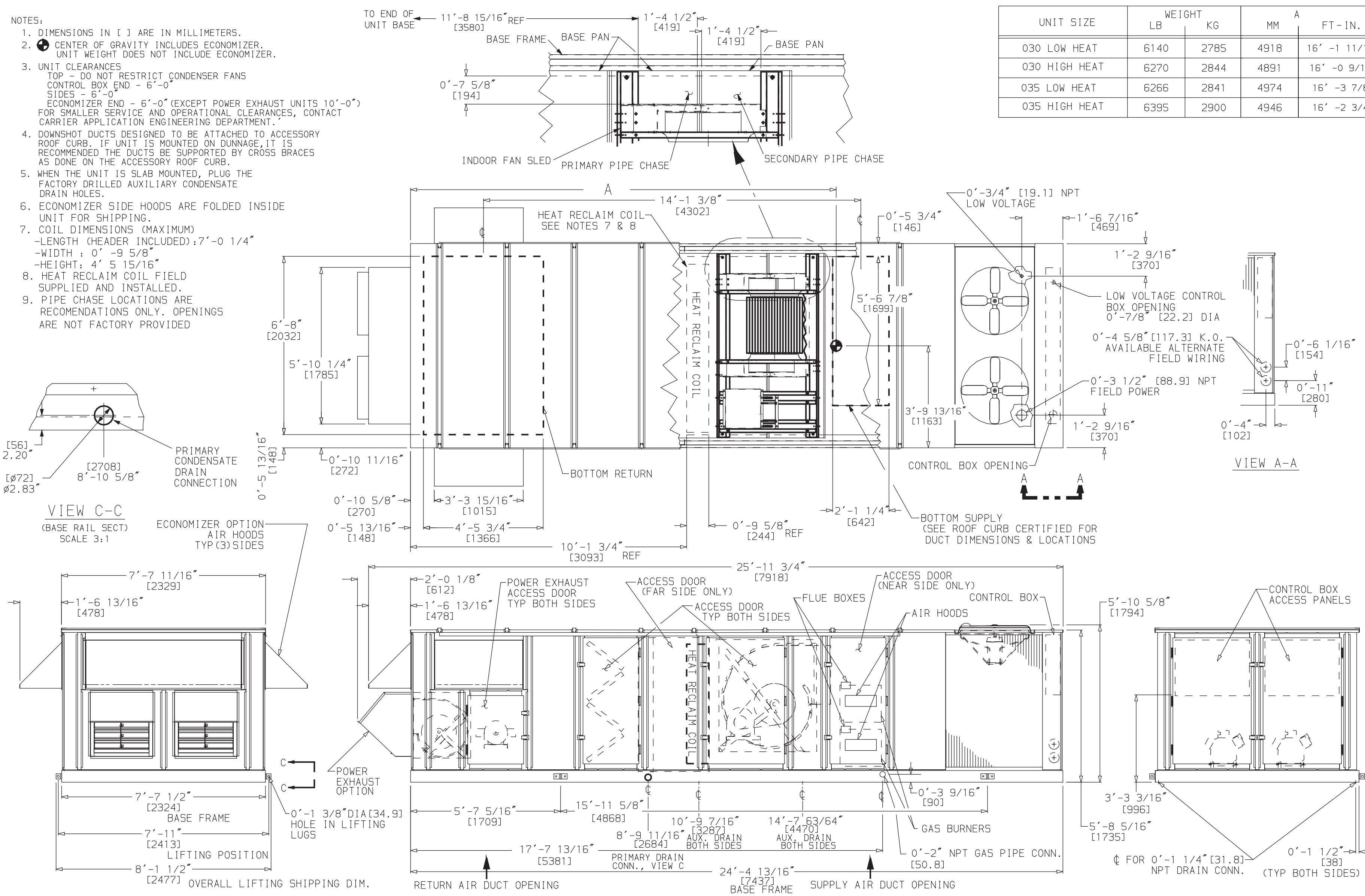


Fig. 18 — Base Unit Dimensional Drawing — 48ZG,ZN075-105 (Standard Chassis)

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0" (EXCEPT POWER EXHAUST UNITS 10'-0")
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.
7. COIL DIMENSIONS (MAXIMUM)
   -LENGTH (HEADER INCLUDED): 7'-0 1/4"
   -WIDTH : 0' -9 5/8"
   -HEIGHT: 4' 5 15/16"
8. HEAT RECLAIM COIL FIELD SUPPLIED AND INSTALLED.
9. PIPE CHASE LOCATIONS ARE RECOMENDATIONS ONLY. OPENINGS ARE NOT FACTORY PROVIDED

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT-IN.
030 LOW HEAT	6140	2785	4918	16' -1 11/16"
030 HIGH HEAT	6270	2844	4891	16' -0 9/16"
035 LOW HEAT	6266	2841	4974	16' -3 7/8"
035 HIGH HEAT	6395	2900	4946	16' -2 3/4"



→ **Fig. 19 — Base Unit Dimensional Drawing — 48ZG,ZN030,035 (Extended Chassis)**

NOTES:

1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP – DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END – 6′-0″
   SIDES – 6′-0″
   ECONOMIZER END – 6′-0″ (EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.
7. COIL DIMENSIONS (MAXIMUM)
   -LENGTH (HEADER INCLUDED): 7′-0 1/4″
   -WIDTH : 0′ -9 5/8″
   -HEIGHT: 4′ 5 15/16″
8. HEAT RECLAIM COIL FIELD SUPPLIED AND INSTALLED.

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT - IN.
040 LOW HEAT	7040	3193	5677	18′ -7 1/2″
040 HIGH HEAT	7170	3252	5650	18′ -6 7/16″
050 LOW HEAT	7081	3211	5704	18′ -8 5/8″
050 HIGH HEAT	7210	3270	5677	18′ -7 1/2″

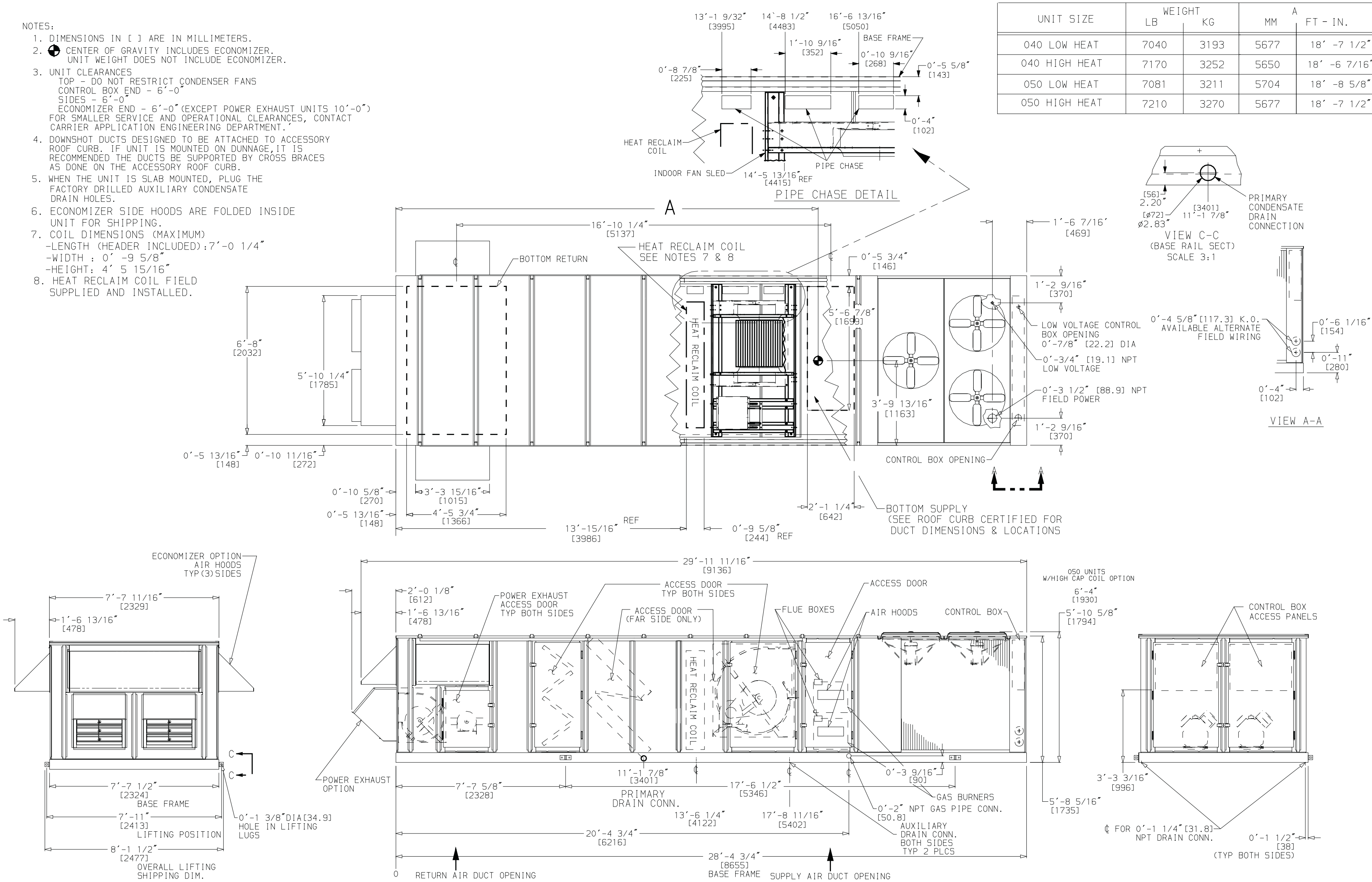
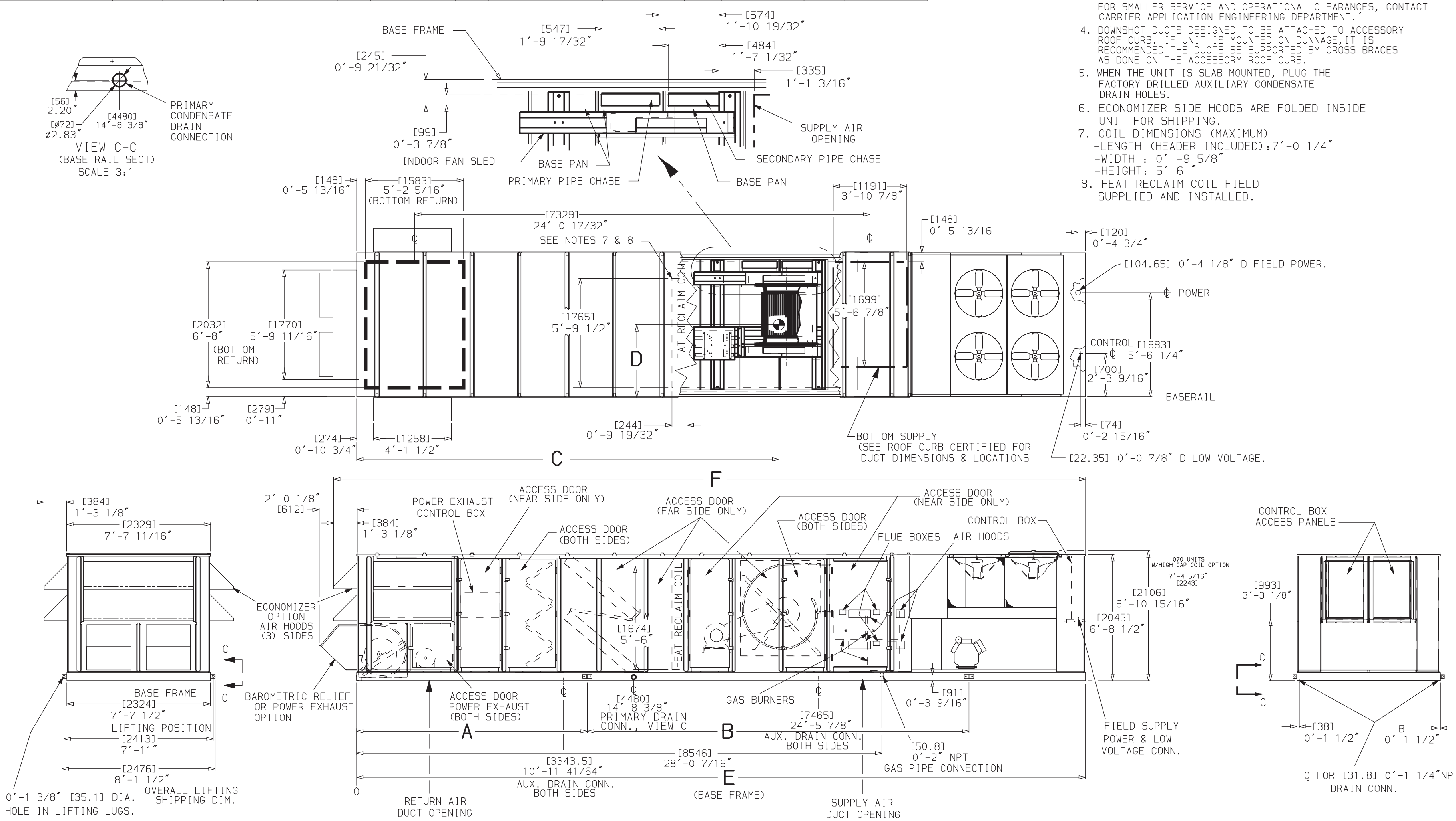


Fig. 20 — Base Unit Dimensional Drawing — 48ZG,ZN040,050 (Extended Chassis)

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT-IN.	B MM	B FT-IN.	C MM	C FT-IN.	D MM	D FT-IN.	E MM	E FT-IN.	F MM	F FT-IN.
055 LOW HEAT	9248	4194	3728	12′-2 3/4″	6171	20′-2 15/16″	6312	20′ -8 9/16″	1163	3′-9 25/32″	11780	38′-7 13/16″	12164	39′-10 7/8″
055 HIGH HEAT	9368	4278	3728	12′-2 3/4″	6171	20′-2 15/16″	6312	20′ -8 9/16″	1163	3′-9 25/32″	11780	38′-7 13/16″	12164	39′-10 7/8″
060 LOW HEAT	9548	4330	3728	12′-2 3/4″	6171	20′-2 15/16″	6312	20′ -8 9/16″	1163	3′-9 25/32″	11780	38′-7 13/16″	12164	39′-10 7/8″
060 HIGH HEAT	9668	4385	3728	12′-2 3/4″	6171	20′-2 15/16″	6312	20′ -8 9/16″	1163	3′-9 25/32″	11780	38′-7 13/16″	12164	39′-10 7/8″

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⊕ CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6′-0″
   SIDES - 6′-0″
   ECONOMIZER END - 6′-0″(EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE,IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.
7. COIL DIMENSIONS (MAXIMUM)
   -LENGTH (HEADER INCLUDED):7′-0 1/4″
   -WIDTH : 0′ -9 5/8″
   -HEIGHT: 5′ 6″
8. HEAT RECLAIM COIL FIELD SUPPLIED AND INSTALLED.



→ **Fig. 21 — Base Unit Dimensional Drawing — 48ZG,ZN055,060 (Extended Chassis)**

706

UNIT SIZE	WEIGHT		"A" DIMENSION	
	LB	KG	MM	FT – IN.
075 LOW	13205	5990	7565	24'-9 13/16"
090 LOW	13415	6085	7612	24'-11 5/8"
105 LOW	14145	6416	7851	25'-9 1/8"
075 HIGH	13380	6069	7591	24'-10 7/8"
090 HIGH	13590	6164	7637	25'-0 3/4"
105 HIGH	14320	6495	7873	25'-9 15/16"

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. ⯐ CENTER OF GRAVITY AND UNIT WEIGHT INCLUDES ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 10'-0"
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS (END) ARE FOLDED INSIDE UNIT FOR SHIPPING. CENTER HOODS ARE SHIPPED DISASSEMBLED INSIDE ECONOMIZER SECTION.

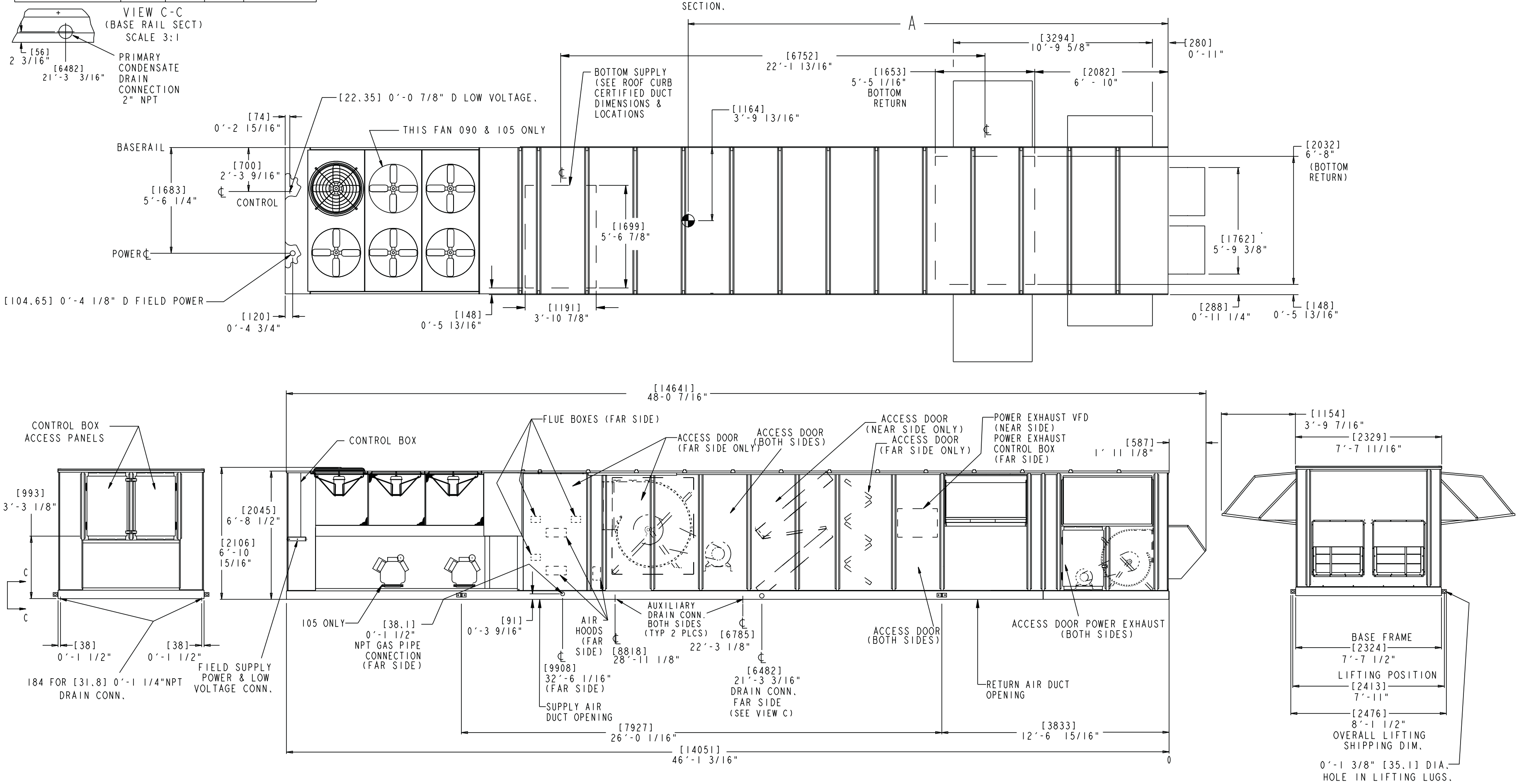


Fig. 22 — Base Unit Dimensional Drawing — 48ZT,ZW075-105 (Units with High-Capacity Power Exhaust)

UNIT SIZE	WEIGHT LB	WEIGHT KG	A MM	A FT - IN.	B MM	B FT - IN.	C MM	C FT - IN.	D MM	D FT - IN.	E MM	E FT - IN.	F MM	F FT - IN.
075 LOW HEAT	11740	5325	3544	11′-7 1/2″	6494	21′ 3 5/8″	5893	19′ 4″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
090 LOW HEAT	11950	5420	3544	11′-7 1/2″	6494	21′ 3 5/8″	5944	19′ 6″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
105 LOW HEAT	12680	5752	3544	11′-7 1/2″	6494	21′ 3 5/8″	6147	20′ 2″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
075 HIGH HEAT	11914	5742	3544	11′-7 1/2″	6494	21′ 3 5/8″	5944	19′ 6″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
090 HIGH HEAT	12124	5499	3544	11′-7 1/2″	6494	21′ 3 5/8″	5969	19′ 7″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″
105 HIGH HEAT	12854	5831	3544	11′-7 1/2″	6494	21′ 3 5/8″	6198	20′ 4″	1163	3′-9 13/16″	12049	39′-6 3/8″	12433	40′-9 1/2″

NOTES:
1. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY INCLUDES ECONOMIZER. UNIT WEIGHT DOES NOT INCLUDE ECONOMIZER.
3. UNIT CLEARANCES
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONTROL BOX END - 6′-0″
   SIDES - 6′-0″
   ECONOMIZER END - 6′-0″ (EXCEPT POWER EXHAUST UNITS 10′-0″)
   FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES, CONTACT CARRIER APPLICATION ENGINEERING DEPARTMENT.
4. DOWNSHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB. IF UNIT IS MOUNTED ON DUNNAGE, IT IS RECOMMENDED THE DUCTS BE SUPPORTED BY CROSS BRACES AS DONE ON THE ACCESSORY ROOF CURB.
5. WHEN THE UNIT IS SLAB MOUNTED, PLUG THE FACTORY DRILLED AUXILIARY CONDENSATE DRAIN HOLES.
6. ECONOMIZER SIDE HOODS ARE FOLDED INSIDE UNIT FOR SHIPPING.

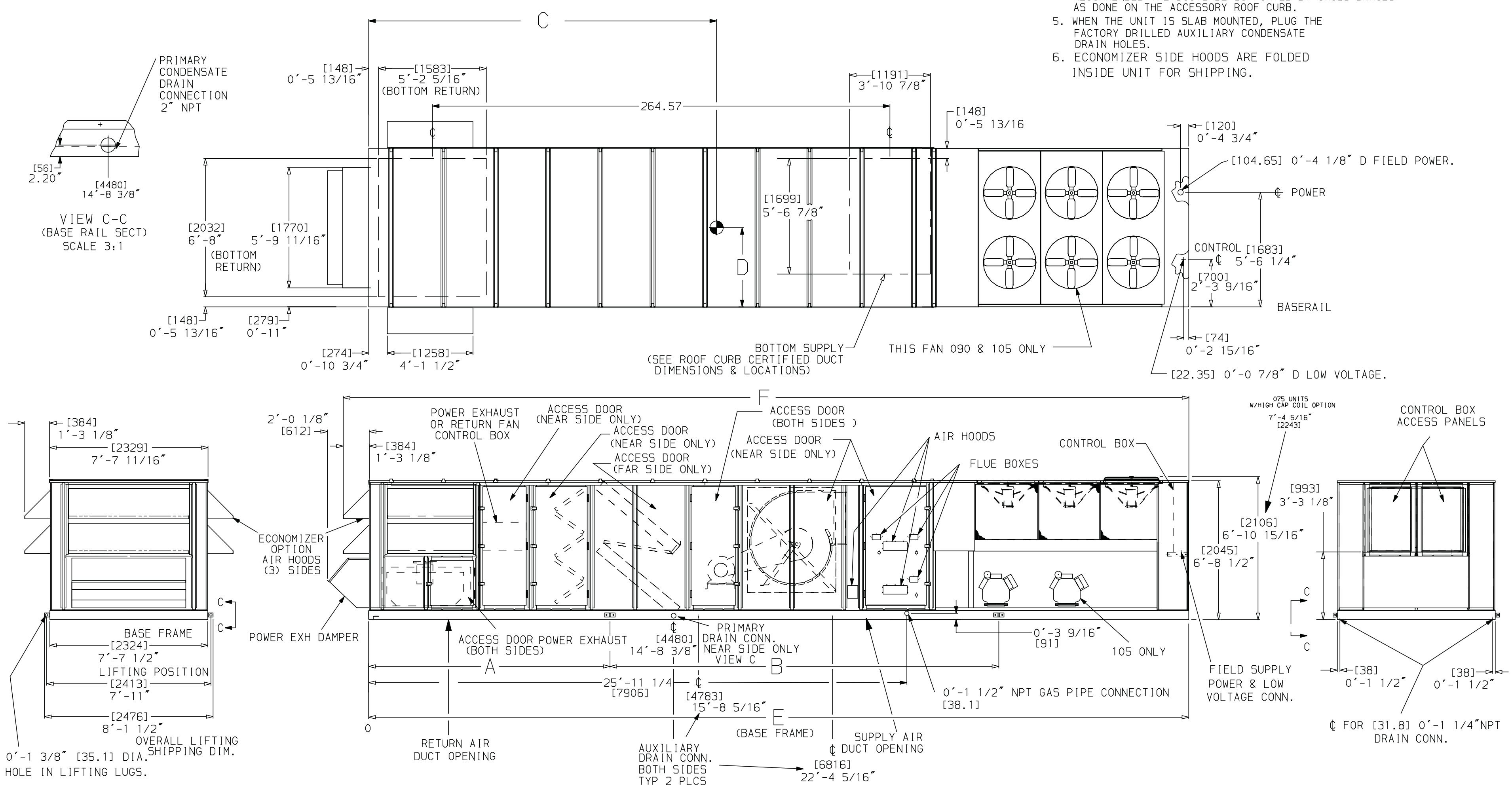


Fig. 23 — Base Unit Dimensional Drawing — 48Z6,Z8075-105 (Units with Return/Exhaust Fan)

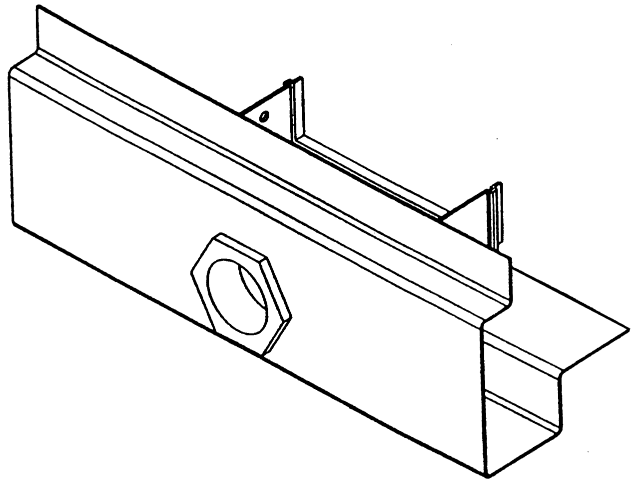
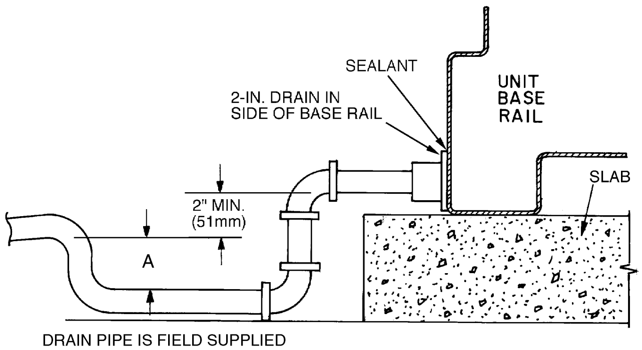


Fig. 24 — Primary Drain Connection



A = 4-in. (102 mm) min — 030-070
7-in. (178 mm) min — 075-105

Fig. 25 — Slab-Mounted Condensate Drain Piping Details

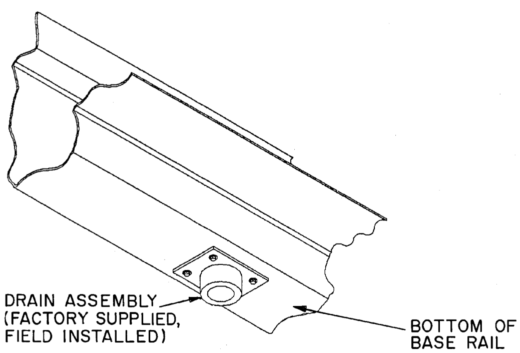


Fig. 26 — Secondary Condensate Drain Location

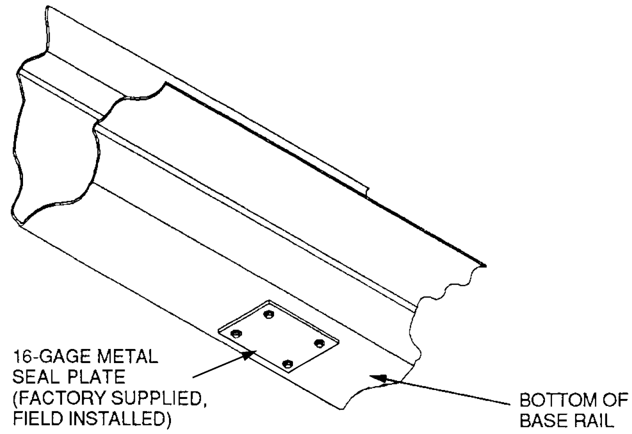
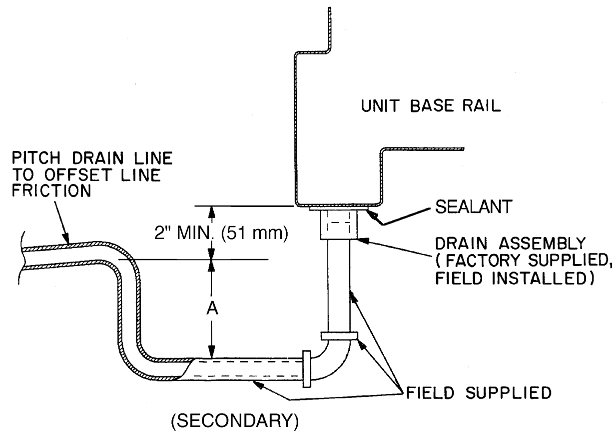


Fig. 27 — Secondary Drain Seal Plate Location



A = 4-in. (102 mm) min — sizes 030-070
7-in. (178 mm) min — sizes 075-105

Fig. 28 — Curb-Mounted Condensate Drain Pipe Details

Install Outdoor Hoods (48ZG,ZN,Z6,Z8 Units)

UNIT SIZES 030-050

25% Outdoor-Air Hoods (Units Without Economizer Option) (Fig. 29)

1. Outdoor-air hoods are shipped bolted to the unit in a shipping position. Remove the 6 screws holding each 25% outdoor air hood shipping cover in place.
2. Remove the holddown screw from each upper corner of each hood.
3. Pivot hoods outward (2 hoods).
4. Install 17 screws around outside of each hood. (Screws are in the fastener package taped to the basepan inside the fan section.)
5. Apply a bead of RTV or similar sealant to corner of each hood at pivot point to prevent water leaks. See Fig. 30.

Economizer Hoods (Units With Economizer Option) (Fig. 31 and 32)

1. Remove the 4 screws holding each of the 2 economizer side hoods in place.
2. Pivot hoods outwards (2 hoods).
3. Apply seal strip to vertical flange of hood sides.
4. Install hood sides of hood top using 19 screws (7 each side, 5 top). Screws are in fastener package located with the hood sides and seal strip which is taped inside the unit.
5. Apply a bead of RTV or similar sealant to corners of economizer hoods to prevent water leaks.

UNIT SIZES 055-105

25% Outdoor-Air Hoods (Fig. 33) — The outdoor-air hoods are factory installed on the 055-105 units.

Economizer Hoods (Units With Economizer Option) (Fig. 34-36)

1. Remove the 6 screws holding each of the 4 economizer shipping covers in place.
2. Remove the holddown screw from each upper corner of each economizer hood.
3. Pivot hoods outward (4 hoods).
4. Apply seal strip to vertical flange of hood sides.
5. Install 18 screws (5 each side, 6 top, and 2 bottom) around the outside of each hood. (Screws are in the fastener package taped to the basepan inside the fan section.)
6. Apply a bead of RTV or similar sealant to corner of economizer hood at pivot point to prevent water leaks. (See Fig. 30.)

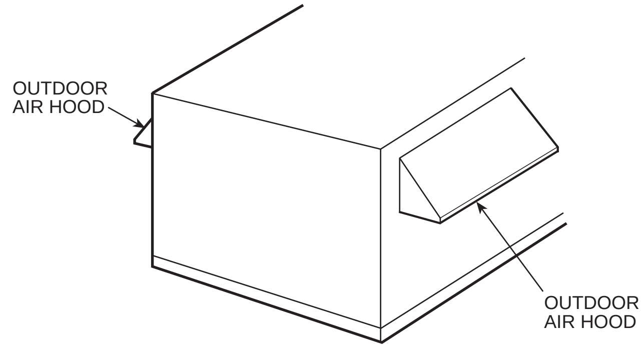


Fig. 29 — Outdoor Air Hood Installation (Sizes 030-050)

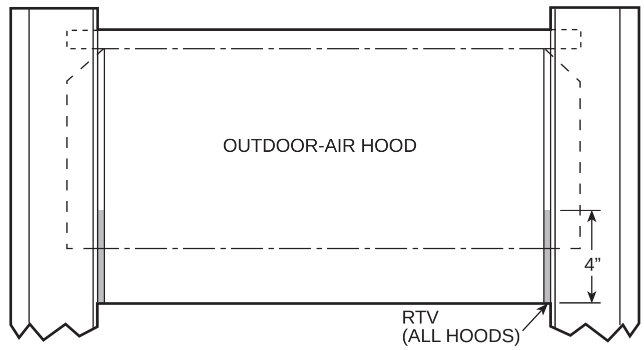


Fig. 30 — Outdoor-Air and Economizer Hood

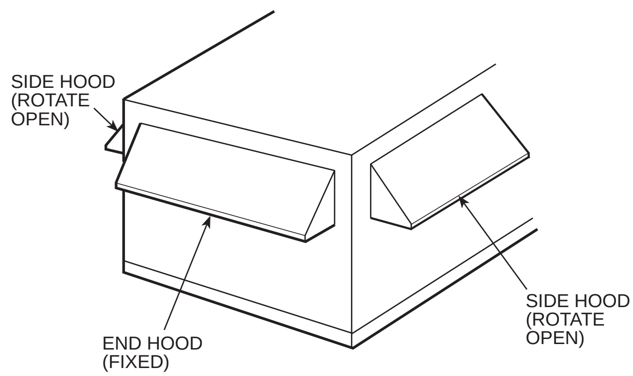


Fig. 31 — Economizer Outdoor-Air Hood Installation (Sizes 030-050)

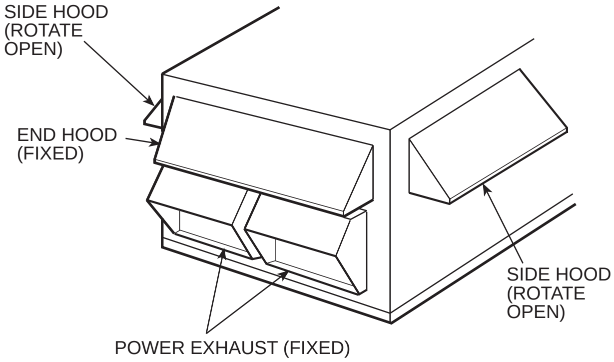


Fig. 32 — Economizer with Power Exhaust Outdoor-Air Hood Installation (Sizes 030-050)

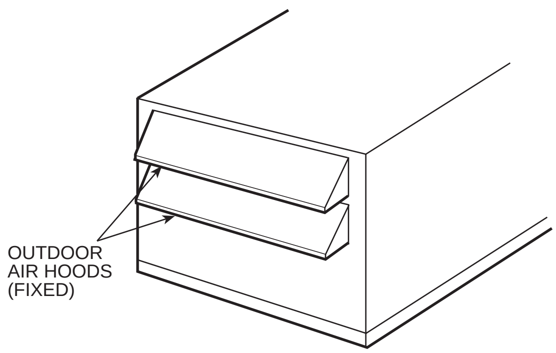


Fig. 33 — 25% Outdoor-Air Hood Location (Sizes 055-105)

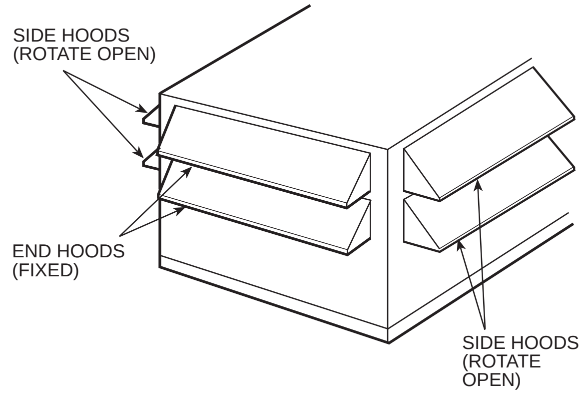


Fig. 34 — Economizer Outdoor-Air Hood Installation (Sizes 055-105)

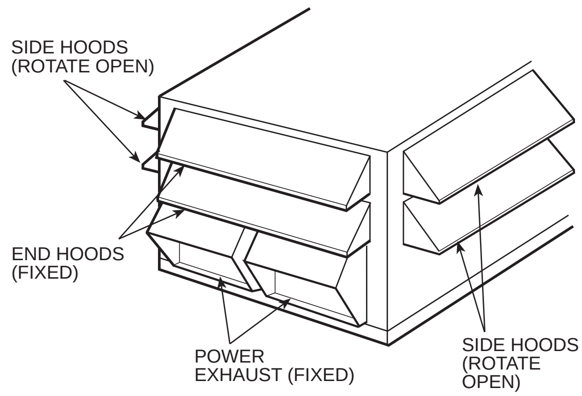


Fig. 35 — Economizer with Power Exhaust Outdoor-Air Hood Installation (Sizes 055-105)

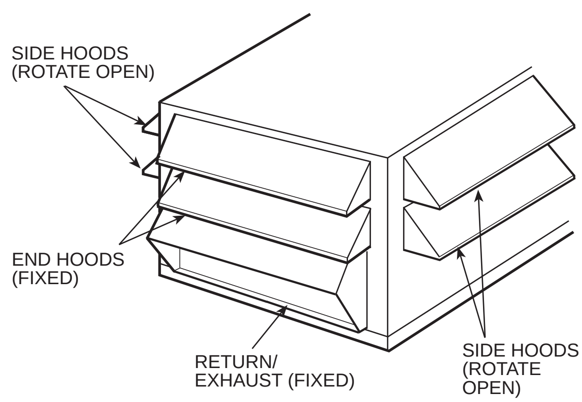


Fig. 36 — Economizer with Return/Exhaust Fan Outdoor-Air Hood Installation (48Z6,Z8075-105 Units)

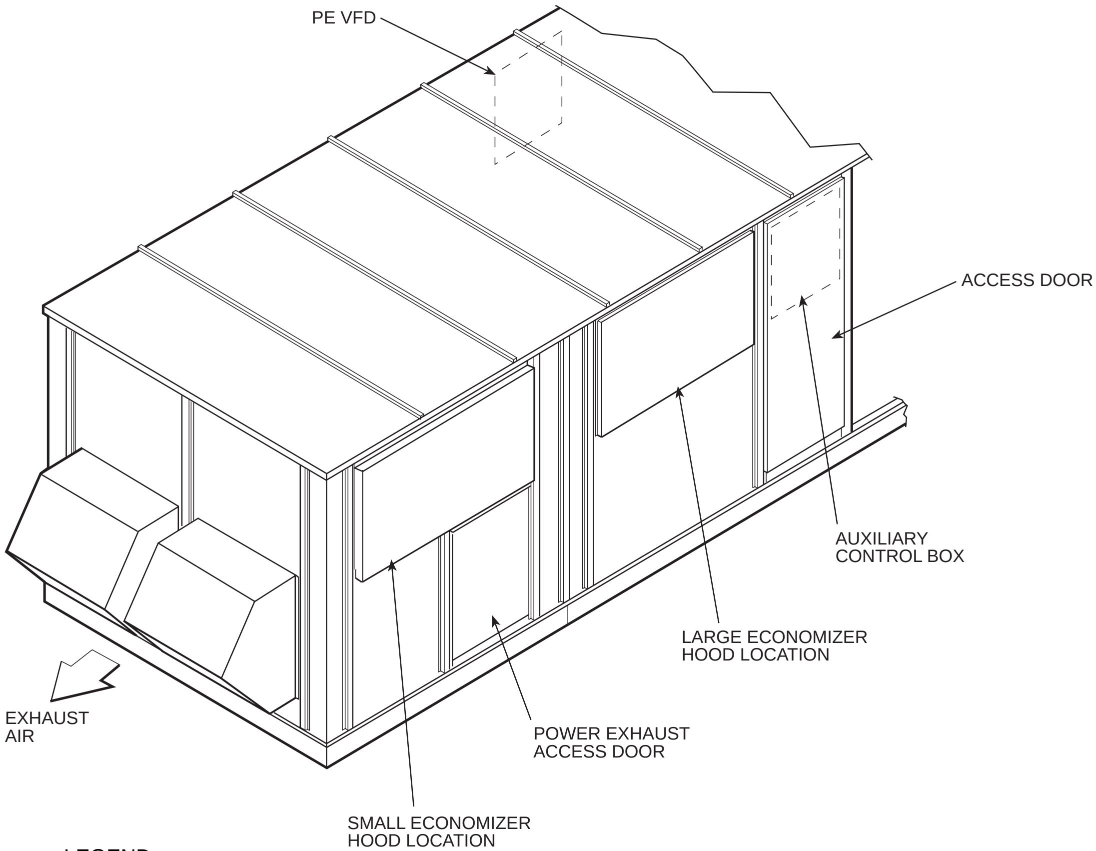
Install Economizer Hoods (48ZT,ZW Units) — The economizer uses a total of 4 outdoor intake hoods, 2 on each side of the unit. See Fig. 37. Two small hoods (one per side) are factory-installed and are pivoted inside the unit chassis for shipment. Two large hoods are shipped in packages located inside the unit. The large hoods (1 on each side) require field assembly and mounting.

INSTALL SMALL HOODS — To install the small economizer hoods, perform the following procedure:

1. Remove the 10 screws holding each of the small economizer hood shipping covers in place.
2. Pivot hoods outward. (There are a total of 2 hoods.)
3. Apply seal strip to vertical flange of hood sides.
4. Install 15 screws (4 each side, 7 across top) around the outside of each hood. Screws are in the fastener package taped to the basepan inside the fan section.
5. Apply a bead of RTV or similar sealant to corner of economizer hood at pivot point to prevent water leaks. (See Fig. 30.)

INSTALL LARGE HOODS — Large hoods are shipped disassembled in the economizer section of the unit behind the large economizer hood shipping cover. See Fig. 38 for assembly details for large economizer hoods. To install the large economizer hoods, perform the following procedure:

1. Remove the 17 screws holding each of the large economizer hood shipping covers in place.
2. Remove the packages containing the disassembled large economizer hoods (total of 2 packages). Each package contains the following: left hood side, right hood side, hood top, hood front, top filter flange, side filter flanges (4), bottom support, front support, filters (6), filter clips (9), seal strip, fasteners.
3. Place seal strip on backside of bottom support along entire length of support, covering 6 clearance holes.
4. Attach bottom support piece to unit. Be sure seal strip is between bottom support and panel on unit.
5. Place seal strip on $^3/_4$-in. flange on both the left and right hood side.
6. Attach the side filter flanges to the left and right hood sides, 2 on each hood side.
7. Attach left and right hood sides to unit. Be sure seal strip is between hood side and unit.
8. Place seal strip on $^3/_4$-in. flange on hood top.
9. Attach top filter flange to hood top.
10. Attach top hood to unit and to hood sides. Be sure seal strip is between hood top and unit.
11. Attach front support between left and right hood sides.
12. Place seal strip on all filter flanges.
13. Attach filter clips to front and bottom supports.
14. Install filters and filter clips. Filters are held in place with filter clips.
15. Attach hood front to hood top and sides.
16. Apply RTV or similar sealant to 6 places shown in Fig. 38.



LEGEND

PE VFD — Power Exhaust Variable Frequency Drive

Fig. 37 — Economizer Hood Location — 48ZT,ZW Units

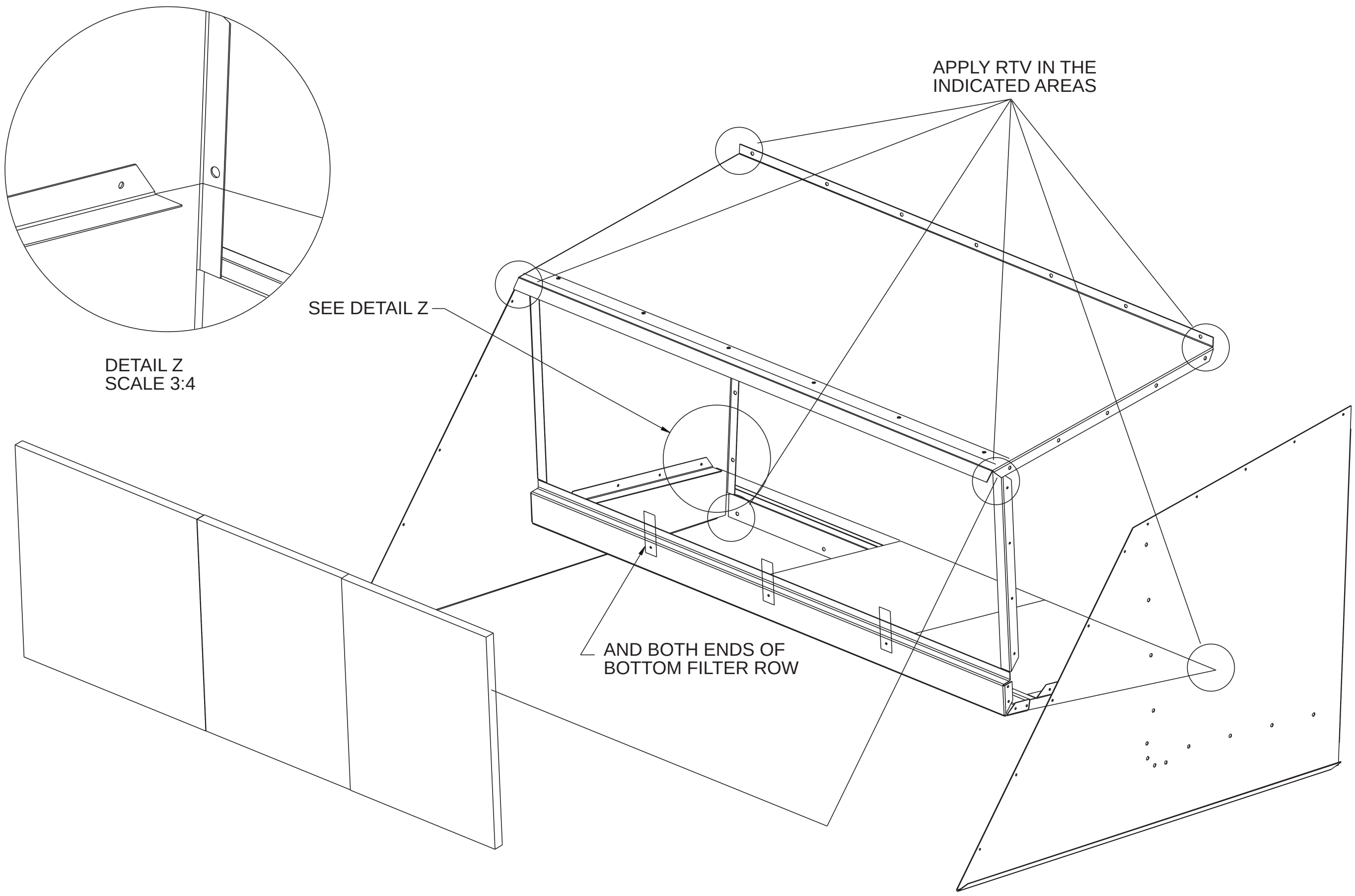


Fig. 38 — Large Economizer Hood Assembly

Field Wire Routing

UNIT SIZES 030-050 — Field wiring can be brought into the unit through the basepan and roof curb or through the corner post in the side of the unit next to the control box.

A $3^1/_2$-in. NPT coupling for field power and a $^3/_4$-in. NPT coupling for 24 v control wiring are provided in the basepan. There are two $4^5/_8$-in. knockouts in the corner post for field power wiring.

If field power wiring is brought through the roof curb, route wiring out through one of the $4^5/_8$-in. knockouts to the field-supplied disconnect and then back into the unit through the other knockout. See Fig. 39 for recommended disconnect location.

If power wiring is brought through the side of the unit, route wiring from field-supplied disconnect through top $4^5/_8$-in. knockouts into unit.

If control wiring is to be brought in through the side of the unit, a $^7/_8$-in. diameter hole must be drilled in the corner post next to the control box.

UNIT SIZES 055-105 — Field wiring is brought into the unit through the bottom of the control box. Wiring can be brought through the roof curb through field-supplied watertight connections. See Fig. 40 and 41.

A $4^5/_{32}$-in. hole for field power wiring and a $^7/_8$-in. hole for 24 v control wiring are provided in the bottom of the control box. Field-supplied couplings must be used when routing wiring into the control box.

See Fig. 40 and 41 for recommended disconnect location.

Field Electrical Connections

> IMPORTANT: The 48ZN,ZW,Z8 units generate, use, and can radiate radio frequency energy. If units are not installed and used in accordance with these instructions, they may cause radio interference. They have been tested and found to comply with limits of a Class A computing device as defined by FCC (Federal Communications Commission) regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

POWER WIRING — Units are factory wired for the voltage shown on the unit nameplate. The main terminal block is suitable for use with aluminum or copper wires. Maximum wire size varies according to disconnect size.

Units Without Factory-Installed Disconnect — When installing units, provide a disconnect per NEC (National Electrical Code) of adequate size (MOCP [Maximum Overcurrent Protection] of unit is on the informative plate). All field wiring must comply with NEC and all local codes. Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 42 for power wiring connections to the unit power terminal block and equipment ground. Maximum wire size is (2) 500 MCM conductors per pole.

Units with Factory-Installed Disconnect — The factory-installed disconnect is an interlocking, door-type. The disconnect handle locks the door when it is in the ON position. The disconnect handle must be in the OFF position to open the control box door. The disconnect is located in a separate control box behind the control box door for all units. See Fig. 43.

All field wiring must comply with NEC and all local codes. Wire must be sized based on MCA (Minimum Circuit Amps) on the unit informative plate. See Fig. 44 for power wiring connections to the unit disconnect and equipment ground.

DISCONNECT SIZE	MAXIMUM WIRE SIZE (MCM)
200 Amps	(1) 300
400 Amps	(1) 600
600 Amps	(2) 600

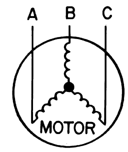
Operating Voltage — Operating voltage to the compressor must be within the voltage range indicated on the unit nameplate. Voltages between phases must be balanced within 2%, and the current must be balanced within 10%. See Tables 7-16 for unit electrical data.

Use the following formula to determine the percentage of voltage imbalance.

Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 v
BC = 464 v
AC = 455 v

$$\text{Average Voltage} = \frac{455 + 464 + 455}{3}$$

$$= \frac{1371}{3}$$

$$= 457$$

Determine maximum deviation from average voltage:

(AB) 457 – 452 = 5 v
(BC) 464 – 457 = 7 v
(AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent voltage imbalance:

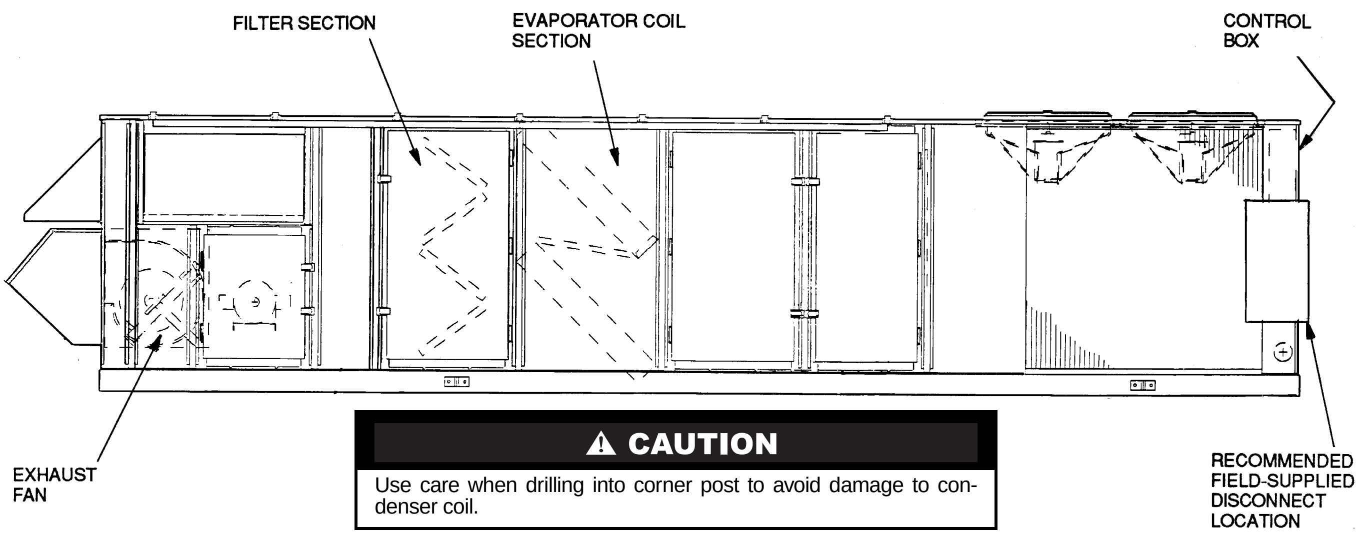
$$\% \text{ Voltage Imbalance} = 100 \times \frac{7}{457}$$

$$= 1.53\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact local utility immediately.

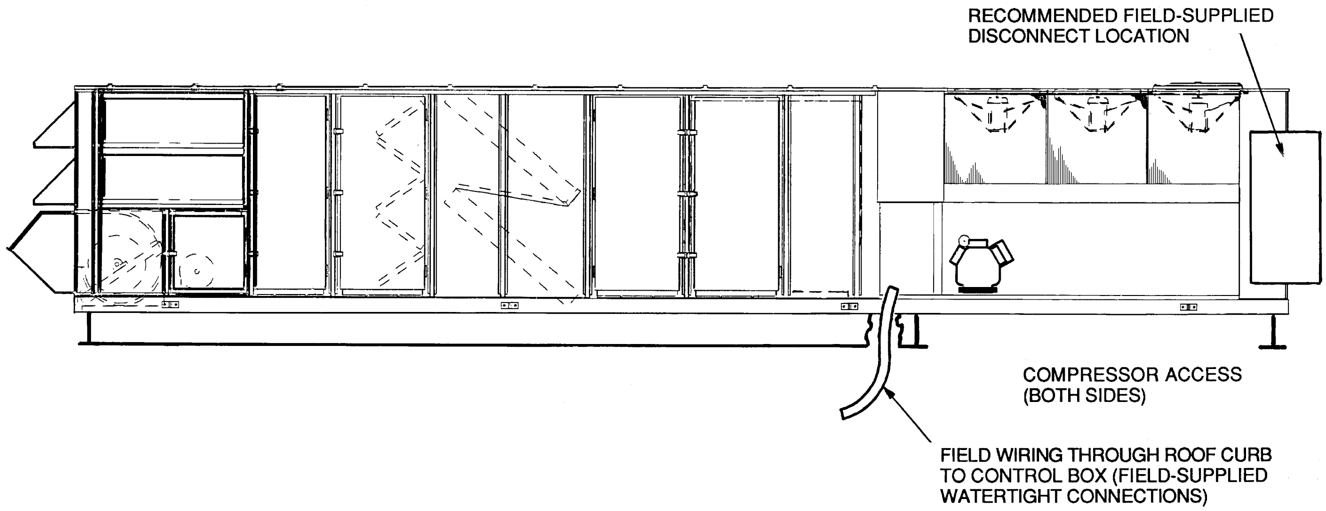
Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.



⚠ CAUTION

Use care when drilling into corner post to avoid damage to condenser coil.

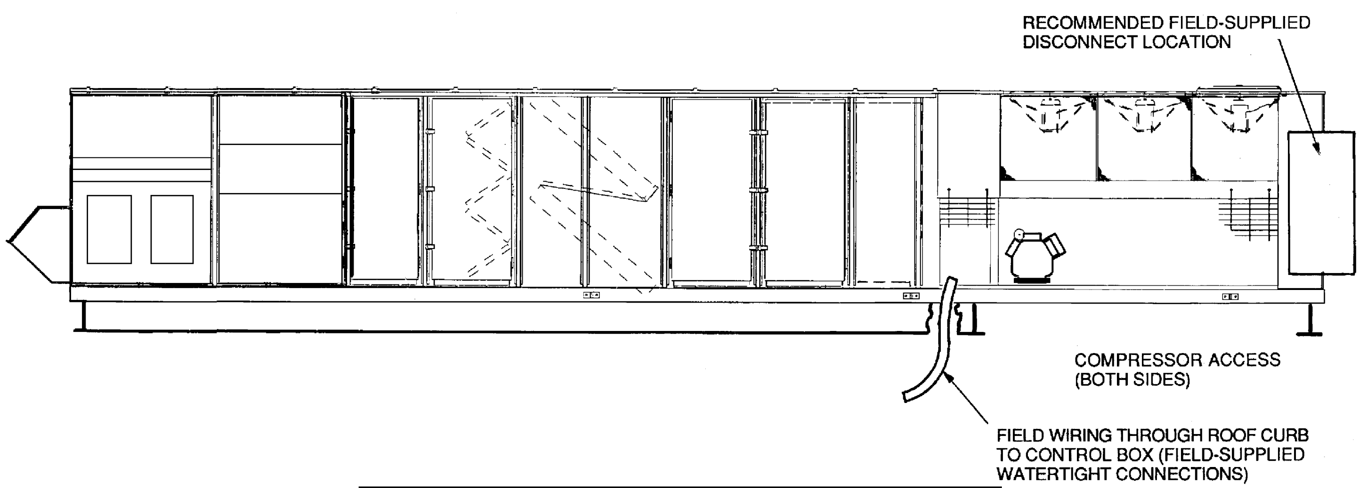
Fig. 39 — Disconnect Location — Size 030-050 Units



⚠ CAUTION

Use care when drilling into corner post to avoid damage to condenser coil.

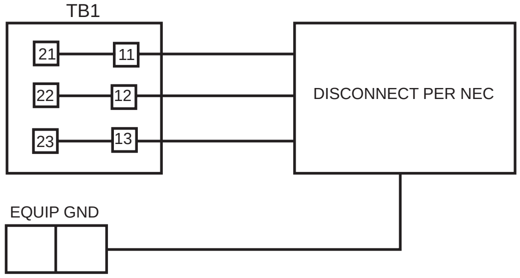
Fig. 40 — Disconnect Location — 48ZG,ZN055-105 and 48Z6,Z8075-105 Units



⚠ CAUTION

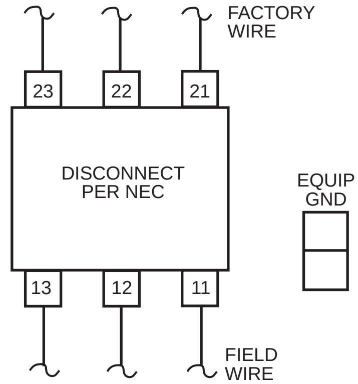
Use care when drilling into corner post to avoid damage to condenser coil.

Fig. 41 — Disconnect Location — 48ZT,ZW075-105 Units



LEGEND
EQUIP — Equipment
GND — Ground
NEC — National Electrical Code
TB — Terminal Block

Fig. 42 — Field Power Wiring Connections



LEGEND
EQUIP — Equipment
GND — Ground
NEC — National Electrical Code

Fig. 44 — Field Power Wiring Connections for Factory-Installed Disconnect

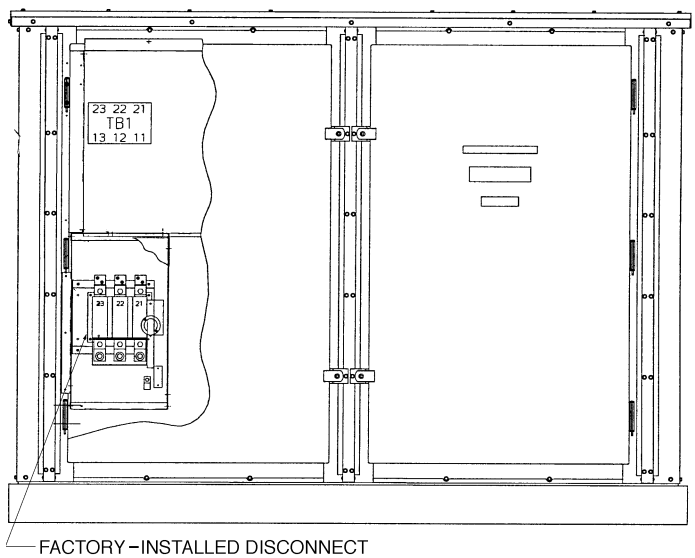


Fig. 43 — Factory-Installed Disconnect Location

Table 7 — Electrical Data, 48ZG,ZN030 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPRESSOR No. 1 RLA	COMPRESSOR No. 1 LRA	COMPRESSOR No. 2 RLA	COMPRESSOR No. 2 LRA	OFM Qty	OFM Total FLA	IFM Hp	IFM FLA	EXHAUST FAN Total Hp	EXHAUST FAN Total FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP
208/230	187-254	53.2	266	53.2	266	2	6.6 (ea)	$7^1/_2$	24.2/22.0	—	—/—	157.1/154.9	200/200
										6	21.2/19.2	178.3/174.1	225/225
										10	33.4/30.4	190.5/185.3	225/225
										15	48.4/44.0	205.5/198.9	250/250
										20	61.6/56.0	220.8/211.6	250/250
								10	30.8/28.0	—	—/—	163.7/160.9	200/200
										6	21.2/19.2	184.9/180.1	225/225
										10	33.4/30.4	197.1/191.3	250/250
										15	48.4/44.0	212.1/204.9	250/250
										20	62.0/56.0	227.4/217.6	250/250
								15	46.2/42.0	—	—/—	179.1/174.9	225/225
										6	21.2/19.2	184.9/180.1	250/225
										10	33.4/30.4	197.1/191.3	250/250
										15	48.4/44.0	212.1/204.9	250/250
										20	62.0/56.0	227.4/217.6	300/250
								20	59.4/54.0	—	—/—	193.9/187.1	250/225
										6	21.2/19.2	215.1/206.3	250/250
										10	33.4/30.4	227.3/217.5	250/250
										15	48.4/44.0	242.3/231.1	300/250
										20	62.0/56.0	256.0/243.6	300/250
								25	74.8/68.0	—	—/—	213.1/204.6	250/225
										6	21.2/19.2	234.3/223.8	300/250
										10	33.4/30.4	246.5/248.6	300/300
										15	48.4/44.0	261.5/248.6	300/300
										20	62.0/56.0	274.7/260.6	300/300
460	414-508	28.8	120	28.8	120	2	3.3 (ea)	$7^1/_2$	11.0	—	—	82.4	110
										6	9.6	92.0	110
										10	15.2	97.6	125
										15	22.0	104.4	125
										20	28.0	110.4	125
								10	14.0	—	—	85.4	110
										6	9.6	95.0	110
										10	15.2	100.6	125
										15	22.0	107.4	125
										20	28.0	113.4	125
								15	21.0	—	—	92.4	110
										6	9.6	102.0	125
										10	15.2	107.6	125
										15	22.0	114.4	125
										20	28.0	120.4	125
								20	27.0	—	—	98.4	125
										6	9.6	108.0	125
										10	15.2	113.6	125
										15	22.0	120.4	125
										20	28.0	126.4	150
								25	34.0	—	—	106.7	125
										6	9.6	116.3	150
										10	15.2	121.9	150
										15	22.0	128.7	150
										20	28.0	134.7	150
575	518-632	23.1	96	23.1	96	2	2.4 (ea)	$7^1/_2$	9.0	—	—	65.8	80
										6	7.8	73.6	90
										10	12.2	78.0	100
										15	18.0	83.8	100
										20	22.0	87.8	110
								10	11.0	—	—	67.8	90
										6	7.8	75.6	90
										10	12.2	80.0	100
										15	18.0	85.8	100
										20	22.0	89.8	110
								15	17.0	—	—	73.8	90
										6	7.8	81.6	100
										10	12.2	86.0	100
										15	18.0	91.8	110
										20	22.0	95.8	110
								20	22.0	—	—	78.8	100
										6	7.8	86.6	100
										10	12.2	91.0	110
										15	18.0	96.8	110
										20	22.0	100.8	110
								25	27.0	—	—	84.8	110
										6	7.8	92.6	110
										10	12.2	97.0	110
										15	18.0	102.8	125
										20	22.0	106.8	125

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 1 (low heat) or 2 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 8 — Electrical Data, 48ZG,ZN035 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPRESSOR No. 1		COMPRESSOR No. 2		OFM		IFM		EXHAUST FAN		POWER SUPPLY	
		RLA	LRA	RLA	LRA	Qty	Total FLA	Hp	FLA	Total Hp	Total FLA	MCA	MOCP
208/230	187-254	53.2	266	69.2	345	2	6.6 (ea)	7½	24.2/22.0	—	—/—	177.1/174.9	225/225
										6	21.2/19.2	198.3/194.1	250/250
										10	33.4/30.4	210.5/205.3	250/250
										15	48.4/44.0	225.5/218.9	250/250
										20	61.6/56.0	238.7/230.9	300/300
								10	30.8/28.0	—	—/—	183.7/180.9	250/250
										6	21.2/19.2	204.9/200.1	250/250
										10	33.4/30.4	217.1/211.3	250/250
										15	48.4/44.0	232.1/224.9	300/250
										20	62.0/56.0	245.3/236.9	300/300
								15	46.2/42.0	—	—/—	199.1/194.9	250/250
										6	21.2/19.2	220.3/214.1	250/250
										10	33.4/30.4	232.5/225.3	300/250
										15	48.4/44.0	247.5/238.9	300/300
										20	62.0/56.0	260.7/250.9	300/300
								20	59.4/54.0	—	—/—	212.3/206.9	250/250
										6	21.2/19.2	233.5/226.1	300/250
										10	33.4/30.4	245.7/237.3	300/300
										15	48.4/44.0	260.7/250.9	300/300
										20	62.0/56.0	273.9/262.9	300/300
								25	74.8/68.0	—	—/—	229.1/220.9	300/250
										6	21.2/19.2	250.3/240.1	300/300
										10	33.4/30.4	262.5/251.3	300/300
										15	48.4/44.0	277.5/264.9	350/300
										20	62.0/56.0	290.7/276.9	350/300
460	414-508	28.8	120	34.6	173	2	3.3 (ea)	7½	11.0	—	—	89.7	110
										6	9.6	99.3	125
										10	15.2	104.9	125
										15	22.0	111.7	125
										20	28.0	117.7	150
								10	14.0	—	—	92.7	125
										6	9.6	102.3	125
										10	15.2	107.9	125
										15	22.0	114.7	125
										20	28.0	120.7	150
								15	21.0	—	—	99.7	125
										6	9.6	109.3	125
										10	15.2	114.9	125
										15	22.0	121.7	150
										20	28.0	127.7	150
								20	27.0	—	—	105.7	125
										6	9.6	115.3	125
										10	15.2	120.9	150
										15	22.0	127.7	150
										20	28.0	133.7	150
								25	34.0	—	—	112.7	125
										6	9.6	122.3	150
										10	15.2	127.9	150
										15	22.0	134.7	150
										20	28.0	140.7	175
575	518-632	23.1	96	26.7	120	2	2.4 (ea)	7½	9.0	—	—	70.3	90
										6	7.8	78.1	100
										10	12.2	82.5	100
										15	18.0	88.3	110
										20	22.0	92.3	110
								10	11.0	—	—	72.3	90
										6	7.8	80.1	100
										10	12.2	84.5	110
										15	18.0	90.3	110
										20	22.0	94.3	110
								15	17.0	—	—	78.3	100
										6	7.8	86.1	110
										10	12.2	90.5	110
										15	18.0	96.3	110
										20	22.0	100.3	125
								20	22.0	—	—	83.3	100
										6	7.8	91.1	110
										10	12.2	95.5	110
										15	18.0	101.3	125
										20	22.0	105.3	125
								25	27.0	—	—	88.4	110
										6	7.8	96.2	110
										10	12.2	100.6	125
										15	18.0	106.4	125
										20	22.0	110.4	125

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 1 (low heat) or 2 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 9 — Electrical Data, 48ZG,ZN040 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPRESSOR No. 1 RLA	COMPRESSOR No. 1 LRA	COMPRESSOR No. 2 RLA	COMPRESSOR No. 2 LRA	OFM Qty	OFM Total FLA	IFM Hp	IFM FLA	EXHAUST FAN Total Hp	EXHAUST FAN Total FLA	POWER SUPPLY MCA	POWER SUPPLY MOCP
208/230	187-254	69.2	345	69.2	345	3	6.6 (ea)	7½	24.2/22.0	—	—/—	199.7/197.5	250/250
										6	21.2/19.2	220.9/216.7	250/250
										10	33.4/30.4	233.1/227.9	300/250
										15	48.4/44.0	248.1/241.5	300/300
										20	61.6/56.0	261.3/253.5	300/300
								10	30.8/28.0	—	—/—	206.3/203.5	250/250
										6	21.2/19.2	227.5/222.7	250/250
										10	33.4/30.4	239.7/233.9	300/300
										15	48.4/44.0	254.7/247.5	300/300
										20	62.0/56.0	267.9/259.5	300/300
								15	46.2/42.0	—	—/—	221.7/217.5	250/250
										6	21.2/19.2	242.9/236.7	300/300
										10	33.4/30.4	255.1/247.9	300/300
										15	48.4/44.0	270.1/261.5	300/300
										20	62.0/56.0	283.3/273.5	350/300
								20	59.4/54.0	—	—/—	234.9/229.5	300/250
										6	21.2/19.2	256.1/248.7	300/300
										10	33.4/30.4	268.3/259.9	300/300
										15	48.4/44.0	283.3/273.5	350/300
										20	62.0/56.0	296.5/285.5	350/350
								25	74.8/68.0	—	—/—	251.7/243.5	300/300
										6	21.2/19.2	272.9/262.7	300/300
										10	33.4/30.4	285.1/273.9	350/300
										15	48.4/44.0	300.1/287.5	350/350
										20	62.0/56.0	313.3/299.5	350/350
460	414-508	34.6	173	34.6	173	3	3.3 (ea)	7½	11.0	—	—	98.8	125
										6	9.6	108.4	125
										10	15.2	114.0	125
										15	22.0	120.8	150
										20	28.0	126.8	150
								10	14.0	—	—	101.8	125
										6	9.6	111.4	125
										10	15.2	117.0	150
										15	22.0	123.8	150
										20	28.0	129.8	150
								15	21.0	—	—	108.8	125
										6	9.6	118.4	150
										10	15.2	124.0	150
										15	22.0	130.8	150
										20	28.0	136.8	150
								20	27.0	—	—	114.8	125
										6	9.6	124.4	150
										10	15.2	130.0	150
										15	22.0	138.8	150
										20	28.0	142.8	175
								25	34.0	—	—	121.8	150
										6	9.6	131.4	150
										10	15.2	137.0	150
										15	22.0	143.8	175
										20	28.0	149.8	175
								30	40.0	—	—	129.1	150
										6	9.6	138.7	175
										10	15.2	144.3	175
										15	22.0	151.1	175
										20	28.0	157.1	175
575	518-632	26.7	120	26.7	120	3	2.4 (ea)	7½	9.0	—	—	76.3	100
										6	7.8	84.1	110
										10	12.2	88.5	100
										15	18.0	94.3	110
										20	22.0	98.3	110
								10	11.0	—	—	78.3	100
										6	7.8	86.1	110
										10	12.2	90.5	110
										15	18.0	96.3	110
										20	22.0	100.3	125
								15	17.0	—	—	84.3	110
										6	7.8	92.1	110
										10	12.2	96.5	110
										15	18.0	102.3	125
										20	22.0	106.3	125
								20	22.0	—	—	89.3	110
										6	7.8	97.1	110
										10	12.2	101.5	125
										15	18.0	107.3	125
										20	22.0	101.3	125
								25	27.0	—	—	94.4	110
										6	7.8	102.2	125
										10	12.2	106.6	125
										15	18.0	112.4	125
										20	22.0	116.4	125

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 1 (low heat) or 2 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 10 — Electrical Data, 48ZG,ZN050 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPRESSOR No. 1		COMPRESSOR No. 2		OFM		IFM		EXHAUST FAN		POWER SUPPLY	
		RLA	LRA	RLA	LRA	Qty	Total FLA	Hp	FLA	Total Hp	Total FLA	MCA	MOCP
208/230	187-254	89.7	446	69.2	345	3	6.6 (ea)	$7\frac{1}{2}$	24.2/22.0	—	—/—	225.3/223.1	300/300
										6	21.2/19.2	246.5/242.3	300/300
										10	33.4/30.4	258.7/253.5	300/300
										15	48.4/44.0	273.7/267.1	350/350
										20	61.6/56.0	286.9/279.1	350/350
								10	30.8/28.0	—	—/—	231.9/229.1	300/300
										6	21.2/19.2	253.1/248.3	300/300
										10	33.4/30.4	265.3/259.5	350/300
										15	48.4/44.0	280.3/273.1	350/350
										20	62.0/56.0	293.5/285.1	350/350
								15	46.2/42.0	—	—/—	247.3/243.1	300/300
										6	21.2/19.2	268.5/262.3	350/350
										10	33.4/30.4	280.7/273.5	350/350
										15	48.4/44.0	295.7/287.1	350/350
										20	62.0/56.0	308.9/299.1	350/350
								20	59.4/54.0	—	—/—	260.5/255.1	350/300
										6	21.2/19.2	281.7/274.3	350/350
										10	33.4/30.4	293.9/285.5	350/350
										15	48.4/44.0	308.9/299.1	350/350
										20	62.0/56.0	322.1/311.1	400/400
								25	74.8/68.0	—	—/—	275.9/269.1	350/350
										6	21.2/19.2	297.1/288.3	350/350
										10	33.4/30.4	309.3/299.5	350/350
										15	48.4/44.0	324.3/313.1	400/400
										20	62.0/56.0	337.5/325.1	400/400
460	414-508	43.6	223	34.6	173	3	3.3 (ea)	$7\frac{1}{2}$	11.0	—	—	110.0	150
										6	9.6	119.6	150
										10	15.2	125.2	150
										15	22.0	132.0	175
										20	28.0	138.0	175
								10	14.0	—	—	113.0	150
										6	9.6	122.6	150
										10	15.2	128.2	150
										15	22.0	135.0	175
										20	28.0	141.0	175
								15	21.0	—	—	120.0	150
										6	9.6	129.6	150
										10	15.2	135.2	175
										15	22.0	142.0	175
										20	28.0	148.0	175
								20	27.0	—	—	126.0	150
										6	9.6	135.6	175
										10	15.2	141.2	175
										15	22.0	148.0	175
										20	28.0	154.0	175
								25	34.0	—	—	133.0	175
										6	9.6	142.6	175
										10	15.2	148.2	175
										15	22.0	155.0	175
										20	28.0	161.0	200
								30	40.0	—	—	139.0	175
										6	9.6	148.6	175
										10	15.2	154.2	175
										15	22.0	161.0	200
										20	28.0	167.0	200
575	518-632	36.5	164	26.7	120	3	2.4 (ea)	$7\frac{1}{2}$	9.0	—	—	88.5	125
										6	7.8	96.3	125
										10	12.2	100.7	125
										15	18.0	106.5	125
										20	22.0	110.5	125
								10	11.0	—	—	90.5	125
										6	7.8	98.3	125
										10	12.2	102.7	125
										15	18.0	108.5	125
										20	22.0	112.5	125
								15	17.0	—	—	96.5	125
										6	7.8	104.3	125
										10	12.2	108.7	125
										15	18.0	114.5	150
										20	22.0	118.5	150
								20	22.0	—	—	101.5	125
										6	7.8	109.3	125
										10	12.2	113.7	150
										15	18.0	119.5	150
										20	22.0	123.5	150
								25	27.0	—	—	106.5	125
										6	7.8	114.3	150
										10	12.2	118.7	150
										15	18.0	124.5	150
										20	22.0	128.5	150

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 1 (low heat) or 2 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 11 — Electrical Data, 48ZG,ZN055 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPR NO. 1		COMPR NO. 2		OFM	IFM		BASE UNIT ONLY		EXHAUST FAN		BASE UNIT WITH EXHAUST FAN	
		RLA	LRA	RLA	LRA	Total FLA	Hp	FLA	MCA	MOCP	Total Hp	Total FLA	MCA	MOCP
208/230	187-254	108	506	74.4	345	26.4	15	46.2/42	281.6/277.4	350/350	10 15 20	34/30 48/44 62/56	315.0/307.4 330.0/321.4 343.2/333.4	400/400 400/400 450/400
							20	59.4/54	294.8/289.4	400/350	10 15 20	34/30 48/44 62/56	328.2/319.4 343.2/333.4 356.4/345.4	400/400 450/400 450/450
							25	74.8/68	310.2/303.4	400/400	10 15 20	34/30 48/44 62/56	343.6/333.4 358.6/347.4 371.8/359.4	450/400 450/450 450/450
							30	88.0/80	323.4/315.4	400/400	10 15 20	34/30 48/44 62/56	356.8/345.4 371.8/359.4 385.0/371.4	450/450 450/450 450/450
							40	114.4/104	351.5/339.4	450/400	10 15 20	34/30 48/44 62/56	384.9/369.8 399.9/383.4 412.6/395.4	450/450 500/450 500/500
460	414-508	50.6	253	34.6	173	13.2	15	21.0	132.1	175	10 15 20	15.2 22.0 28.0	147.3 154.1 160.1	175 200 200
							20	27.0	138.1	175	10 15 20	15.2 22.0 28.0	153.3 160.1 166.1	200 200 200
							25	34.0	145.1	175	10 15 20	15.2 22.0 28.0	160.3 167.1 173.1	200 200 200
							30	40.0	151.1	200	10 15 20	15.2 22.0 28.0	166.3 173.1 179.1	200 200 225
							40	52.0	163.4	200	10 15 20	15.2 22.0 28.0	178.6 185.4 191.4	225 225 225
575	518-632	39.1	176	28.8	120	9.6	15	17.0	104.3	125	10 15 20	12.2 18.0 22.0	116.5 122.3 126.3	150 150 150
							20	22.0	109.3	125	10 15 20	12.2 18.0 22.0	121.5 127.3 131.3	150 150 150
							25	27.0	114.3	150	10 15 20	12.2 18.0 22.0	126.5 132.3 136.3	150 150 175
							30	32.0	119.3	150	10 15 20	12.2 18.0 22.0	131.5 137.3 141.3	150 175 175
							40	41.0	128.8	150	10 15 20	12.2 18.0 22.0	141.0 146.8 150.8	175 175 175

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 12 — Electrical Data, 48ZG,ZN060 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPR NO. 1		COMPR NO. 2		OFM	IFM		BASE UNIT ONLY		EXHAUST FAN		BASE UNIT WITH EXHAUST FAN	
		RLA	LRA	RLA	LRA	Total FLA	Hp	FLA	MCA	MOCP	Total Hp	Total FLA	MCA	MOCP
208/230	187-254	108	506	108	506	26.4	15	46.2/42	314.9/310.7	400/400	10 15 20	34/30 48/44 62/56	348.3/340.7 363.3/354.7 376.6/366.7	450/400 450/450 450/450
							20	59.4/54	328.1/322.7	400/400	10 15 20	34/30 48/44 62/56	361.5/352.7 376.5/366.7 389.7/378.7	450/450 450/450 450/450
							25	74.8/68	343.5/336.7	450/400	10 15 20	34/30 48/44 62/56	376.9/366.7 391.9/380.7 405.1/392.7	450/450 450/450 500/500
							30	88.0/80	356.7/348.7	450/450	10 15 20	34/30 48/44 62/56	390.1/378.7 405.1/392.7 418.3/404.7	450/450 500/500 500/500
							40	114.4/104	384.8/372.7	450/450	10 15 20	34/30 48/44 62/56	418.2/403.1 433.2/416.7 445.9/428.7	500/500 500/500 500/500
460	414-508	50.6	253	50.6	253	13.2	15	21.0	148.1	175	10 15 20	15.2 22.0 28.0	163.3 170.1 176.1	200 200 200
							20	27.0	154.1	200	10 15 20	15.2 22.0 28.0	169.3 176.1 182.1	200 225 225
							25	34.0	161.1	200	10 15 20	15.2 22.0 28.0	176.3 183.1 189.1	225 225 225
							30	40.0	167.1	200	10 15 20	15.2 22.0 28.0	182.3 189.1 195.1	225 225 225
							40	52.0	179.4	225	10 15 20	15.2 22.0 28.0	194.6 201.4 207.4	225 250 250
575	518-632	39.1	176	39.1	176	9.6	15	17.0	114.6	150	10 15 20	12.2 18.0 22.0	126.8 132.6 136.6	150 150 175
							20	22.0	119.6	150	10 15 20	12.2 18.0 22.0	131.8 137.6 141.6	150 175 175
							25	27.0	124.6	150	10 15 20	12.2 18.0 22.0	136.8 142.6 146.6	175 175 175
							30	32.0	129.6	150	10 15 20	12.2 18.0 22.0	141.8 147.6 151.6	175 175 175
							40	41.0	139.6	175	10 15 20	12.2 18.0 22.0	151.3 157.1 161.1	175 175 200

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 13 — Electrical Data, 48ZG,ZN070 Units

NOMINAL VOLTAGE (3 Ph 60 Hz)	VOLTAGE RANGE	COMPR NO. 1		COMPR NO. 2		OFM	IFM		BASE UNIT ONLY		EXHAUST FAN		BASE UNIT WITH EXHAUST FAN	
		RLA	LRA	RLA	LRA	Total FLA	Hp	FLA	MCA	MOCP	Total Hp	Total FLA	MCA	MOCP
208/230	187-254	108	506	142	690	33.0	15	46.2/42	364.8/360.6	500/500	10 15 20	34/30 48/44 62/56	398.2/390.6 413.2/404.6 426.4/416.6	500/500 500/500 500/500
							20	59.4/54	378.0/372.6	500/500	10 15 20	34/30 48/44 62/56	411.4/402.6 426.4/416.6 439.6/428.6	500/500 500/500 500/500
							25	74.8/68	393.4/386.6	500/500	10 15 20	34/30 48/44 62/56	426.8/416.6 441.8/430.6 455.0/442.6	500/500 500/500 500/500
							30	88.0/80	406.6/389.6	500/500	10 15 20	34/30 48/44 62/56	440.0/428.6 455.0/442.6 468.2/454.6	500/500 500/500 600/500
							40	114.4/104.0	433.0/422.6	500/500	10 15 20	34/30 48/44 62/56	466.4/453.0 481.4/466.6 494.1/478.6	600/500 600/600 600/600
460	414-508	50.6	253	65.4	345	16.5	15	21.0	169.9	225	10 15 20	15.2 22.0 28.0	185.1 191.9 197.9	250 250 250
							20	27.0	175.9	225	10 15 20	15.2 22.0 28.0	191.1 197.9 203.9	250 250 250
							25	34.0	182.9	225	10 15 20	15.2 22.0 28.0	198.1 204.9 210.9	250 250 275
							30	40.0	188.9	250	10 15 20	15.2 22.0 28.0	204.1 210.9 216.9	250 275 275
							40	52.0	200.9	250	10 15 20	15.2 22.0 28.0	216.1 222.9 228.9	250 250 250
575	518-632	39.1	176	52.6	276	12.0	15	17.0	133.9	175	10 15 20	12.2 18.0 22.0	146.1 151.9 155.9	175 200 200
							20	22.0	138.9	175	10 15 20	12.2 18.0 22.0	151.1 156.9 160.9	200 200 200
							25	27.0	143.9	175	10 15 20	12.2 18.0 22.0	156.1 161.9 165.9	200 200 200
							30	32.0	148.9	200	10 15 20	12.2 18.0 22.0	161.1 166.9 170.9	200 200 200
							40	41.0	157.9	200	10 15 20	12.2 18.0 22.0	170.1 175.9 179.9	200 225 225

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 0.3 FLA each.

Table 14 — Electrical Data — 48ZG,ZN075-105 Units

SIZE	VOLTAGE (V-Ph-Hz)	VOLTAGE RANGE	COMPRESSOR No. 1 RLA	COMPRESSOR No. 1 LRA	COMPRESSOR No. 2 RLA	COMPRESSOR No. 2 LRA	COMPRESSOR No. 3 RLA	COMPRESSOR No. 3 LRA	COMPRESSOR No. 4 RLA	COMPRESSOR No. 4 LRA	OFM Total FLA	IFM Hp	IFM FLA	BASE UNIT ONLY MCA	BASE UNIT ONLY MOCP	OPTIONAL POWER EXHAUST FAN Total Hp	OPTIONAL POWER EXHAUST FAN Total FLA	BASE UNIT WITH EXHAUST FAN MCA	BASE UNIT WITH EXHAUST FAN MOCP
075	460-3-60	414-508	50.6	253	65.4	345	—	—	—	—	16.5	30	40.0	188.9	250	10	15.2	204.1	250
																15	22.0	210.9	250
																20	28.0	216.9	250
												40	52.0	200.9	250	10	15.2	216.1	250
																15	22.0	222.9	250
																20	28.0	228.9	250
												50	65.0	213.9	250	10	15.2	229.1	250
																15	22.0	235.9	300
																20	28.0	241.9	300
												60	77.0	228.8	300	10	15.2	244.0	300
																15	22.0	250.8	300
																20	28.0	256.8	300
												75	96.0	252.5	300	10	15.2	267.7	300
																15	22.0	274.5	350
																20	28.0	280.5	350
090	460-3-60	414-508	65.4	345	65.4	345	—	—	—	—	19.8	30	40.0	207.0	250	10	15.2	222.2	350
																15	22.0	229.0	250
																20	28.0	235.0	300
												40	52.0	219.0	250	10	15.2	234.2	250
																15	22.0	241.0	300
																20	28.0	247.0	300
												50	65.0	232.0	250	10	15.2	247.2	300
																15	22.0	254.0	300
																20	28.0	260.0	300
												60	77.0	246.9	300	10	15.2	262.1	300
																15	22.0	268.9	300
																20	28.0	274.9	300
												75	96.0	270.6	350	10	15.2	285.8	350
																15	22.0	292.6	350
																20	28.0	298.6	350
105	460-3-60	414-508	50.6	253	34.6	173	50.6	253	34.6	173	19.8	30	40.0	242.9	250	10	15.2	258.1	300
																15	22.0	264.9	300
																20	28.0	270.9	300
												40	52.0	255.2	300	10	15.2	270.4	300
																15	22.0	277.2	300
																20	28.0	283.2	300
												50	65.0	271.5	300	10	15.2	286.7	350
																15	22.0	293.5	350
																20	28.0	299.5	350
												60	77.0	286.5	350	10	15.2	301.7	350
																15	22.0	308.5	350
																20	28.0	314.5	350
												75	96.0	310.2	400	10	15.2	325.4	400
																15	22.0	332.2	400
																20	28.0	338.2	400

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Supply) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 460 v, single-phase, 60 Hertz and 0.3 FLA each.

Table 15 — Electrical Data — 48Z6,Z8075-105 Units

UNIT SIZE	VOLTAGE (3 Ph, 60 Hz	VOLTAGE RANGE		COMPRESSOR No. 1		COMPRESSOR No. 2		COMPRESSOR No. 3		COMPRESSOR No.4		CONDENSER FAN MOTOR		EVAPORATOR FAN MOTOR		RETURN/ EXHAUST FAN		POWER SUPPLY	
		Min	Max	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	Hp	FLA (total)	MCA	MOCP
075	460	414	508	50.6	253	65.4	345	—	—	—	—	5	3.3 (ea)	30	40.0	20	27	215.9	250
																25	34	222.9	250
																30	40	228.9	250
																40	52	240.9	300
														40	52.0	20	27	227.9	250
																25	34	234.9	300
																30	40	240.9	300
																40	52	252.9	300
														50	65.0	20	27	240.9	300
																25	34	247.9	300
																30	40	253.9	300
																40	52	265.9	300
														60	77.0	20	27	255.8	300
																25	34	262.8	300
																30	40	268.8	300
																40	52	280.8	350
														75	96.0	20	27	279.5	350
																25	34	286.5	350
																30	40	292.5	350
																40	52	304.5	400
090	460	414	508	65.4	345	65.4	345	—	—	—	—	6	3.3 (ea)	30	40.0	20	27	234.0	250
																25	34	241.0	300
																30	40	247.0	300
																40	52	259.0	300
														40	52.0	20	27	246.0	300
																25	34	253.0	300
																30	40	259.0	300
																40	52	271.0	300
														50	65.0	20	27	259.0	300
																25	34	266.0	300
																30	40	272.0	300
																40	52	284.0	300
														60	77.0	20	27	273.9	350
																25	34	280.9	350
																30	40	286.9	350
																40	52	298.9	350
														75	96.0	20	27	297.6	350
																25	34	304.6	400
																30	40	310.6	400
																40	52	322.6	400
105	460	414	508	50.6	253	50.6	253	34.6	173	34.6	173	6	3.3 (ea)	30	40.0	20	27	269.9	300
																25	34	276.9	300
																30	40	282.9	300
																40	52	294.9	300
														40	52.0	20	27	282.2	300
																25	34	289.2	300
																30	40	295.2	300
																40	52	307.2	350
														50	65.0	20	27	298.5	350
																25	34	305.5	350
																30	40	311.5	350
																40	52	323.5	350
														60	77.0	20	27	313.5	350
																25	34	320.5	350
																30	40	326.5	400
																40	52	338.5	400
														75	96.0	20	27	337.2	400
																25	34	344.2	400
																30	40	350.2	400
																40	52	362.2	450

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing
MOCP — Maximum Overcurrent Protection
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 460 v, single-phase, 60 Hertz and 0.3 FLA each.

Table 16 — Electrical Data — 48ZT,ZW075-105 Units

UNIT SIZE	VOLTAGE 3 PH, 60 Hz	VOLTAGE RANGE	COMPRESSOR No. 1 RLA	No. 1 LRA	No. 2 RLA	No. 2 LRA	No. 3 RLA	No. 3 LRA	No. 4 RLA	No. 4 LRA	OFM Total FLA	IFM Hp	IFM FLA	IFM LRA	EXHAUST FAN Total Hp	EXHAUST FAN Total FLA	BASE UNIT WITH EXHAUST FAN MCA	MOCP
075	460	414-508	50.6	253	65.4	345	—	—	—	—	16.5	30	40.0	230	20	28	216.9	250
															30	42	230.9	250
															40	54	242.9	300
															50	68	256.9	300
															60	80	268.9	300
												40	52.0	304	20	28	228.9	250
															30	42	242.9	300
															40	54	254.9	300
															50	68	268.9	300
															60	80	280.9	300
												50	65.0	370	20	28	241.9	300
															30	42	255.9	300
															40	54	267.9	300
															50	68	281.9	300
															60	80	293.9	350
												60	77.0	453	20	28	256.8	300
															30	42	270.8	300
															40	54	282.8	350
															50	68	296.8	350
															60	80	308.8	350
												75	96.0	—	20	28	280.5	350
															30	42	294.5	350
															40	54	306.5	400
															50	68	320.5	400
															60	80	332.5	400
	575	518-632	39.1	176	52.6	276	—	—	—	—	12.0	30	32.0	—	20	22	170.9	200
															30	34	182.9	225
															40	44	192.9	225
															50	54	202.9	250
															60	64	212.9	250
												40	41.0	—	20	22	179.9	225
															30	34	191.9	225
															40	44	201.9	250
															50	54	211.9	250
															60	64	221.9	250
												50	52.0	—	20	22	190.9	225
															30	34	202.9	250
															40	44	212.9	250
															50	54	222.9	250
															60	64	232.9	250
												60	62.0	—	20	22	203.2	250
															30	34	215.2	250
															40	44	225.2	250
															50	54	235.2	250
															60	64	245.2	300
090	460	414-508	65.4	345	65.4	345	—	—	—	—	19.8	30	40.0	230	20	28	235.0	300
															30	42	249.0	300
															40	54	261.0	300
															50	68	275.0	300
															60	80	287.0	350
												40	52.0	304	20	28	247.0	300
															30	42	261.0	300
															40	54	273.0	300
															50	68	287.0	350
															60	80	299.0	350
												50	65.0	370	20	28	260.0	300
															30	42	274.0	300
															40	54	286.0	350
															50	68	300.0	350
															60	80	312.0	350
												60	77.0	453	20	28	274.9	350
															30	42	288.9	350
															40	54	300.9	350
															50	68	314.9	350
															60	80	326.9	400
												75	96.0	—	20	28	298.6	350
															30	42	312.6	400
															40	54	324.6	400
															50	68	338.6	400
															60	80	350.6	400

Table 16 — Electrical Data — 48ZT,ZW075-105 Units (cont)

UNIT SIZE	VOLTAGE 3 PH, 60 Hz	VOLTAGE RANGE	COMPRESSOR								OFM	IFM			EXHAUST FAN		BASE UNIT WITH EXHAUST FAN	
			No. 1		No. 2		No. 3		No. 4									
			RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	Total FLA	Hp	FLA	LRA	Total Hp	Total FLA	MCA	MOCP
090	575	518-632	52.6	276	52.6	276	—	—	—	—	14.4	30	32.0	—	20	22	186.8	225
															30	34	198.8	250
															40	44	208.8	250
															50	54	218.8	250
															60	64	228.8	250
												40	41.0	—	20	22	195.8	225
															30	34	207.8	250
															40	44	217.8	250
															50	54	227.8	250
															60	64	237.8	250
												50	52.0	—	20	22	206.8	250
															30	34	218.8	250
															40	44	228.8	250
															50	54	238.8	250
															60	64	248.8	300
												60	62.0	—	20	22	219.1	250
															30	34	231.1	250
															40	44	241.1	300
															50	54	251.1	300
															60	64	261.1	300
105	460	414-508	50.6	253	34.6	173	50.6	253	34.6	173	19.8	30	40.0	230	20	28	270.9	300
															30	42	284.9	300
															40	54	296.9	300
															50	68	310.9	350
															60	80	322.9	350
												40	52.0	304	20	28	283.2	300
															30	42	297.2	300
															40	54	309.2	350
															50	68	323.2	350
															60	80	335.2	350
												50	65.0	370	20	28	299.5	350
															30	42	313.5	350
															40	54	325.5	350
															50	68	339.5	400
															60	80	351.5	400
												60	77.0	453	20	28	314.5	350
															30	42	328.5	400
															40	54	340.5	400
															50	68	354.5	400
															60	80	366.5	400
												75	96.0	—	20	28	338.2	400
															30	42	352.2	400
															40	54	364.2	450
															50	68	378.2	450
															60	80	390.2	450
	575	518-632	39.1	176	26.7	120	39.1	176	26.7	120	14.4	30	32.0	—	20	22	209.8	225
															30	34	221.8	250
															40	44	231.8	250
															50	54	241.8	250
															60	64	251.8	300
												40	41.0	—	20	22	219.3	250
															30	34	231.3	250
															40	44	241.3	250
															50	54	251.3	300
															60	64	261.3	300
												50	52.0	—	20	22	233.0	250
															30	34	245.0	250
															40	44	255.0	300
															50	54	265.0	300
															60	64	275.0	300
												60	62.0	—	20	22	245.5	300
															30	34	257.5	300
															40	44	267.5	300
															50	54	277.5	300
															60	64	287.5	300

LEGEND

FLA — Full Load Amps
Hp — Nominal Horsepower
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing)
MOCP — Maximum Overcurrent Protection
OFM — Outdoor (Condenser) Fan Motor
RLA — Rated Load Amps

NOTE: Units use 2 (low heat) or 3 (high heat) combustion fan motors rated at 460 v, single-phase, 60 Hertz and 0.3 FLA each.

c LISTED

Air Pressure Tubing — Before options such as Inlet Guide Vanes (IGV), Variable Frequency Drive (VFD), and/or Modulating Power Exhaust can operate properly, the pneumatic tubing for pressure sensing must be installed. Use fire-retardant plenum tubing (field-supplied). All control devices use $^1/_4$-in. tubing. Tubing must be run from the appropriate sensing location (in the duct or in the building space) to the control device location in the unit.

INLET GUIDE VANES — The tubing for the duct pressure (DP) control option should sample supply duct pressure about $^2/_3$ of the way out from the unit in the main trunk duct, at a location where a constant duct pressure is desired.

The duct pressure is sensed by a pressure transducer. The output of the pressure transducer is directed to the unit control module. On all sizes, the DP transducer is located in the unit auxiliary control box. See Fig. 45 and 46 for auxiliary control box location. See Fig. 47 and 48 for auxiliary control box details. Use a nominal $^1/_4$-in. plastic tubing.

VARIABLE FREQUENCY DRIVE — The tubing for the duct pressure (DP) control option should sample supply duct pressure about $^2/_3$ of the way out from the unit in the main trunk duct, at a location where a constant duct pressure is desired.

On these units, the duct pressure is sensed by a pressure transducer. The pressure transducer output is directed to the unit control module. On all sizes, the DP transducer is located in the unit auxiliary control box. See Fig. 45 and 46 for auxiliary control box location. See Fig. 47 and 48 for auxiliary control box details. Use a nominal $^1/_4$-in. plastic tubing.

Refer to appropriate base unit Controls and Troubleshooting book for instructions on adjusting set points for duct pressure controls.

MODULATING POWER EXHAUST — The tubing for the building pressure (BP) control (achieved via the modulating power exhaust option) should sample building pressure in the area near the entrance lobby (or other appropriate and sensitive location) so that location is controlled as closely to design pressures as possible.

These units use a pressure transducer for sensing building pressure. The BP transducer is located in the unit auxiliary control box. See Fig. 45 and 46 for auxiliary control box location. See Fig. 47 and 48 for auxiliary control box details. Use a nominal $^1/_4$-in. plastic tubing.

For instructions on adjusting BP control set points, refer to the Controls and Troubleshooting book.

RETURN/EXHAUST POWER EXHAUST — The tubing for the building pressure (BP) control (achieved via the Return/Exhaust Power Exhaust option) should sample building pressure in the area near the entrance lobby (or other appropriate and sensitive location) so that location is controlled as closely to design pressures as possible.

The units use a pressure transducer for sensing building pressure. The BP transducer is located in the unit auxiliary control box. See Fig. 46 for auxiliary control box location. Fig. 49 for auxiliary control box details. Use a nominal $^1/_4$-in. plastic tubing.

For instructions on adjusting BP control set points, refer to the Controls and Troubleshooting book.

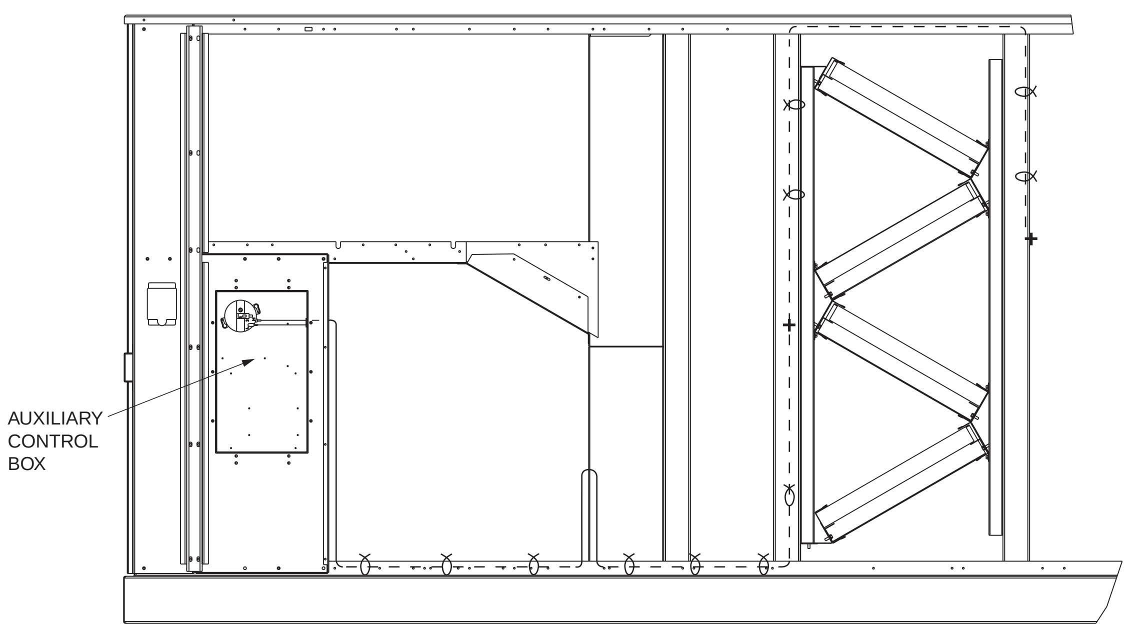


Fig. 45 — Auxiliary Control Box Location (Sizes 030-050)

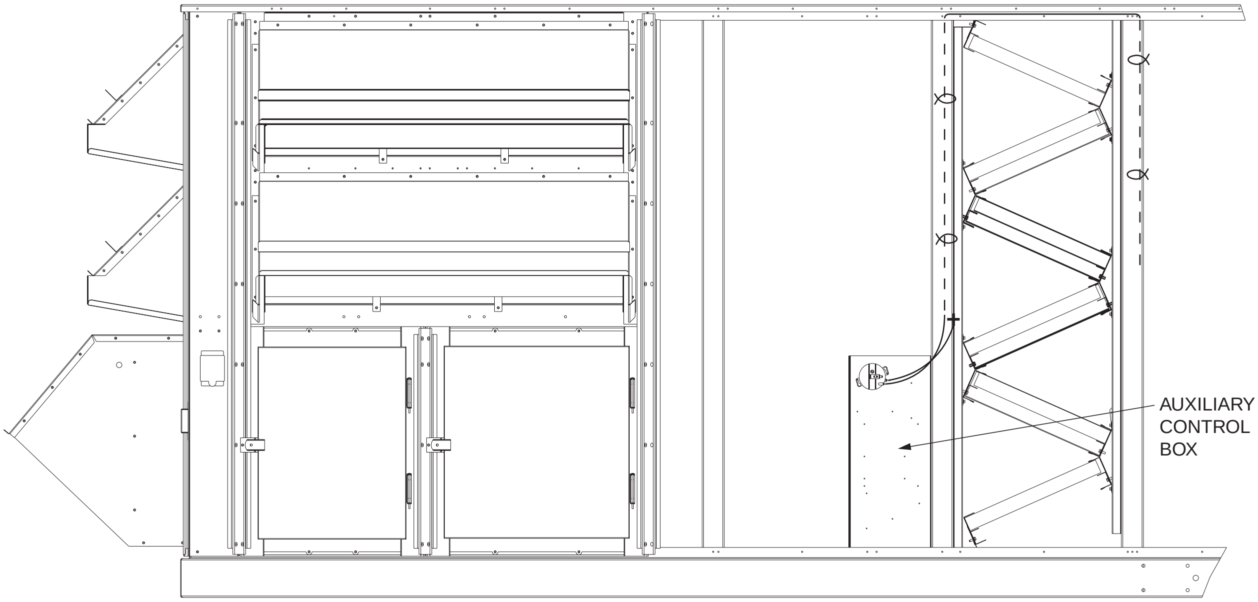
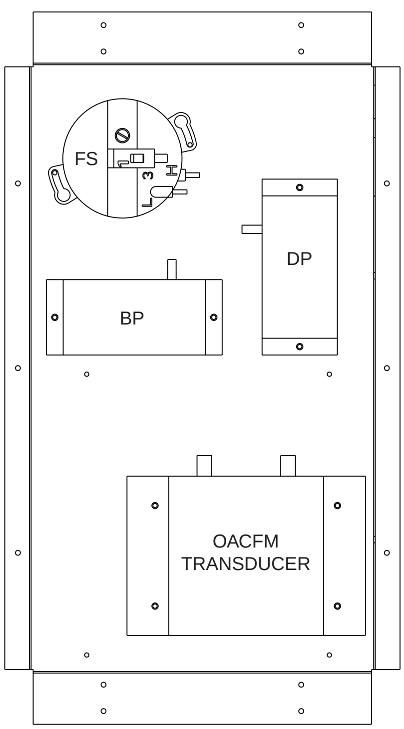


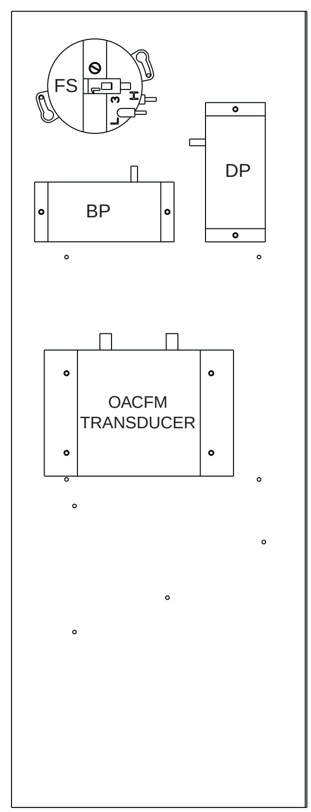
Fig. 46 — Auxiliary Control Box Location (Sizes 055-105)



LEGEND

BP — Building Pressure Transducer
DP — Duct Pressure Transducer
FS — Filter Switch
OACFM — Outdoor Air Cfm Sensor Transducer

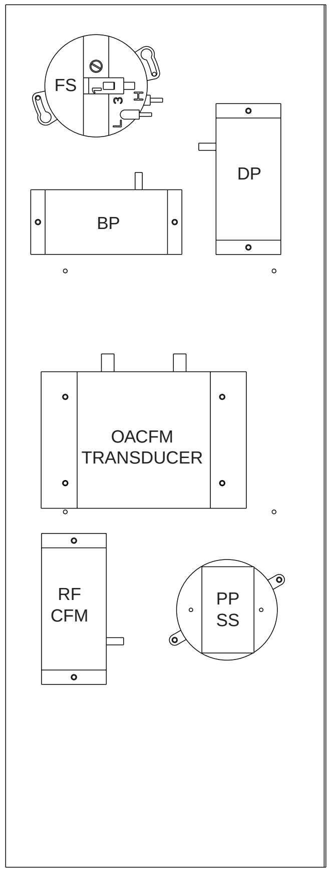
Fig. 47 — Auxiliary Control Box Details (Sizes 030-050)



LEGEND

BP — Building Pressure Transducer
DP — Duct Pressure Transducer
FS — Filter Switch
OACFM — Outdoor Air Cfm Sensor Transducer

Fig. 48 — Auxiliary Control Box Details (Sizes 055-105 Without Return Fan)



LEGEND

BP	—	Building Pressure Transducer
DP	—	Duct Pressure Transducer
FS	—	Filter Switch
OACFM	—	Outdoor Air Cfm Sensor Transducer
PPSS	—	Plenum Pressure Safety Switch
RFCFM	—	Return Fan Cfm Sensor Transducer

Fig. 49 — Auxiliary Control Box Details (Size 075-105 Units With Return Fan)

Supply-Fan Shipping Brackets —

Supply-fan shipping brackets (4 per unit) must be removed from each corner of the fan sled before starting unit.

UNIT SIZES 030-050

1. To remove brackets, raise fan sled by turning adjusting bolt counterclockwise until spring is compressed slightly.
2. Remove screws holding shipping bracket to unit cross rail.
3. Remove shipping bracket (top of bracket is slotted so that it will slide out).
4. After removing all shipping brackets, level fan sled using the adjusting screws. On all 4 corners, dimension from cross rail to fan sled should be as shown in Fig. 50.

UNIT SIZES 055-070 — To remove shipping brackets, remove the 6 screws holding each bracket to the cross rail. There are 8 brackets per unit. See Fig. 51.

After removing all shipping brackets, level fan sled using the adjusting screws. On all 4 corners dimension from cross rail to fan sled should be as shown in Fig. 51.

UNIT SIZES 075-105 — Supply-fan shipping brackets must be removed from each corner of the fan sled before starting unit. To remove shipping brackets, remove the 6 screws holding each bracket to the cross rail. There are 4 brackets per unit. See Fig. 52.

After removing all shipping brackets, level fan sled using the adjusting screws. On all 4 corners dimension from cross rail to fan sled should be as shown in Fig. 52.

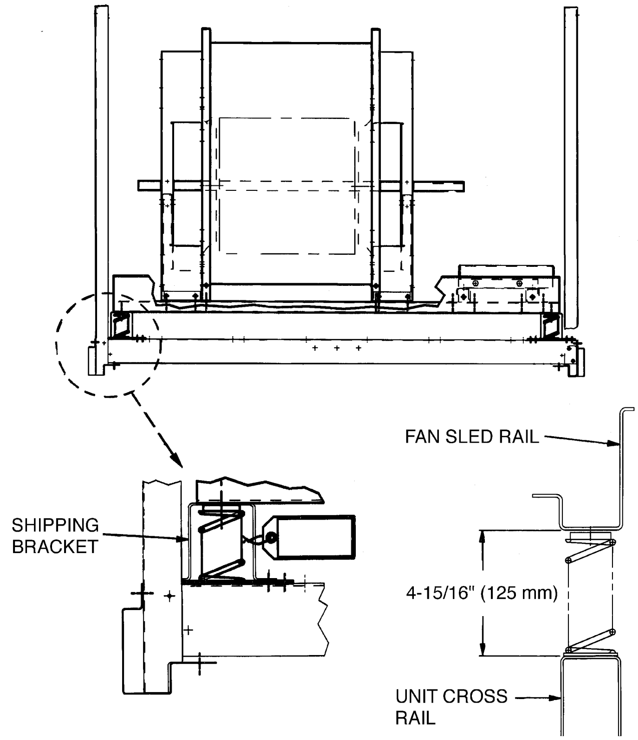


Fig. 50 — Shipping Brackets; Size 030-050 Units

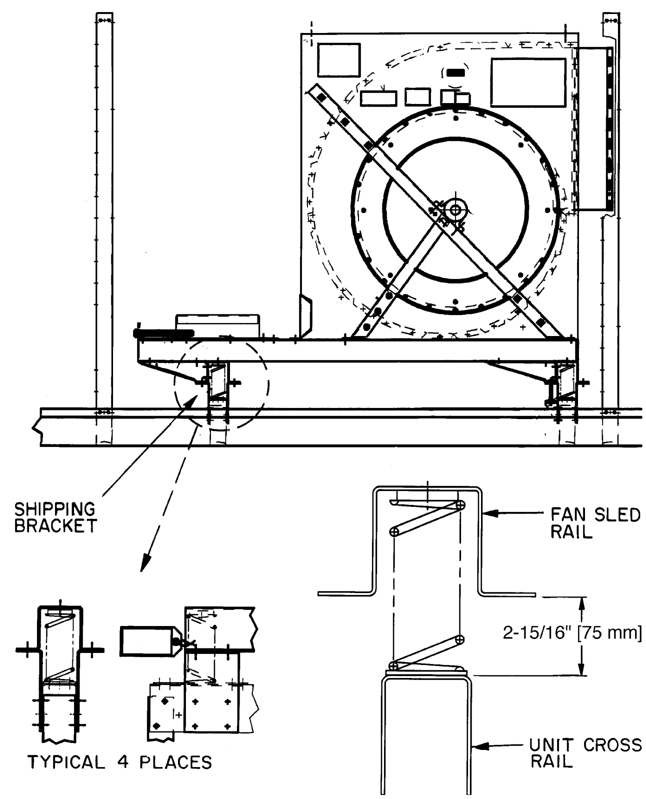


Fig. 51 — Shipping Brackets; Size 055-070 Units

Return/Exhaust-Fan Shipping Brackets (48Z6, Z8 Units) —

Return/Exhaust fan shipping brackets must be removed from each corner of the fan sled before starting unit.

To remove shipping brackets, remove 2 screws holding each bracket to the cross rail. There are 4 brackets per unit.

After removing all shipping brackets, level the fan using the adjustment screws. On all 4 corners the dimension from cross rail to fan sled should be as shown in Fig. 53

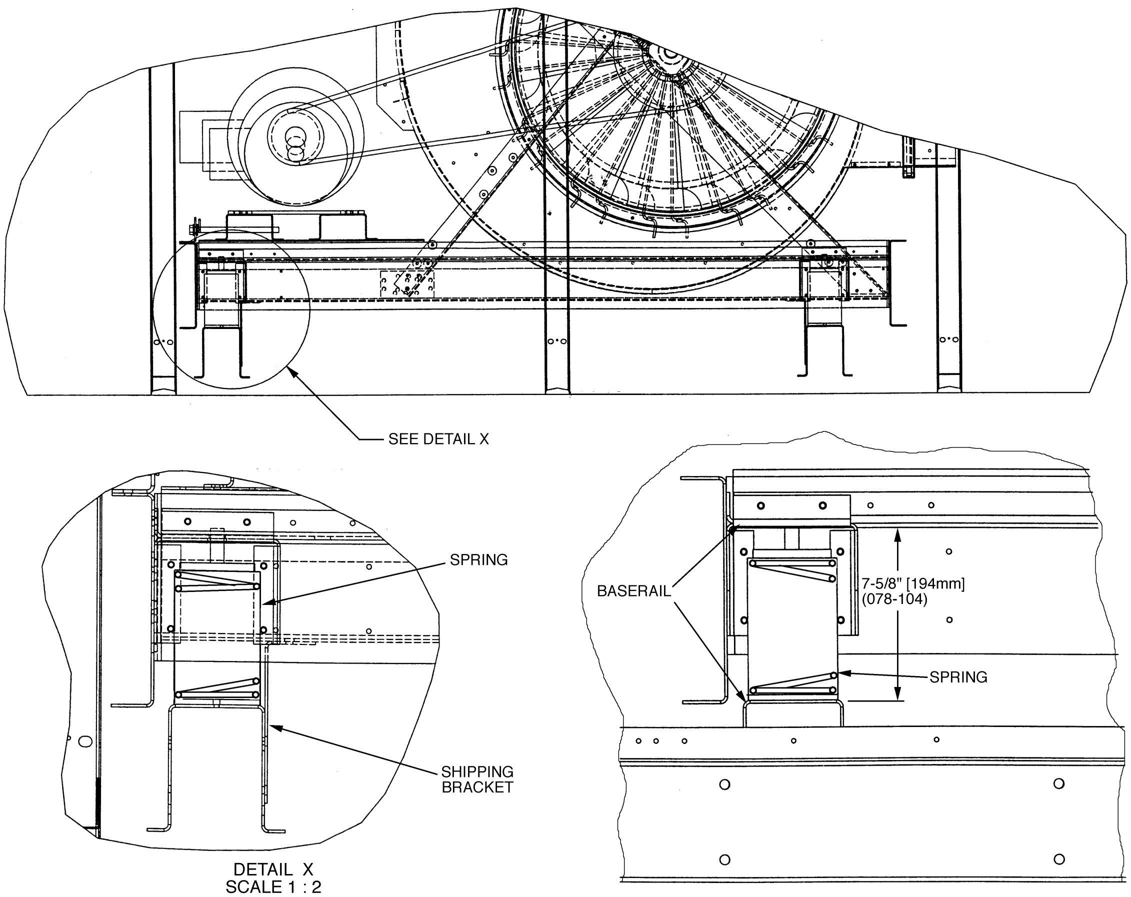


Fig. 52 — Shipping Brackets (Sizes 075-105)

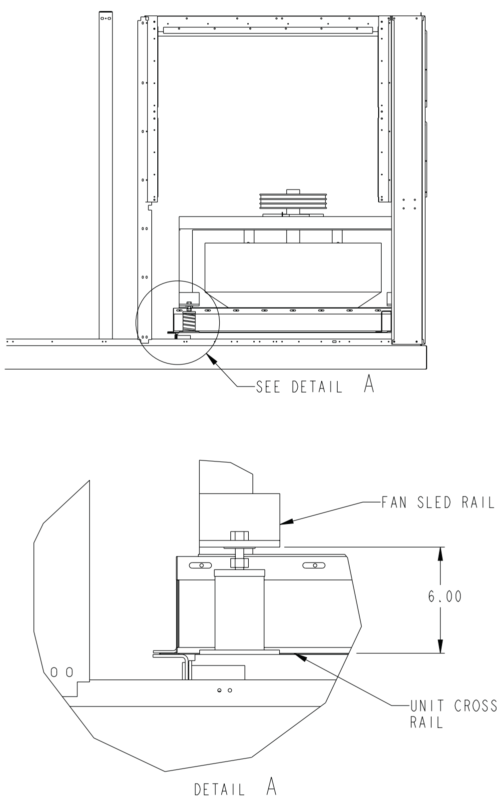
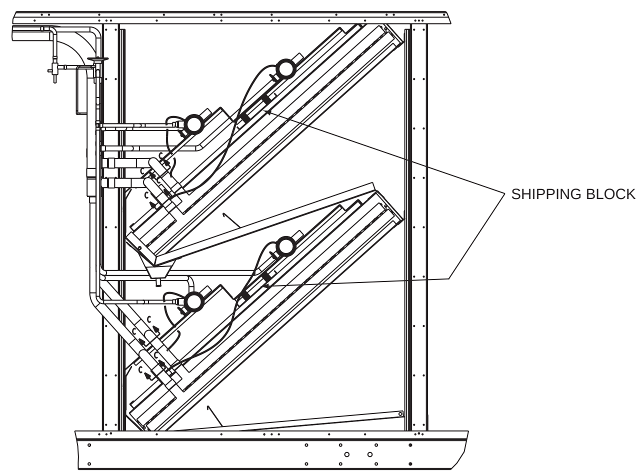


Fig. 53 — Return/Exhaust Fan Shipping Brackets

→ **Remove TXV Shipping Blocks —** Shipping blocks for the TXV bracket are used on size 030-075 units with high capacity coils and all 075-105 size units. Remove the foam shipping block before starting unit. See Fig. 54.



→ **Fig. 54 — Foam TXV Shipping Blocks**

Compressor Mounting

SIZES 030-090 — Each compressor is supported on 4 springs. The springs are compressed for shipment. After the unit is installed, the holddown nuts need to be loosened for normal operation. See Fig. 55 for compressor mounting details. Loosen each bolt using nut indicated until the flatwasher ($^{3}/_{8}$-in.) can be moved with finger pressure. Do not remove the locknuts. Check each compressor mounting to ensure all 4 springs have been loosened properly.

SIZE 105 — Compressors are mounted on rails and held down by rail bolts during shipment. After unit is installed, loosen the rail bolts to allow the rails and compressors to float freely on the springs located under the rails. See Fig. 56 and 57.

Gas Piping — Unit is equipped for use with natural gas only. Installation must conform with local building codes, or in the absence of local codes, with the National Fuel Gas Code (NFGC), ANSI Z223.1.

A $^{1}/_{8}$-in. NPT tapping plug, accessible for test gage connection, must be field installed immediately upstream of gas supply connection to unit, but after manual gas valve. See Fig. 58. Natural gas pressure at unit gas connection must not be less than 5 in. wg (1245 Pa) or greater than 13 in. wg (3235 Pa).

Size gas supply piping for 0.5 in. wg (124.5 Pa) maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

⚠ CAUTION

Disconnect gas piping from unit when leak testing at pressures greater than 0.5 psig (3448 Pa). Pressures greater than 0.5 psig (3448 Pa) will cause gas valve damage resulting in a hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig (3448 Pa), it must be replaced.

Optional Staged Gas Control — The 48Z030-105 large rooftop units may be ordered with an optional factory-installed staged gas control system that monitors heating operation of the rooftop. The control system is composed of several components as listed in sections below. Table 17 shows 48Z series Staged Gas implementation.

Refer to the Unit Controls and Troubleshooting book for information on configuring staged gas control.

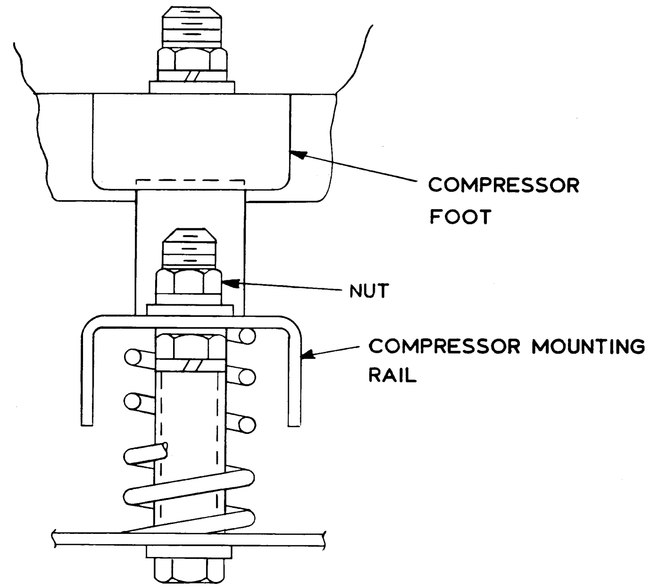


Fig. 56 — Front View of Compressor Mounting Rail Assembly — Size 105 Units

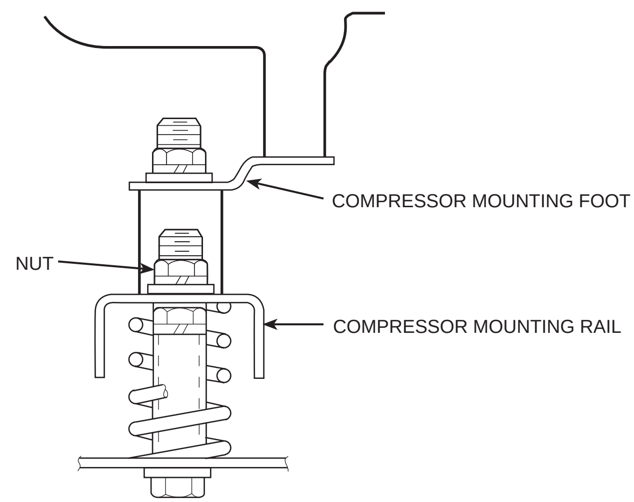
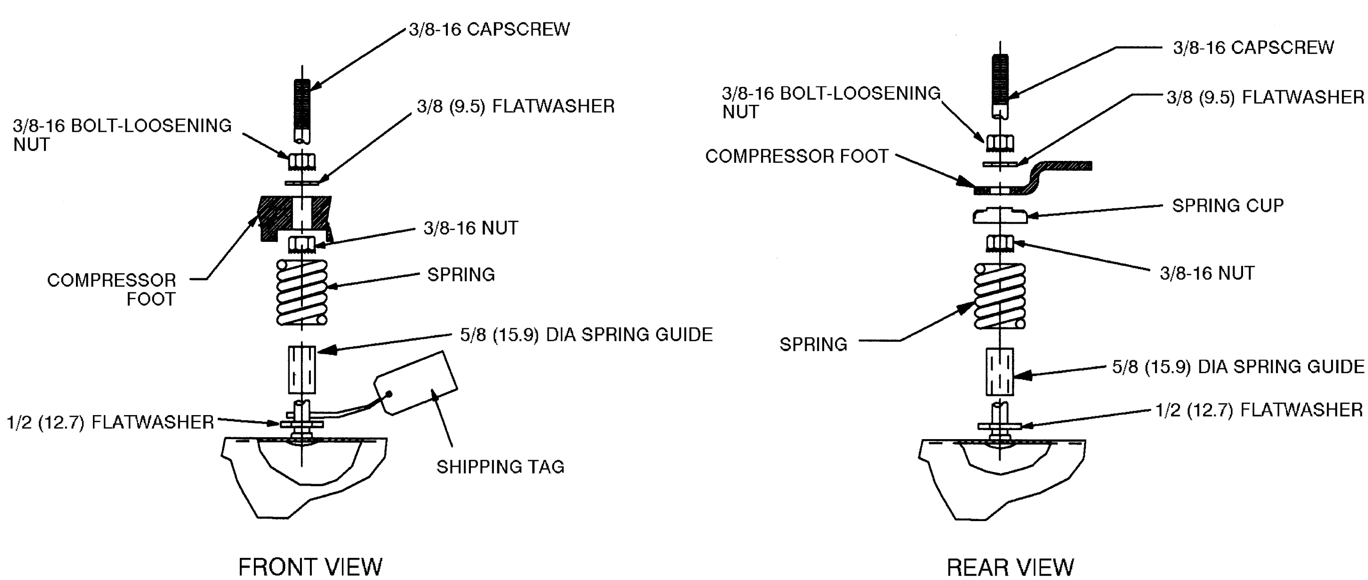
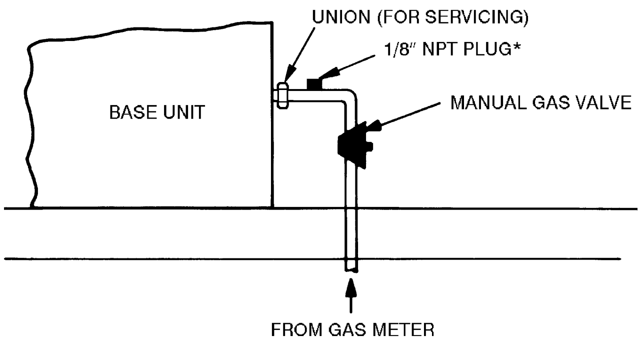


Fig. 57 — Rear View of Compressor Mounting Rail Assembly — Size 105 Units



NOTE: All dimensions are in inches (mm).

Fig. 55 — Compressor Mounting (Sizes 030-090)



*NPT plug is field supplied.
NOTE: Follow all local codes.

Fig. 58 — Gas Piping Details

Installing Flue/Inlet Hoods — The flue and inlet hoods are shipped in a package taped to the basepan in the fan section. The flue (outlet) hoods are pre-assembled. The flue deflector and inlet hoods require assembly.

The hoods are located on the heating section access panel as shown in Fig. 59 (sizes 030-050) or Fig. 60 (sizes 055-105). See Table 18 for a list of parts used to assemble each hood and quantities of each hood type used with each unit.

1. Remove shipping block-offs and shipping tape from all openings in the access panel.
2. Attach flue outlet hoods (see Fig. 61) to access panel using screws provided. Hoods are placed over each combustion outlet.
3. Install flue deflector baffle inside flue deflector hood. See Fig 62 for sizes 030-050 and 075-105 (V-type deflector). See Fig. 63 for sizes 055-105 (curve-type deflector). Install flue deflector hood assembly over each flue outlet hood (installed in Step 2). Observe the offset mounting hole locations in the deflector hood flanges when attaching hood to panel (see Fig. 64). Holes in the mounting flange must be at the bottom when attached.
4. Inlet hoods are shipped unassembled and must be assembled on the access panel (see Fig. 65). Flanges of the hood top and sides should be placed on the inside of the access panel openings. Install hood top and sides with screws provided. Attach speed clips to screen and insert screen into bottom opening of hood. Secure with 3 screws. On large inlet hoods, attach viewport cover over opening in hood (see Fig. 66). Secure with two screws.

Supply-Air Thermistors (Staged Gas Units Only) — Supply-air thermistors are a field-installed, factory-provided component. Three supply-air thermistors are shipped with staged gas units inside the heating section. Thermistor wires must be connected to SGC in the heating section. See Table 19. The supply-air thermistors should be located in the supply duct with the following criteria:

- downstream of the heat exchanger cells
- equally spaced as far as possible from the heat exchanger cells
- a duct location where none of the supply air thermistors are within sight of the heat exchanger cells
- a duct location with good mixed supply air portion of the unit.

Table 17 — 48Z Series Staged Gas Implementation

NO. OF STAGES	MODEL NUMBER POSITION				POINT				HEAT SIZE
	3	5	6,7,8	10	HTSTGTYP	CAPMXSTG	LIMTHIHT	LIMTLOHT	
2 stages	Z	H, K, W, Y	030 035 040 050		Default=0	Default=45	Default=170 F	Default=160 F	Low
5 stages	Z	J, L, X, Z	030 035 040 050		Default=1	Default=20	Default=170 F	Default=160 F	High
		H, K, W, Y	055 060 070		Default=1	Default=20	Default=135 F	Default=125 F	Low
		H, K	075 090 105	-,A,B C,D,E	Default=1	Default=20	Default=135 F	Default=125 F	
		H, K	075 090 105	G,H,J,K,L,M	Default=1	Default=20	Default=130 F	Default=120 F	
9 stages	Z	J, L, X, Z	055 060 070		Default=3	Default=15	Default=135 F	Default=125 F	High
		J, L	075 090 105	-,A,B C,D,E	Default=3	Default=15	Default=135 F	Default=125 F	
		J, L	075 090 105	G,H,J,K,L,M	Default=3	Default=15	Default=130 F	Default=120 F	

LEGEND

CAPMXSTG — Maximum Capacity per Changes
HTSTGTYP — Heat Stage Type
LIMTHIHT — Limit Switch Thermistor High Temperature
LIMTLOHT — Limit Switch Thermistor Low Temperature

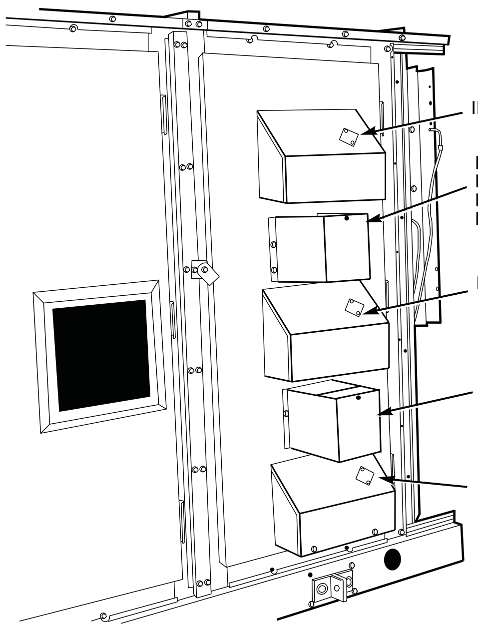


Fig. 59 — Flue/Inlet Hood Locations, 030-060 Units

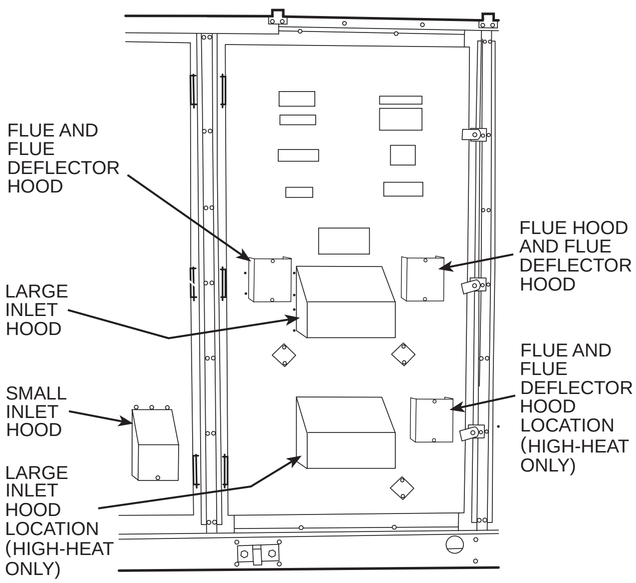


Fig. 60 — Flue/Inlet Hood Locations, 055-105 Units

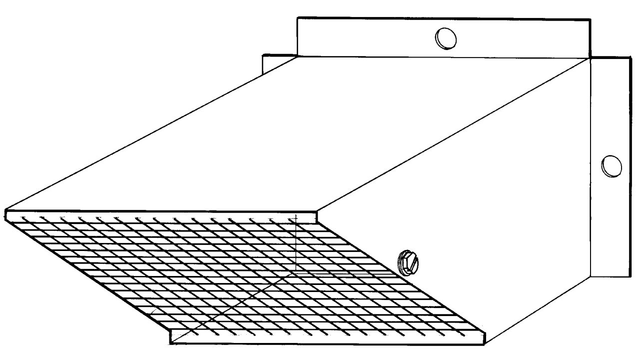


Fig. 61 — Flue Outlet Hood

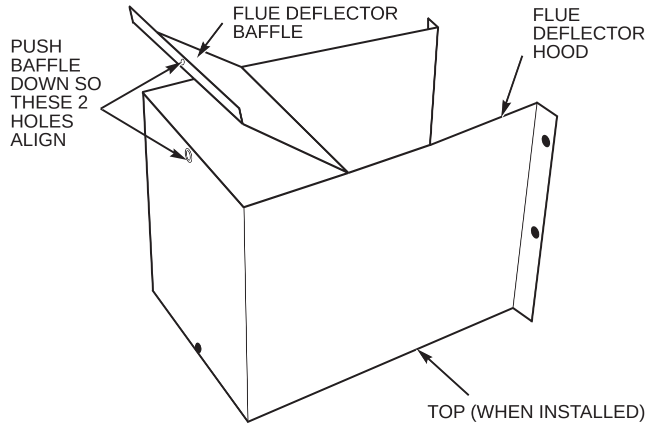


Fig. 62 — Flue Deflector Baffle, 030-050 and 075-105 Units (V-Type)

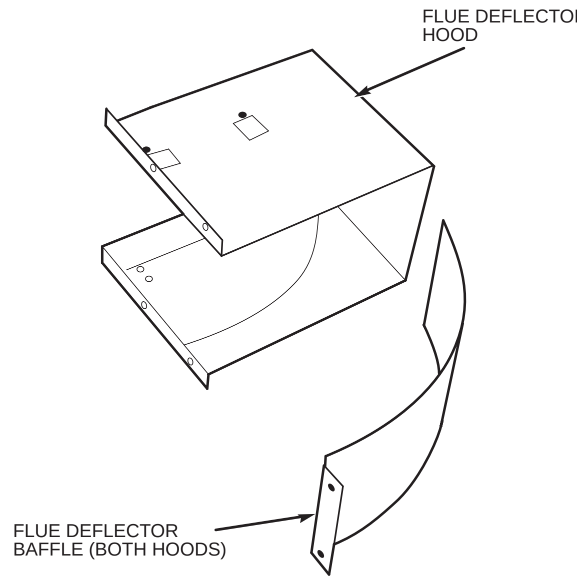


Fig. 63 — Flue Deflector Baffle, 055-105 Units (Curve-Type)

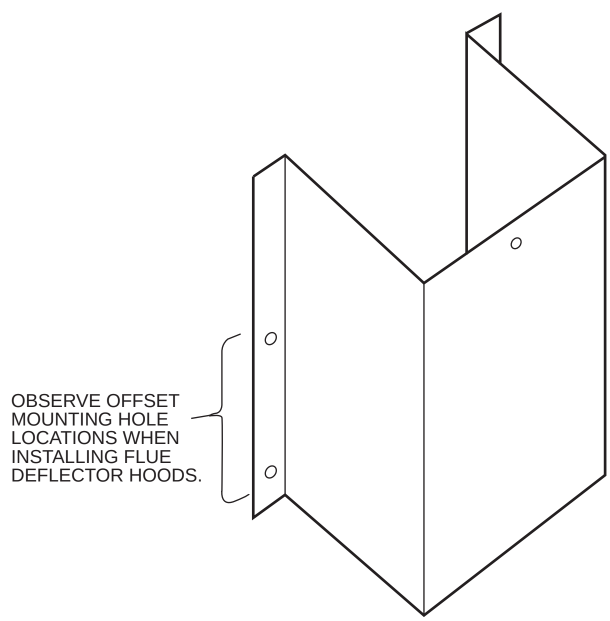


Fig. 64 — Mounting Deflector Hoods

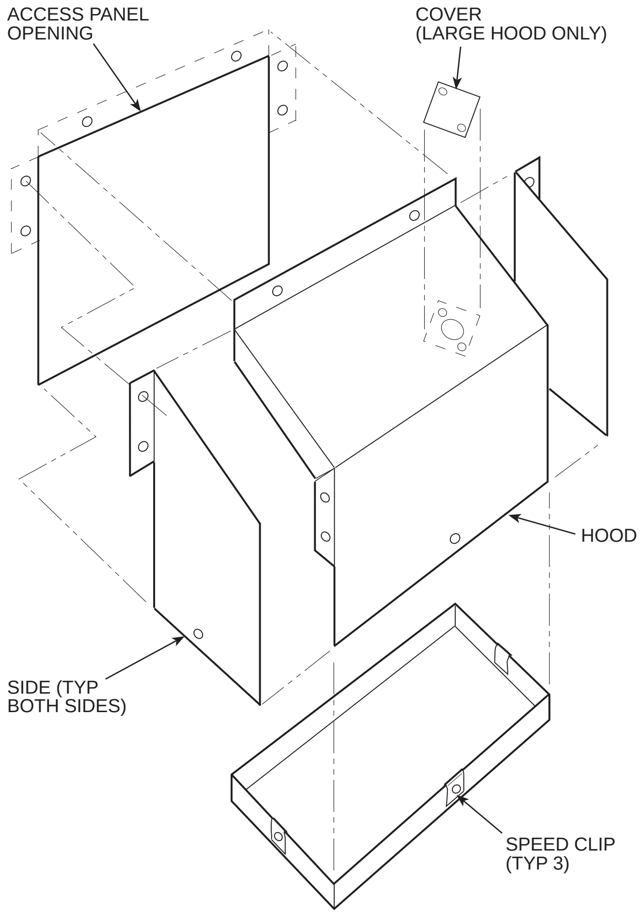


Fig. 65 — Inlet Hood Assembly

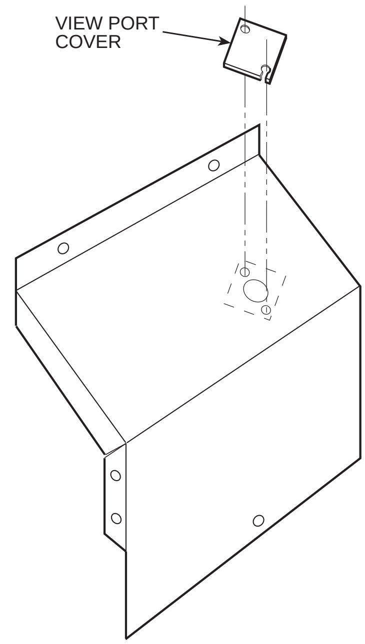


Fig. 66 — Inlet Hood View Port Cover Installation (055-105 Units Only)

Table 18 — Flue and Inlet Hood Usage

HOOD TYPE	PARTS LIST	FIG. NO.	QUANTITY USED					
			030-050 (Low Heat)	030-050 (High Heat)	055-070 (Low Heat)	055-070 (High Heat)	075-105 (Low Heat)	075-105 (High Heat)
Large Inlet (14-in.)	Top (14-in.) Side (Left) Side (Right) Screen Cover Speed Clips Screws	66,67	3	3	1	2	1	2
Small Inlet (6-in.)	Top (6-in.) Side (Left) Side (Right) Screen Cover Speed Clips Screws	66	—	—	1	1	1	1
Flue Outlet	Pre-assembled	62	1	2	2	3	2	3
Flue Deflector (V-Type)	Hood Deflector Baffle Screws	63	1	2	—	—	2	2
Flue Deflector (Curve-Type)	Hood Deflector Baffle Screws	64	—	—	2	3	—	1

Table 19 — SGC Thermistor Designations

THERMISTOR	PIN CONNECTION POINT	FUNCTION AND LOCATION	PART NO.
		Thermistors	
SAT1	J8 – 1,2 (SGC)	Supply-Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	HH79NZ033
SAT2	J8 – 3,4 (SGC)	Supply-Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	
SAT3	J8 – 5,6 (SGC)	Supply-Air Thermistor (SAT) — Inserted into supply section underneath the gas heat section (factory-provided, field-installed)	
LIMTTEMP	J8 – 15,16 (SGC)	Limit Switch Thermistor (LIMTTEMP) — Inserted next the lower limit switch (factory-installed)	

Install Unit Accessories — For applications requiring accessories, the following packages are available:

All Units:
- Barometric relief
- Space temperature sensor
- CO_2 sensor
- Space temperature sensor with CO_2
- Airflow switch
- Filter switch
- Smoke detector

All 48ZG,ZT,Z6 Units:
- Modulating power exhaust
- Pressure operated unloaders

All 48ZN,ZW,Z8 Units:
- Modulating power exhaust
- VFD remote display

Refer to the individual accessory installation instructions in each accessory package for information on installing accessories.

CONTROLS INSTALLATION

Constant Volume (CV) Units — The 48ZG,ZT,Z6 units may be used in applications with additional control features, options, or accessories. Refer to the appropriate accessory installation instructions for more information on installing that accessory. Control options and accessories available for CV units are:

- Thermostats
- Enthalpy sensor
- Enthalpy switch
- Relative humidity sensor
- CEM (Controls Expansion Module)
- Navigator hand-held display

CONTROL WIRING — The unit can be controlled with a Carrier-approved accessory electro-mechanical or electronic thermostat that has two stages of cooling, two stages of heating control, and an output for fan control. The thermostat may also include time of day scheduling or use scheduling routines built into the *Comfort*Link™ controls.

Install the thermostat according to the installation instructions shipped with the accessory thermostat. Locate thermostat assembly on a solid interior wall to sense average temperature.

Route thermostat cable or equivalent leads of colored wire from subbase terminals through conduit into the low voltage connections in the main control box. For thermostat TB203 connections, see Fig. 67.

NOTE: For wire runs up to 50 ft, use no. 18 AWG (American Wire Gage) insulated wire (35 C minimum). For over 75 ft, use no. 14 AWG insulated wire (35 C minimum). All wire larger than no. 18 AWG cannot be directly connected at the thermostat and will require a junction box and splice at the thermostat.

Variable Air Volume Units — The 48ZN,ZW,Z8 units may be used in applications with additional control features, options, or accessories. Refer to the appropriate accessory installation instructions for more information on installing that accessory. Refer to the Controls and Troubleshooting manual for more information concerning installation and configuration of options and accessories. Control options and accessories available for VAV units are:

- Enthalpy sensor
- Enthalpy switch
- Relative humidity sensor
- CEM (Controls Expansion Module)
- Navigator hand-held display
- VFD remote display

VAV CONTROL WIRING

The recommended types of control wiring are shown below:

MANUFACTURER	PART NO.	
	Regular Wiring	Plenum Wiring
Alpha	1895	—
American	A21451	A48301
Belden	8205	884421
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

SENSORS — Sensors should be wired using single twisted pairs of 20 AWG (American Wire Gage) conductor cable rated for the application, except for the T-56 accessory sensor which requires 3-conductor cable.

NOTE: Humidity and CO_2 sensors must be powered from isolated 24-v power supplies.

HUMIDITY CONTROL AND HOT WATER AND STEAM VALVES — These devices require 20 AWG twisted pair conductor cables rated for the application for the 4 to 20 mA signal.

SPACE TEMPERATURE SENSOR (T-55) — The space temperature sensor (P/N 33ZCT55SPT) is shipped standard with every unit, and is located in the main control box. Space temperature sensor wires are to be connected to terminals in the unit main control box.

⚠ CAUTION

Jumper **MUST** be in place between pins 1 and 3, 3 and 4 or inaccurate readings could result.

To connect the space temperature sensor, see Fig. 68.

SPACE TEMPERATURE SENSOR (T-56) — The space temperature sensor (P/N 33ZCT56SPT) wires are connected to terminals in the unit main control box.

⚠ CAUTION

Jumper **MUST** be in place between pins 1 and 3, 3 and 4 or inaccurate readings could result.

To connect the space temperature sensor, see Fig. 68.

COMMUNICATING SPACE TEMPERATURE SENSOR (T-58) — The communicating space temperature sensor (P/N 33ZCT58SPT) is wired to the CCN connections on TB202.

SPACE TEMPERATURE AVERAGING — Applications that require averaging using multiple space temperature sensors can be satisfied using either 4 or 9 sensors as shown in Fig. 69.

NOTE: Only Carrier sensors may be used for standard T-55 space averaging. Sensors must be used in multiples of 1, 4, and 9 only, with total sensors wiring not to exceed 1000 ft. However, space temperature reset can be accomplished with only one sensor.

NOTE: Do not use T-56 sensors for space temperature averaging because the 5-degree offset function will not work in a multiple sensor application.

HEAT INTERLOCK RELAY (VAV Units Only — Not Necessary For Digital Air Volume Applications) — Variable air volume (VAV) units using optimal start (morning warm-up) and/or occupied heating require that room terminals be controlled to the fully open position when the unit goes into Heating mode. The HIR (Heat Interlock Relay) function is provided for this control. When the unit goes into Heating mode, the HIR is energized to provide switch closure or opening (depending on how the field-supplied power source is set up) to open the room terminals. The field connections for the HIR are at TB201 terminals 7 and 8. See Fig. 70.

Option and Accessory Control Wiring — The Z series units may be used in applications with additional control features, options, or accessories. Refer to the Controls and Troubleshooting manual for more information concerning installation and configuration of options and accessories. Figures 70-80 contain wiring information on the following features:

- Heat interlock relay (Fig. 70)
- Outdoor air enthalpy switch (Fig. 71)
- CO_2 space sensor (Fig. 72)
- Filter status switch (Fig. 73)
- Fan status switch (Fig. 74)
- Space humidity sensor (Fig. 75)
- Return air humidity sensor (Fig. 75)
- Return air CO_2 sensor (Fig. 76)
- Return air smoke detector (Fig. 77)
- Smoke control — fire shutdown (Fig. 78)
- Smoke control — purge (Fig. 79)
- Smoke control — evacuation (Fig. 79)
- Smoke control — pressurization (Fig. 79)
- CCN connections (Fig. 80)

Carrier Comfort Network (CCN) Interface — The 48ZN, ZW,Z8 units can be connected to the CCN if desired. The communication bus wiring is supplied and installed in the field. It consists of shielded, 3-conductor cable with shield wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it, the negative pins must be wired to the negative pins, and the signal pins must be wired to signal ground pins. Wiring connections for the CCN should be made at the terminal block using the screw terminals. The board also contains an RJ14 CCN plug that can be used to connect a Navigator or field service computer. There is also another RJ14 LEN (Local Equipment Network) connection that is used to download software. Consult CCN Contractor's Manual for further information.

NOTE: Conductors and drain wire must be 20 AWG minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of –4 to 140 F (–20 C to 60 C) is required. See Table 20 for cables that meet the requirements.

Table 20 — CCN Connection Approved Shielded Cables

MANUFACTURER	CABLE PART NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

> IMPORTANT: When connecting the CCN communication bus to a system element, use a color coding system for the entire network to simplify installation and checkout.

The following color code is recommended:

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	COMM1 PLUG PIN NO.
+	RED	1
GROUND	WHITE	2
–	BLACK	3

NOTE: If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous field must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only).

To connect the unit to the network (Fig. 80):

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground) and black (–) conductors. (If a different network color scheme is used, substitute appropriate colors.)
3. Wire the CCN to the screw terminals on the COMM board as follows (Fig. 80):
   a. Secure the red (+) wire to CCN screw terminal + on the COMM board.
   b. Secure the white (ground) wire to CCN screw terminal C on the COMM board.
   c. Secure the black (–) wire to CCN screw terminal – on the COMM board.
   d. Secure shield wire to CCN screw terminal SHIELD on the COMM board.

> IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check CCN connector, and run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

→ RJ14 PLUG WIRING — Units on the CCN can be monitored from the space at the sensor through the RJ14 connector, if desired. To wire the RJ14 connector into the CCN (Fig. 80):

> IMPORTANT: The cable selected for the RJ14 connector wiring MUST be identical to the CCN communication bus wire used for the entire network.

1. Cut the CCN wire and strip ends of the red (+), white (ground), and black (–) conductors. (If another wire color scheme is used, strip ends of appropriate wires.)
2. Secure the red (+) wire to CCN screw terminal + on the COMM board.
3. Secure the white (ground) wire to CCN screw terminal C on the COMM board.
4. Secure the black (–) wire to CCN screw terminal – on the COMM board.
5. Secure shield wire to CCN screw terminal SHIELD on the COMM board.
6. Connect the other end of the communication bus cable to the CCN communication bus.

Smoke Control Modes — Rooftop units can be used for aid in building smoke control in the event of a building fire. The available functions include: Fire Shutdown, Pressurization, Evacuation, and Smoke Purge. These functions are enhanced when multiple rooftop units are used to zone a building. See Table 21 and Fig. 78 and 79.

FIRE SHUTDOWN — Fire Shutdown mode terminates all unit operation (cooling, heating, supply fan, and power exhaust). This mode prevents recirculation of contaminated air back into the space. The mode will not allow admission into the space of unsuitable outside air. See Fig. 78 for wiring.

PRESSURIZATION — Pressurization mode is intended to keep smoke out of a zone. The factory-installed optional economizer is required for this function. Pressurization is accomplished by the following:

- opening the economizer (option)
- running the supply fan (optional inlet guide vanes open or optional VFD at normal duct static pressure set point)
- closing the power exhaust dampers (if installed as option or accessory)
- shutting off the power exhaust fans (if installed as option or accessory)

This allows the space to be overpressurized relative to adjacent zones and prevents or slows entry of smoke into this space from adjacent zones. See Fig. 79 for wiring.

EVACUATION — Evacuation mode removes smoke or undesirable air from interior spaces without reintroducing unsuitable air. The factory-installed optional economizer with option/accessory power exhaust is required for this function. Evacuation is accomplished by the following:

- turning the supply fan off
- opening the economizer (option required)
- running the exhaust fans (option or accessory required)
- opening the exhaust dampers.

See Fig. 79 for wiring.

SMOKE PURGE — Smoke Purge mode removes smoke from the interior spaces and replaces it with fresh outside air. The factory-installed optional economizer with option/accessory power exhaust are required for this function. Smoke purge is accomplished by the following:

- turning supply fan on
- opening the economizer (option required)
- running the exhaust fans (option or accessory required)
- opening the exhaust dampers

See Fig. 79 for wiring.

SMOKE CONTROL INSTALLATION — Implementation of the various Smoke Control Modes on these units requires the installer to modify the unit wiring to add contacts (via either manual switches or relays) that will selectively interrupt and override standard factory control sequences. See Table 21 and Fig. 78 and 79 for more information.

Table 21 — Smoke Control Modes

FUNCTION	MODE			
	Fire Shutdown	Pressurization	Evacuation*	Smoke Purge*
Supply Fan	Off	On	Off	On
IGV/VFD†	—	Open/On	—	Open/On
Economizer	Closed	Open	Open	Open
Return Air Damper	Open	Closed	Closed	Closed
Exhaust Fans	Off	Off	On	On
Exhaust Damper	Closed	Closed	Open	Open

LEGEND

IGV — Inlet Guide Vane
PIC — Product Integrated Control
VAV — Variable Air Volume
VFD — Variable Frequency Drive

*Power exhaust option required for this mode.
†Applicable to VAV and PIC units with appropriate options.

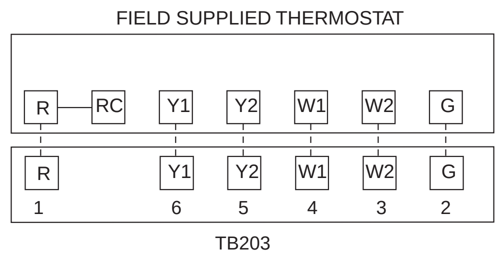


Fig. 67 — Field Control Thermostat Wiring

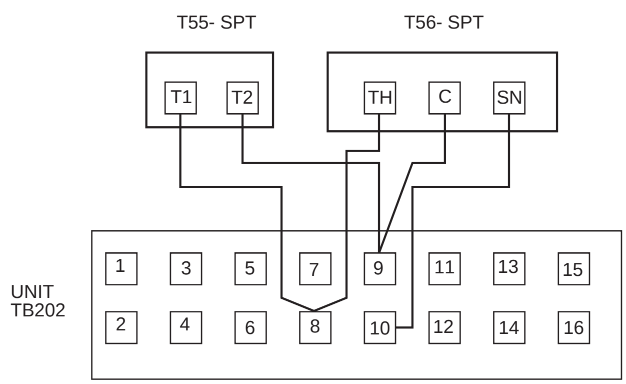
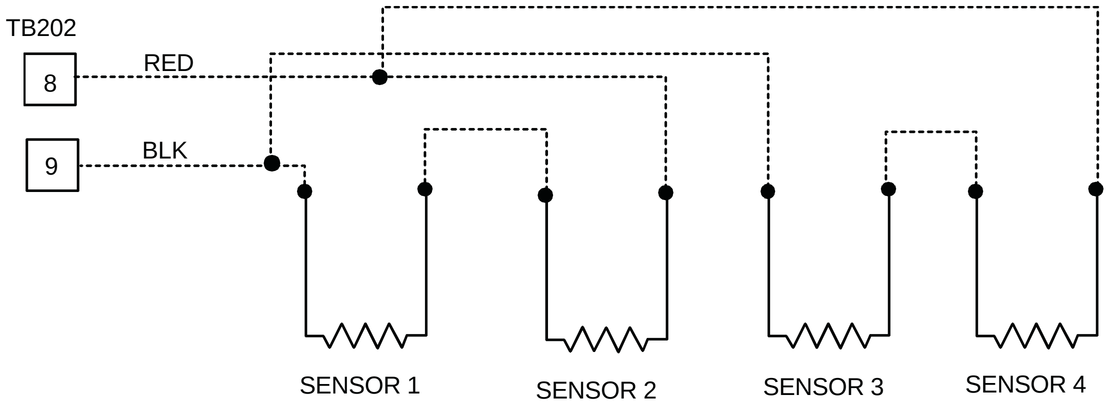
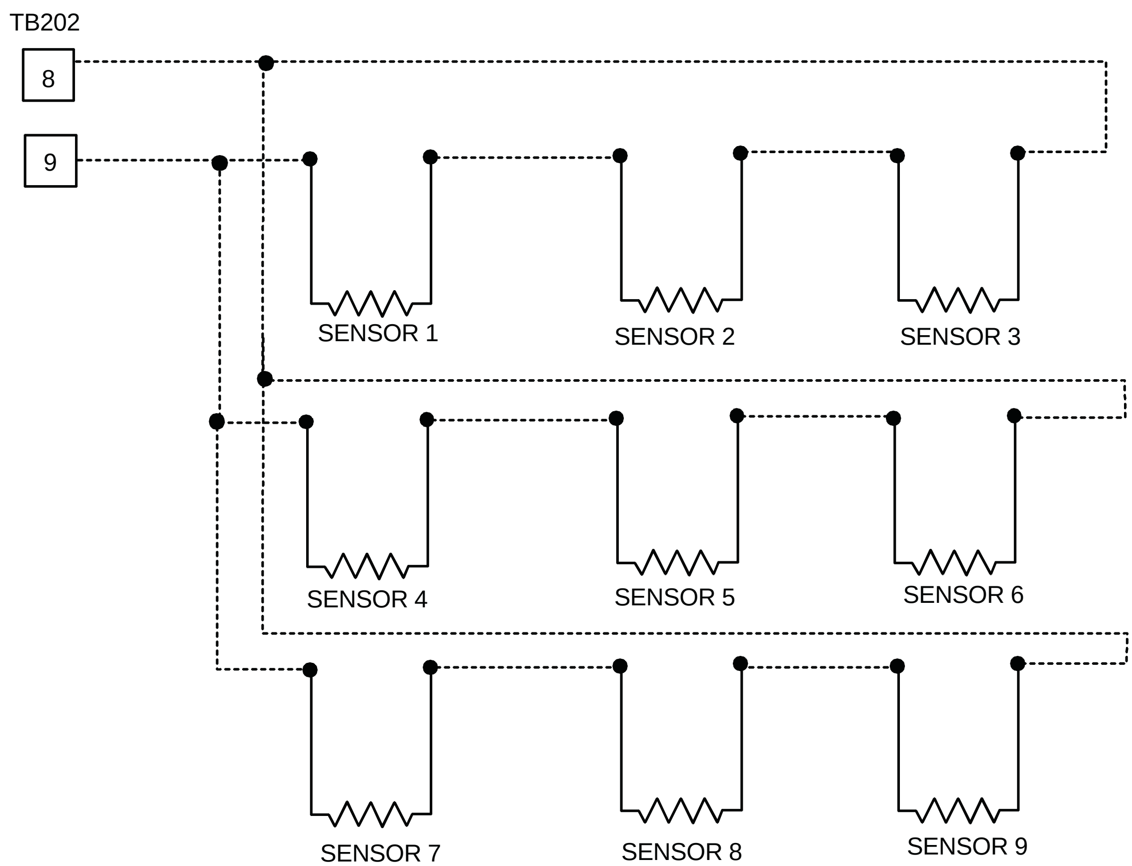


Fig. 68 — T55 or T56 Wiring



SPACE TEMPERATURE AVERAGING (4 SENSOR APPLICATION)



SPACE TEMPERATURE AVERAGING (9 SENSOR APPLICATION)

NOTE: Use T55 sensor only.

Fig. 69 — Space Temperature Averaging Wiring

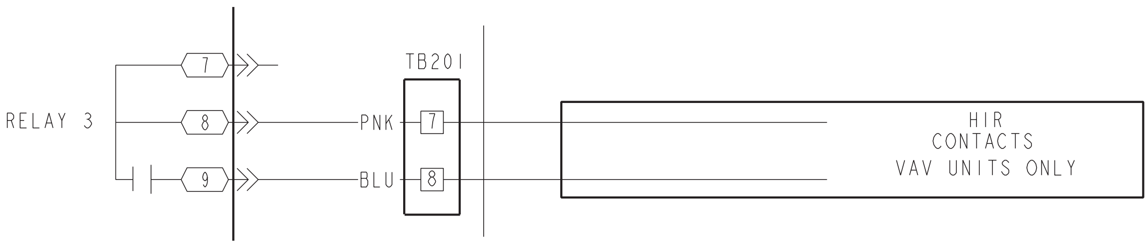


Fig. 70 — Heat Interlock Relay Wiring

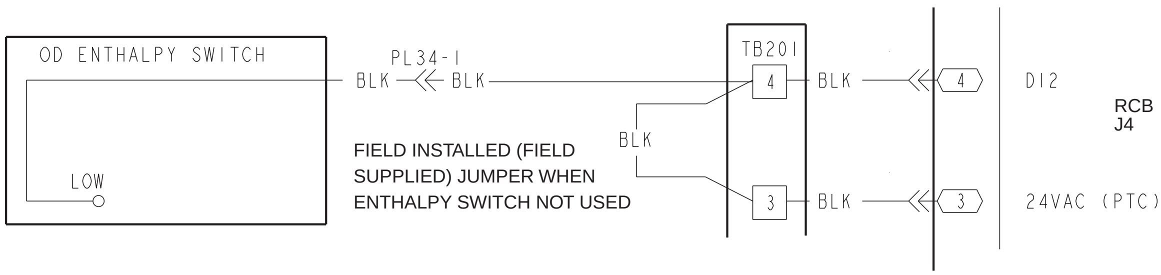


Fig. 71 — Outdoor Air Enthalpy Switch Wiring

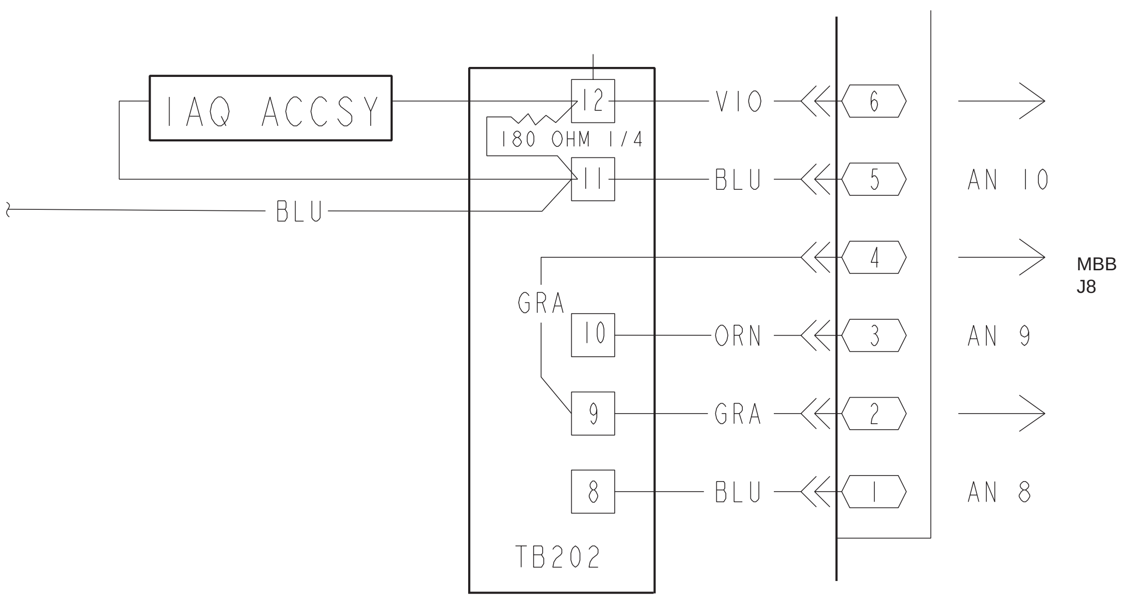


Fig. 72 — CO_2 Space Sensor Wiring

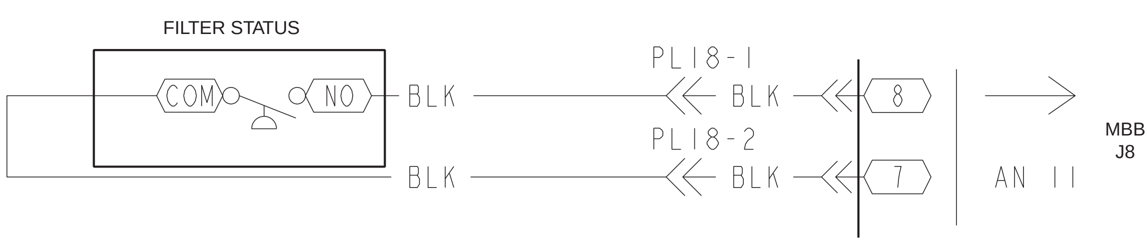


Fig. 73 — Filter Status Wiring

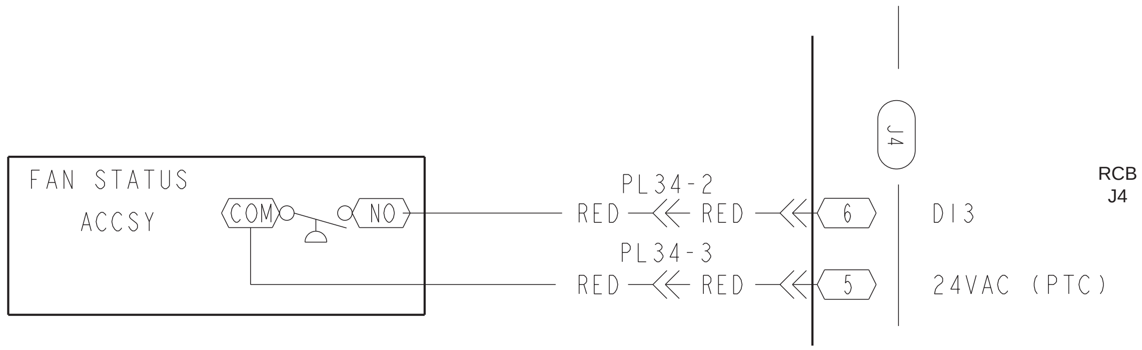


Fig. 74 — Fan Status Switch Wiring

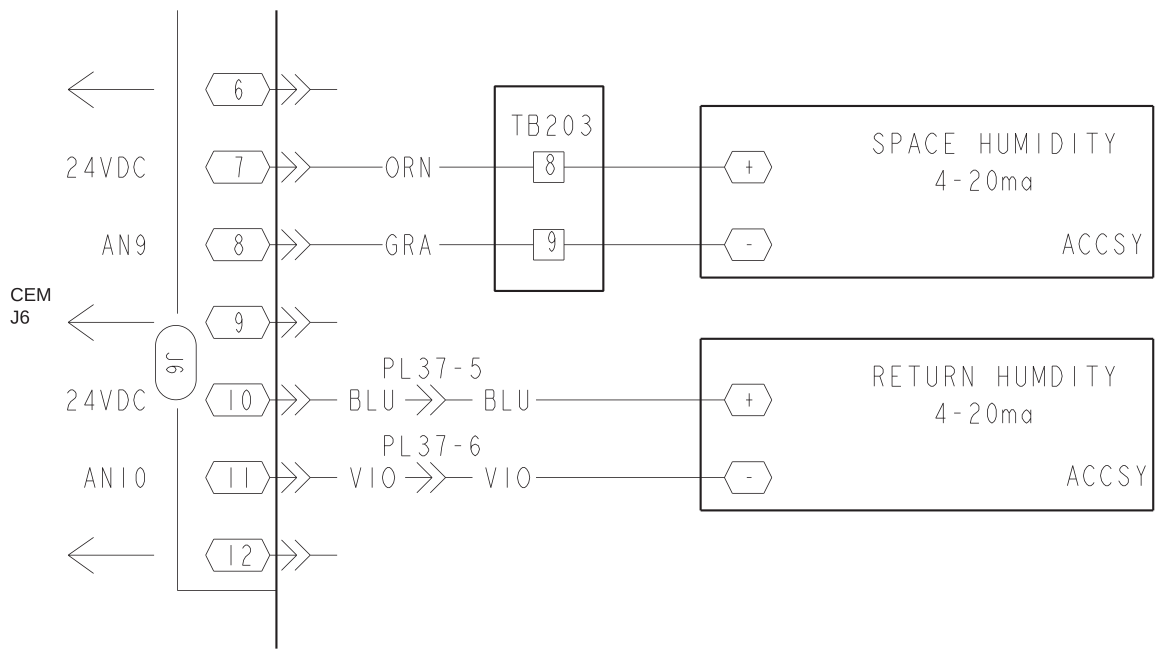


Fig. 75 — Space and Return Air Humidity Sensor Wiring

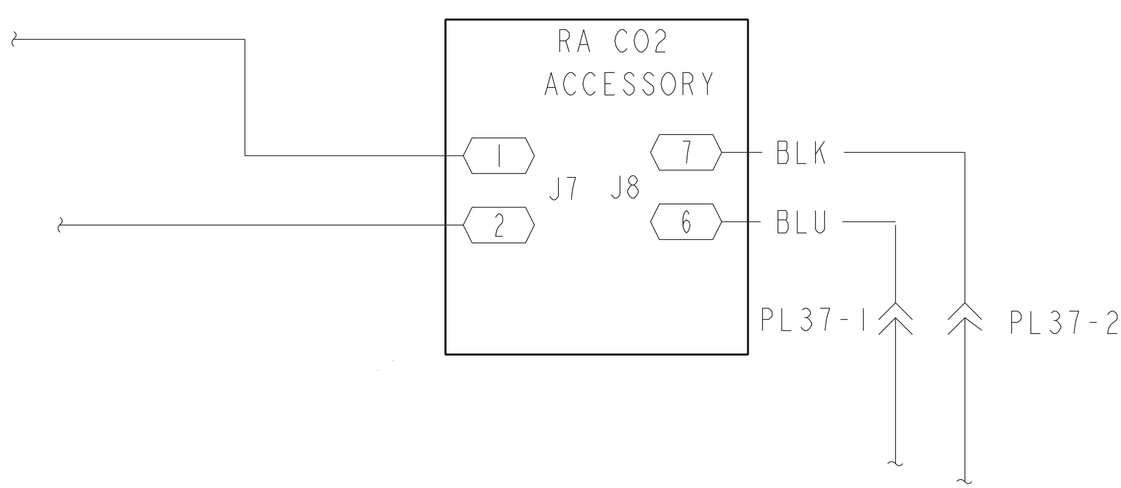


Fig. 76 — Return Air CO_2 Sensor Wiring

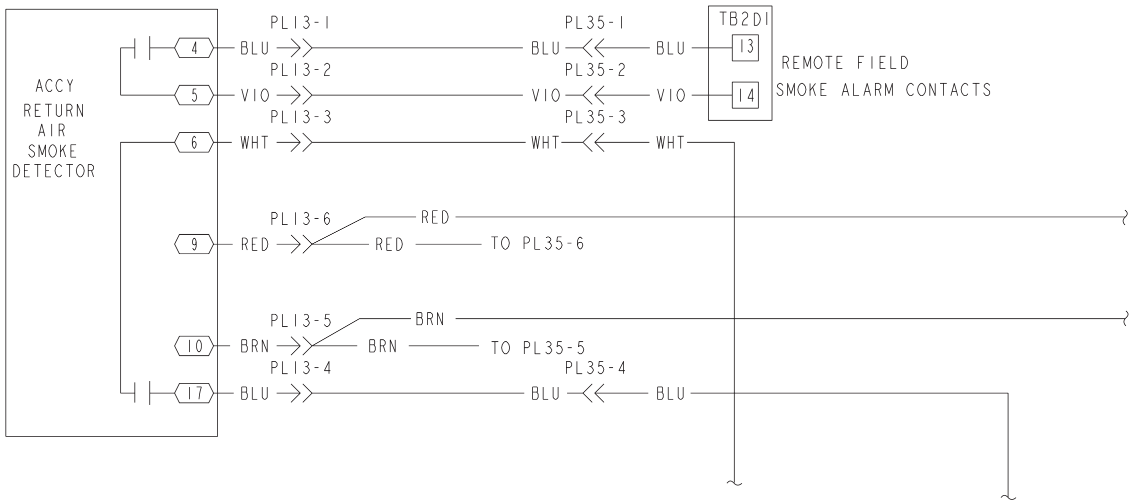


Fig. 77 — Return Air Smoke Detector Wiring

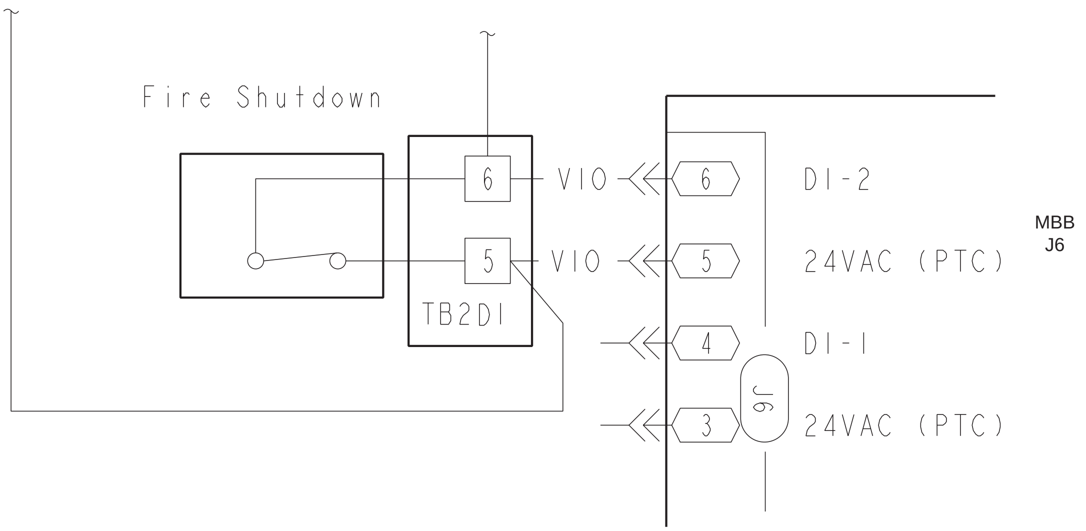


Fig. 78 — Fire Shutdown Wiring

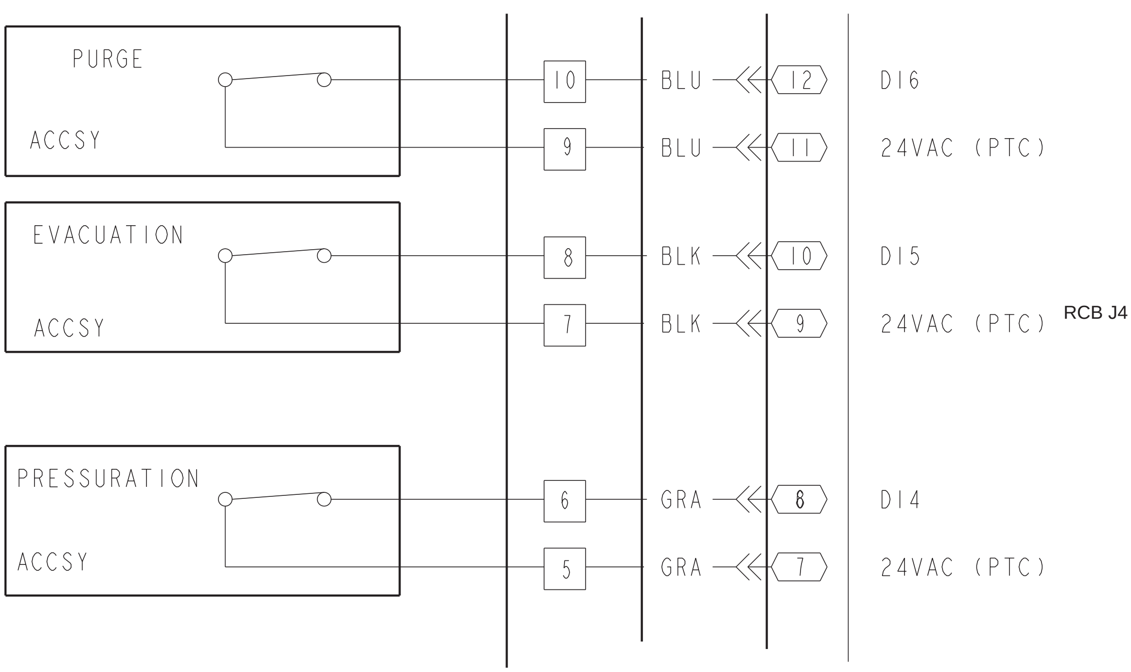


Fig. 79 — Purge, Evacuation, and Pressurization Wiring

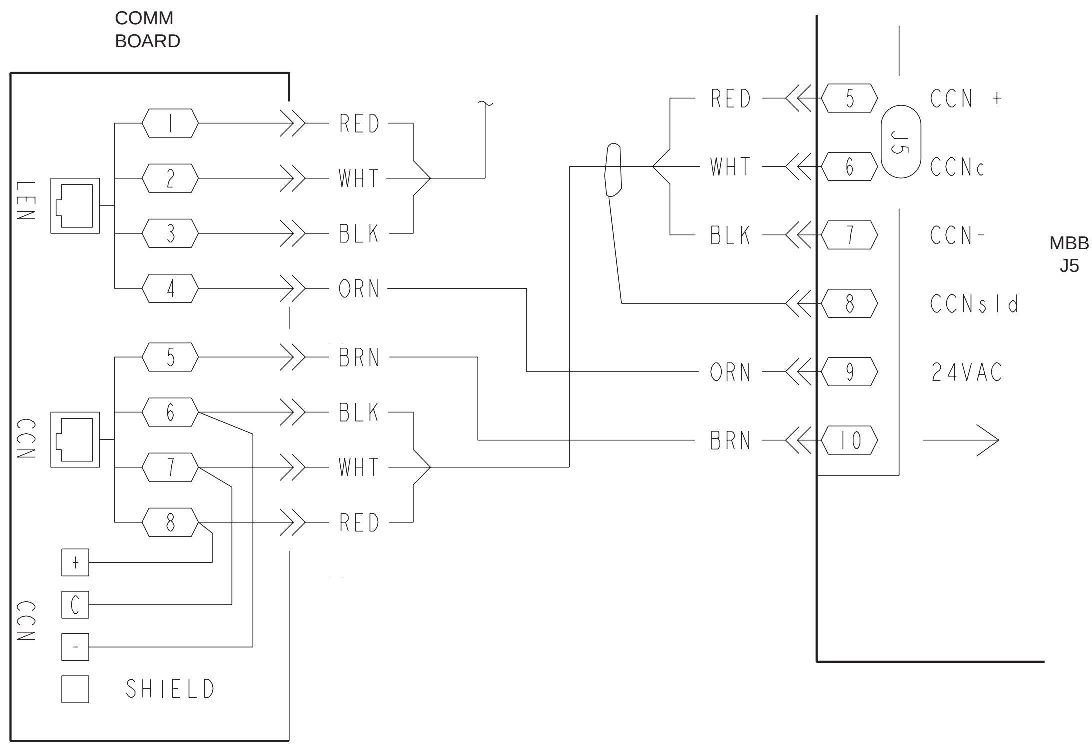


Fig. 80 — CCN Connections

48PG08−16
Single Package Rooftop Units
Electric Cooling/Gas Heating with Puron® (R−410A)
Refrigerant and Electromechanical Controls

Carrier®
Turn to the Experts.℠

Installation Instructions

TABLE OF CONTENTS

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with kits or accessories when installing.

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

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instruction manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform the basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

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

Before installing or servicing unit, always turn off all power to unit. There may be more than 1 disconnect switch. Turn off accessory heater power, if applicable.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

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

Puron® refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron refrigerant equipment.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. What to do if you smell gas:

DO NOT try to light any appliance.
DO NOT touch any electrical switch, or use any phone in your building.
IMMEDIATELY call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
If you cannot reach your gas supplier, call the fire department.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

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

IMPORTANT: Units have high ambient operating limits. If limits are exceeded, the units will automatically lock the compressor out of operation. Manual reset will be required to restart the compressor.

INSTALLATION

Step 1 — Plan for Location

Select a location for the unit and its support system (curb or other) that provides minimum clearances required for safety, unit performance and service access below, around and above unit as specified in unit drawings. Consider also the effect of adjacent units.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air. For proper unit operation, adequate combustion and ventilation air must be provided in accordance with Section 5.3 (Air for Combustion and Ventilation) of the National Fuel Gas Code, ANSI Z223.1 (American National Standards Institute). Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Locate mechanical draft system flue assembly at least 4 ft from any opening through which combustion products could enter the building, and at least 4 ft from any adjacent building (or per local code). Locate the flue assembly at least 10 ft (or per local code) from an adjacent unit's fresh air intake hood if within 3 ft of same elevation. When unit is located adjacent to public walkways, flue assembly must be at least 7 ft above grade.

Select a unit mounting system that provides adequate height to allow installation of condensate trap per requirements. Refer to Step 7 — Install External Trap for Condensate Drain for required trap dimensions.

Roof Mount

Check building codes for weight distribution requirements. Unit operating weight is shown in Tables 1 and 2.

Step 2 — Provide Unit Support

Roof Curb

Assemble or install accessory roof curb in accordance with instructions shipped with this accessory. See Fig. 1 and 2. Install insulation, cant strips, roofing, and counter flashing as shown. Ductwork can be installed to roof curb before unit is set in place. Ductwork must be attached to curb and not to the unit. Curb must be level. This is necessary to permit unit drain to function properly. Unit leveling tolerance is ± $^{1}/_{16}$ in. per linear ft in any direction. Refer to Accessory Roof Curb Installation Instructions for additional information as required. When accessory roof curb is used, unit may be installed on class A, B, or C roof covering material. Carrier roof curb accessories are for flat roofs or slab mounting.

IMPORTANT: The gasketing of the unit to the roof curb is critical for a watertight seal. Install gasket with the roof curb as shown in Fig. 1, 2, and 3. Improperly applied gasket can also result in air leaks and poor unit performance. Do not slide unit to position on roof curb.

Alternate Unit Support

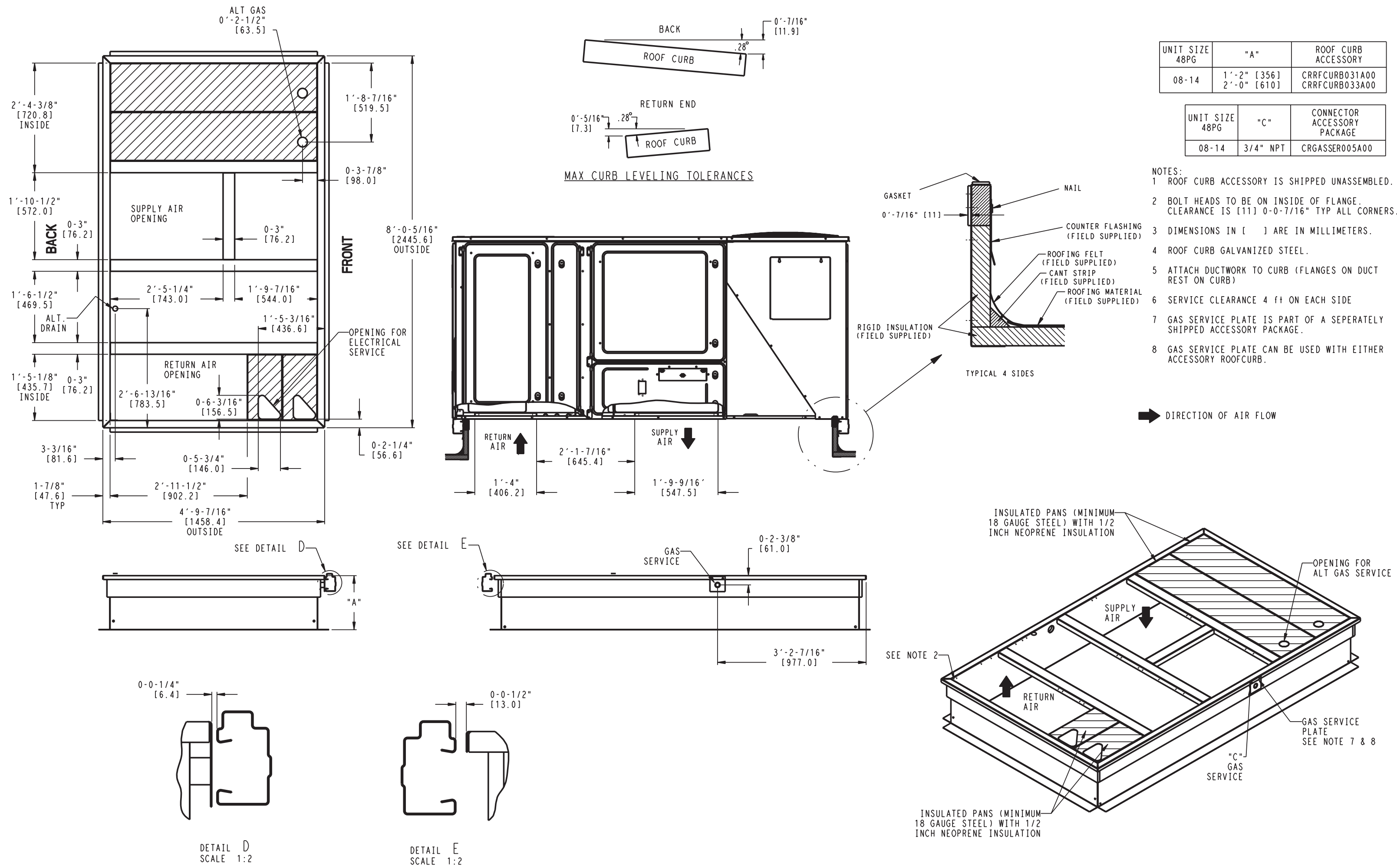
When a curb cannot be used, install unit on a noncombustible surface. Support unit with sleepers, using unit curb support area. If sleepers cannot be used, support long sides of unit with a minimum of 3 equally spaced 4-in. x 4-in. pads on each side.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

All panels must be in place when rigging.



UNIT SIZE 48PG	"A"	ROOF CURB ACCESSORY
08-14	1'-2" [356] 2'-0" [610]	CRRFCURB031A00 CRRFCURB033A00

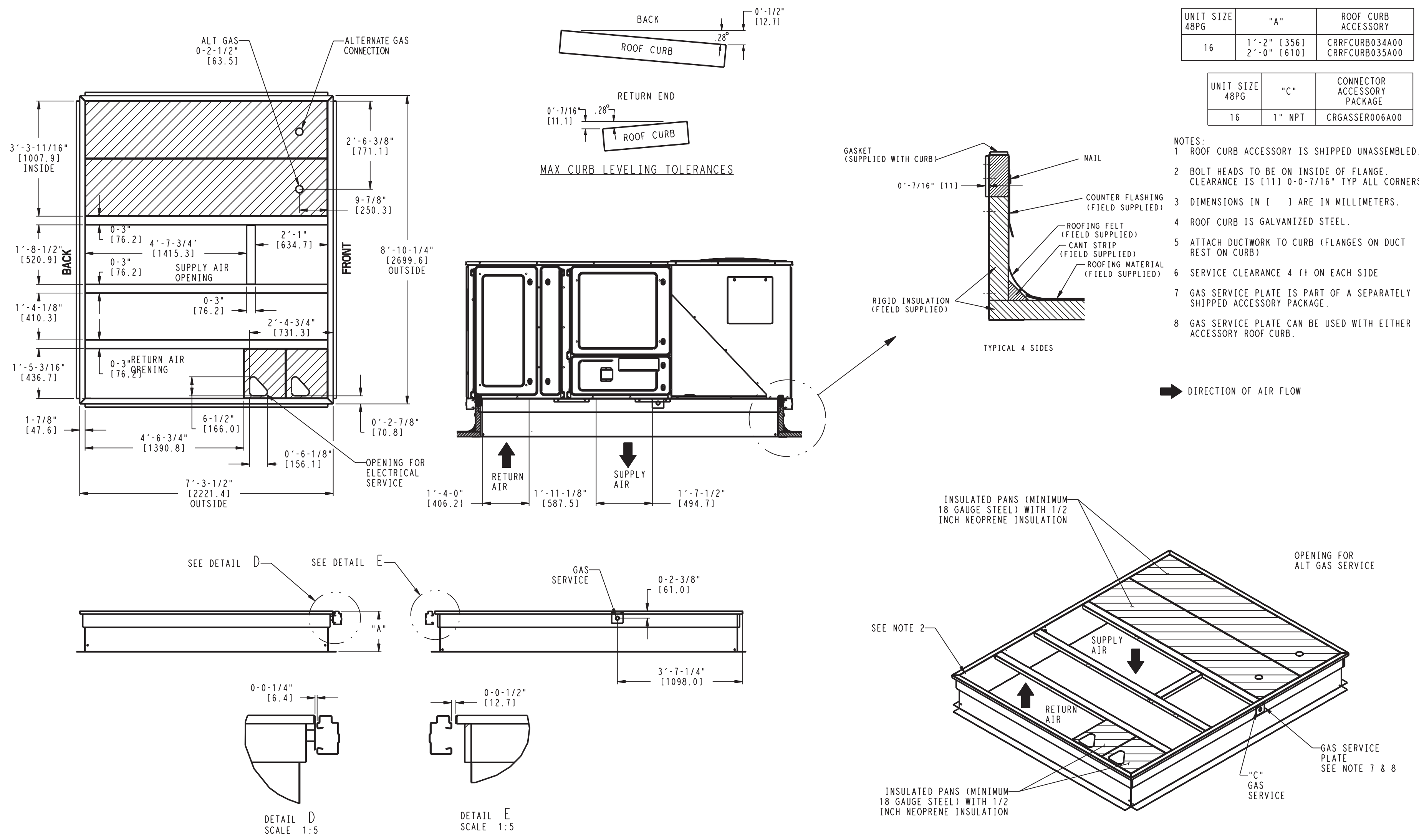
UNIT SIZE 48PG	"C"	CONNECTOR ACCESSORY PACKAGE
08-14	3/4" NPT	CRGASSER005A00

NOTES:
1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
2 BOLT HEADS TO BE ON INSIDE OF FLANGE. CLEARANCE IS [11] 0-0-7/16" TYP ALL CORNERS.
3 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
4 ROOF CURB GALVANIZED STEEL.
5 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
6 SERVICE CLEARANCE 4 ft ON EACH SIDE
7 GAS SERVICE PLATE IS PART OF A SEPERATELY SHIPPED ACCESSORY PACKAGE.
8 GAS SERVICE PLATE CAN BE USED WITH EITHER ACCESSORY ROOFCURB.

C06252

Fig. 1 – Roof Curb Details (48PG08-14)

48PG08-16



UNIT SIZE 48PG	"A"	ROOF CURB ACCESSORY
16	1'-2" [356] 2'-0" [610]	CRRFCURB034A00 CRRFCURB035A00

UNIT SIZE 48PG	"C"	CONNECTOR ACCESSORY PACKAGE
16	1" NPT	CRGASSER006A00

NOTES:
1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
2 BOLT HEADS TO BE ON INSIDE OF FLANGE. CLEARANCE IS [11] 0-0-7/16" TYP ALL CORNERS.
3 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
4 ROOF CURB IS GALVANIZED STEEL.
5 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
6 SERVICE CLEARANCE 4 ft ON EACH SIDE
7 GAS SERVICE PLATE IS PART OF A SEPARATELY SHIPPED ACCESSORY PACKAGE.
8 GAS SERVICE PLATE CAN BE USED WITH EITHER ACCESSORY ROOF CURB.

C06228

Fig. 2 − Roof Curb Details (48PG16)

Step 3 — Rig and Place Unit

> **⚠ CAUTION**
>
> **UNIT DAMAGE HAZARD**
>
> Failure to follow this caution could result in unit and/or property damage.
>
> Do not slide unit to position when it is sitting on the curb. Curb gasketing material may be damaged and leaks may result.

Inspect unit for transportation damage. See Tables 1 and 2 for physical data. File any claim with transportation agency.

Do not drop unit; keep upright. Use wooden top skid or spreader bars over unit to prevent sling or cable damage. Rollers may be used to move unit across a roof. Level by using unit rail as a reference; leveling tolerance is ± $^{1}/_{16}$ in. per linear ft in any direction. See Fig. 3 for additional information. Unit rigging weight is shown in Fig. 3.

Rigging holes are provided in the unit base rails as shown in Fig. 2. Refer to rigging instructions on unit.

Installation Onto Curb

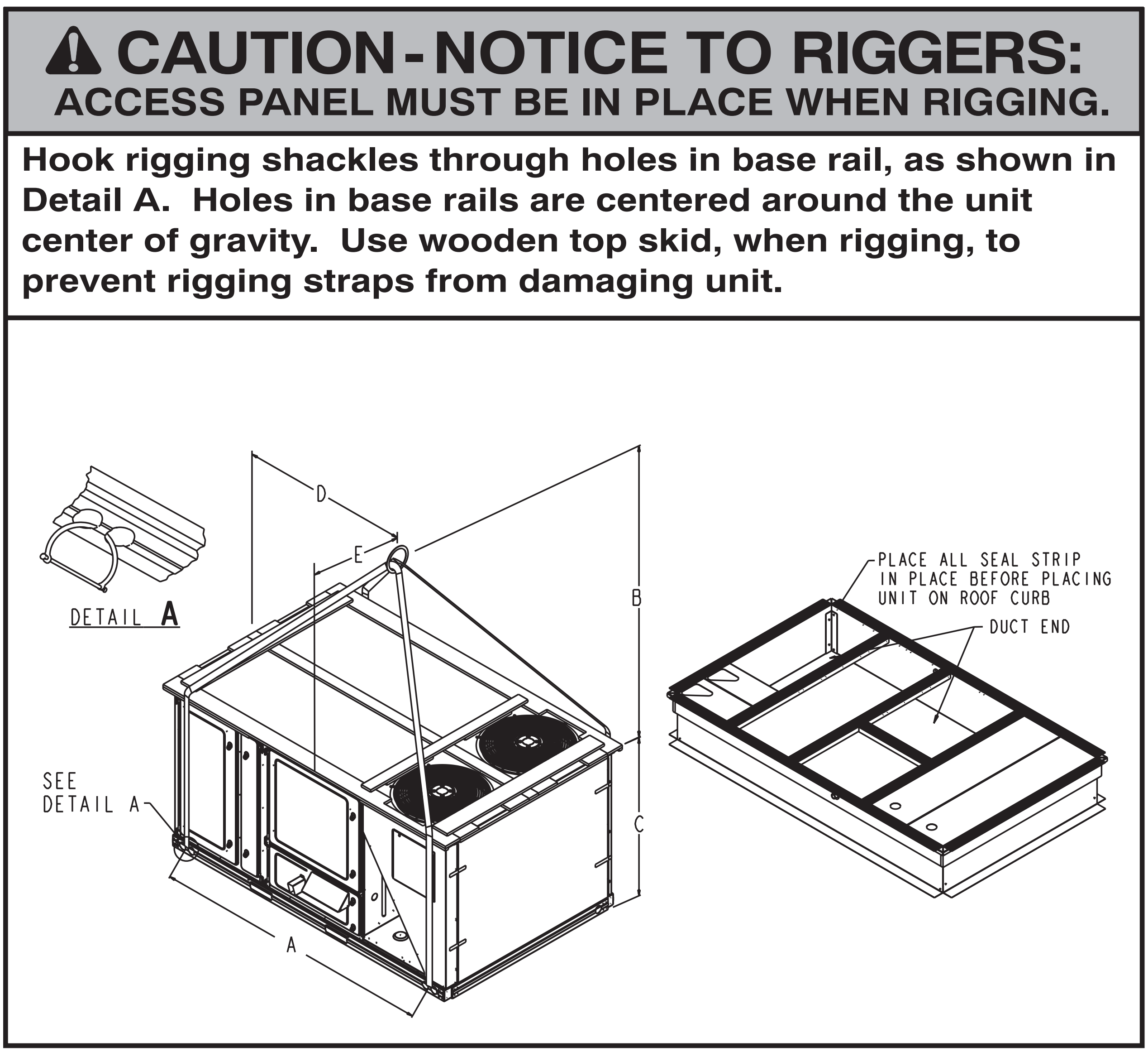
The 48PG units are designed to fit on the accessory full perimeter curb. Correct placement of the unit onto the curb is critical to operating performance. To aid in correct positioning, place unit on roof curb to maintain $^{1}/_{4}$-in. gap between the inside of rail and roof curb on long sides and a $^{1}/_{2}$-in. gap between the inside of rail and roof curb on both duct and condenser ends. Refer to Fig. 1, 2, 3 and 4, to assure proper duct opening alignment.

NOTE: Before positioning unit on curb, make sure bottom drain connection plug is tight. See Step 7 — Install External Trap for Condensate Drain for more information.

Slab Mount (Horizontal Units Only)

Provide a level concrete slab that extends a minimum of 6-in. beyond unit cabinet. Install a gravel apron in front of condenser-coil air inlet to prevent grass and foliage from obstructing airflow.

NOTE: Horizontal units may be installed on a roof curb if required.



C06253

Fig. 3 — 48PG Rigging Label

Table 1 — Physical Data (48PG08-14)

BASE UNIT 48PG		08	09	12	14
NOMINAL CAPACITY (Tons)		7 1/2	8 1/2	10	12 1/2
OPERATING WEIGHT (lb)					
Unit*		1217	1224	1324	1400
Economizer					
Vertical		57	57	57	57
Horizontal		59	59	59	59
Roof Curb					
14-in.		180	180	180	180
24-in.		268	268	268	268
COMPRESSOR		Fully Hermetic Scroll			
Quantity		2	2	2	2
Oil Type Sys A		Copeland 3MA	Copeland 3MA	Copeland 3MA	Copeland 3MA
Sys B		Copeland 3MA	Copeland 3MA	Copeland 3MA	Copeland 3MA
Number of Refrigerant Circuits		2	2	2	2
Oil (oz) Sys A		42	42	66	56
Sys B		42	42	66	56
REFRIGERANT TYPE		R-410A (Puron® Refrigerant)			
Expansion Device		TXV	TXV	TXV	TXV
Operating Charge (lb) Sys A		11.8	11.3	13.7	17.2
Sys B		11.8	11.3	13.7	17.2
Operating Charge Total All Systems (lb)		23.5	22.6	27.4	34.4
CONDENSER COIL		Enhanced Copper Tubes, Aluminum Lanced Fins, Face Split			
Condenser A (Outer)					
Rows...Fins/in.		2…17	2…17	2…17	3…17
Face Area (sq ft)		17.4	17.4	17.4	17.4
Condenser B (Inner)					
Rows...Fins/in.		2...17	2...17	2…17	3...17
Face Area (sq ft)		17.4	17.4	17.4	17.4
CONDENSER FAN		Propeller			
Quantity…Diameter (in.)		2...24	2...24	2...24	2...24
Nominal Cfm (Total, all fans)		7204	7204	8241	7300
Motor Hp		1/4	1/4	1/3	1/3
Nominal Rpm		1100	1100	1100	1100
EVAPORATOR COIL		Enhanced Copper Tubes, Aluminum Double-Wavy Fins, Face Split			
Rows…Fins/in.		3…15	3…15	4…15	4…15
Face Area (sq ft)		14.9	14.9	14.9	14.9
EVAPORATOR FAN		Centrifugal Type, Belt Drive			
Quantity…Size (in.)	Low	1...15 x 15	1...15 x 15	1...15 x 15	1...15 x 15
	High	1...15 x 15	1...15 x 15	1...15 x 15	1...15 x 15
Type Drive	Low	Belt	Belt	Belt	Belt
	High	Belt	Belt	Belt	Belt
Nominal Cfm		3000	3400	4000	5000
Maximum Continuous Bhp	Low	2.4	2.4	3.1	3.7
	High	3.1	3.7	3.7	5.25
Motor Nominal Rpm		1725	1725	1725	1725
Motor Frame Size	Low	56Y	56Y	56Y	56Y
	High	56Y	56Y	56Y	56Y
Fan Rpm Range	Low	568-771	568-771	690-893	690-893
	High	812-1015	812-1015	852-1055	852-1055
Motor Bearing Type		Ball	Ball	Ball	Ball
Maximum Fan Rpm		1600	1600	1600	1600
Motor Pulley Pitch Diameter Range (in.)	Low	2.8-3.8	2.8-3.8	3.4-4.4	3.4-4.4
	High	4.0-5.0	4.0-5.0	4.6-5.6	4.6-5.6
Fan Pulley Pitch Diameter	Low	8.5	8.5	8.5	8.5
	High	8.5	8.5	8.5	8.5
Nominal Motor Shaft Diameter (in.)	Low	5/8	5/8	7/8	7/8
	High	7/8	7/8	7/8	7/8
Belt…Pitch Length (in.)	Low	63.3	63.3	63.3	63.3
	High	65.3	65.3	65.3	65.3
Belt…Type	Low	AX	AX	AX	AX
	High	AX	AX	AX	AX
Pulley Center Line Distance Min. (in.)	Low	21.0	21.0	21.0	21.0
	High	21.0	21.0	21.0	21.0
Pulley Center Line Distance Max. (in.)	Low	23.4	23.4	23.4	23.4
	High	23.4	23.4	23.4	23.4
Speed Change per Full Turn of Movable Pulley Flange (rpm)	Low	41	41	41	41
	High	41	41	41	41
Movable Pulley Maximum Full Turns from Closed Position	Low	5	5	5	5
	High	5	5	5	5
Factory Pulley Setting (rpm)	Low	568	568	690	690
	High	812	812	852	852
Fan Shaft Diameter at Pulley (in.)		1	1	1	1
GAS HEAT SECTION					
Rollout Switch					
Open Temperature (F)	Low	225	225	225	225
	Med	225	225	225	225
	High	225	225	225	225
Closed Temperature (F)	Low	175	175	175	175
	Med	175	175	175	175
	High	175	175	175	175
Gas Input (Btuh) Stage 1 /Stage 2	PGD/L	95,200/136,000	95,200/136,000	126,700/181,000	126,700/181,000
	PGE/M	126,700/181,000	126,700/181,000	158,200/226,000	158,200/226,000
	PGF/N	158,200/226,000	158,200/226,000	174,300/249,000	174,300/249,000
Burner Orifice Diameter (in. ...drill size)†					
Natural Gas		0.089...43	0.089...43	0.089...43	0.089...43
Liquid Propane		0.070...50	0.070...50	0.070...50	0.070...50
Thermostat Heat Anticipator Setting (amps)					
First Stage		.14	.14	.14	.14
Second Stage		.20	.20	.20	.20
Manifold Pressure (in. wg)					
Natural Gas		3.5	3.5	3.5	3.5
Liquid Propane		3.5	3.5	3.5	3.5

48PG08–16

BASE UNIT 48PG		08	09	12	14
Gas Valve Quantity		1	1	1	1
Gas Supply Pressure Range (in. wg)		5.0-13.0	5.0-13.0	5.0-13.0	5.0-13.0
Field Gas Connection Size (in.)		$^3/_4$	$^3/_4$	$^3/_4$	$^3/_4$
HIGH-PRESSURE SWITCH (psig)					
Cutout		660 ± 10	660 ± 10	660 ± 10	660 ± 10
Reset (Auto.)		505 ± 20	505 ± 20	505 ± 20	505 ± 20
LOW-PRESSURE SWITCH (psig)					
Cutout		40 ± 7	40 ± 7	40 ± 7	40 ± 7
Reset (Auto.)		80 ± 7	80 ± 7	80 ± 7	80 ± 7
FREEZE PROTECTION THERMOSTAT (F)					
Cutout		30 ± 5	30 ± 5	30 ± 5	30 ± 5
Reset (Auto.)		45 ± 5	45 ± 5	45 ± 5	45 ± 5
RETURN-AIR FILTERS		Throwaway			
Quantity…Size (in.)		4...20 x 25 x 2	4...20 x 25 x 2	4...20 x 25 x 2	4...20 x 25 x 2

LEGEND

TXV — Thermostatic Expansion Valve

* Aluminum evaporator coil/aluminum condenser coil.

† For applications less than 2000 ft elevation.

Table 2 — Physical Data (48PG16)

BASE UNIT 48PG		16
NOMINAL CAPACITY (Tons)		15
OPERATING WEIGHT (lb)		
Unit*		1895
EconoMizer		
Vertical		149
Horizontal		149
Roof Curb		
14-in.		240
24-in.		360
COMPRESSOR		Fully Hermetic Scroll
Quantity		3
Oil Type Sys A		Copeland 3MA
Sys B		Copeland 3MA
Sys C		Copeland 3MA
Number of Refrigerant Circuits		3
Oil (oz) Sys A		66
Sys B		66
Sys C		66
REFRIGERANT TYPE		R-410A (Puron® Refrigerant)
Expansion Device		TXV
Operating Charge (lb) Sys A		13.5
Sys B		15.0
Sys C		15.0
Operating Charge Total All Systems (lb)		43.5
CONDENSER COIL		Enhanced Copper Tubes, Aluminum Lanced Fins, Face Split
Condenser A (Outer)		
Rows...Fins/in.		2…17
Face Area (sq ft)		26.6
Condenser B (Inner)		
Rows...Fins/in.		2...17
Face Area (sq ft)		30.2
CONDENSER FAN		Propeller
Quantity…Diameter (in.)		3...24
Nominal Cfm (Total, all fans)		12,500
Motor Hp		$^1/_3$
Nominal Rpm		1100
EVAPORATOR COIL		Enhanced Copper Tubes, Aluminum Double-Wavy Fins, Face Split
Rows…Fins/in.		3…15
Face Area (sq ft)		22.2
EVAPORATOR FAN		Centrifugal Type, Belt Drive
Quantity…Size (in.)	Low	1...15x15, 1...12x12
	Mid-Low	1...15x15, 1...12x12
	High	1...15x15, 1...12x12
Type Drive	Low	Belt
	Mid-Low	Belt
	High	Belt
Nominal Cfm		6000
Maximum Continuous Bhp	Low	3.7
	Mid-Low	5.25
	High	7.5
Motor Frame Size	Low	56
	Mid-Low	56
	High	S213T
Fan Rpm Range	Low	710- 879
	Mid-Low	872-1066
	High	1066-1260
Motor Bearing Type		Ball
Motor Pulley Pitch Diameter Min (in.)	Low	4.2
	Mid-Low	4.2
	High	4.2
Motor Pulley Pitch Diameter Max (in.)	Low	5.2
	Mid-Low	5.2
	High	6.2
Fan Pulley Pitch Diameter (in.)	Low	10.2
	Mid-Low	8.5
	High	8.5
Nominal Motor Shaft Diameter (in.)	Low	$^7/_8$
	Mid-Low	$^7/_8$
	High	$1^3/_8$

48PG08–16

BASE UNIT 48PG		16
Belt…Pitch Length (in.)	Low	49.3
	Mid-Low	47.8
	High	43.8
Belt…Type	Low	AX
	Mid-Low	BX
	High	BX
Pulley Center Line Distance Min. (in.)	Low	14.2
	Mid-Low	10.8
	High	8.6
Pulley Center Line Distance Max. (in.)	Low	10.8
	Mid-Low	14.2
	High	12
Speed Change per Full Turn of Movable Pulley Flange (rpm)	Low	34
	Mid-Low	41
	High	41
Movable Pulley Maximum Full Turns from Closed Position	Low	5
	Mid-Low	5
	High	5
Factory Pulley Setting (rpm)	Low	812
	Mid-Low	983
	High	1191
Fan Shaft Diameter at Pulley (in.)		1 3/16
GAS HEAT SECTION		
Rollout Switch		
Open Temperature (F)	Low	195
	Med	195
	High	195
Closed Temperature (F)	Low	115
	Med	115
	High	115
Gas Input (Btuh) Stage 1/Stage 2	PGD/L	176,000/220,000
	PGE/M	248,000/310,000
	PGF/N	320,000/400,000
Burner Orifice Diameter (in. ...drill size)†		
Natural Gas	Std	0.1285...30
Liquid Propane	Alt	0.1015...38
Thermostat Heat Anticipator Setting (amps)		
First Stage		.14
Second Stage		.20
Manifold Pressure (in. wg)		
Natural Gas	Std	3.0
Liquid Propane	Alt	3.0
Gas Valve Quantity		1
Gas Supply Pressure Range (in. wg)		5.0-13.0
Field Gas Connection Size (in.)		3/4
HIGH-PRESSURE SWITCH (psig)		
Cutout		660 ± 10
Reset (Auto.)		505 ± 20
LOW-PRESSURE SWITCH (psig)		
Cutout		40 ± 7
Reset (Auto.)		80 ± 7
FREEZE PROTECTION THERMOSTAT (F)		
Cutout		30 ± 5
Reset (Auto.)		45 ± 5
RETURN-AIR FILTERS		Throwaway
Quantity…Size (in)		8...20 x 20 x 2

LEGEND

TXV — Thermostatic Expansion Valve

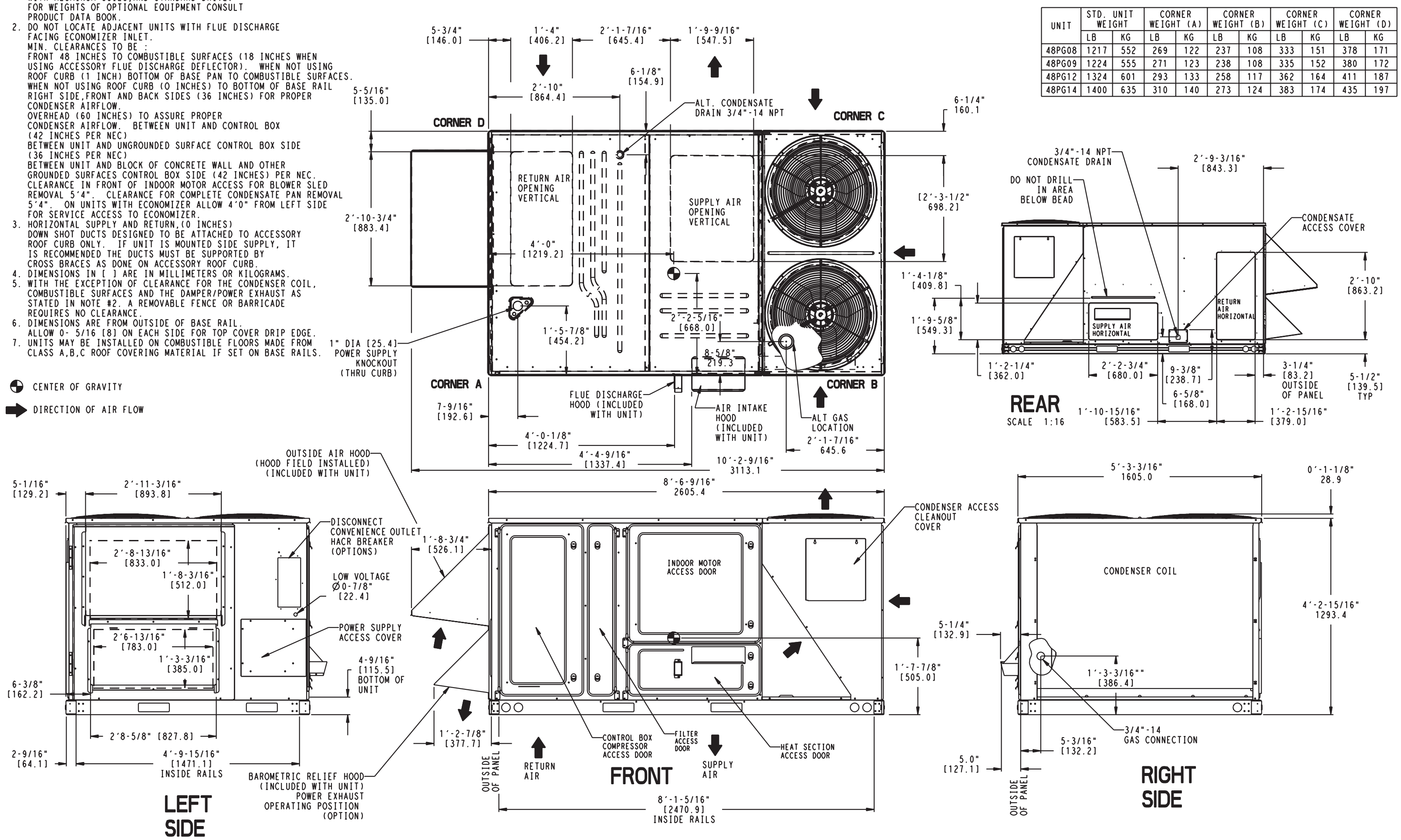
* Aluminum evaporator coil/aluminum condenser coil.

† For applications less than 2000 ft elevation.

NOTES:

1. WEIGHTS SHOWN ARE FOR 48PG (HI HEAT) UNIT WITH ALUMINUM COILS, AND STANDARD DRIVE. FOR WEIGHTS OF OPTIONAL EQUIPMENT CONSULT PRODUCT DATA BOOK.
2. DO NOT LOCATE ADJACENT UNITS WITH FLUE DISCHARGE FACING ECONOMIZER INLET. MIN. CLEARANCES TO BE : FRONT 48 INCHES TO COMBUSTIBLE SURFACES (18 INCHES WHEN USING ACCESSORY FLUE DISCHARGE DEFLECTOR). WHEN NOT USING ROOF CURB (1 INCH) BOTTOM OF BASE PAN TO COMBUSTIBLE SURFACES. WHEN NOT USING ROOF CURB (0 INCHES) TO BOTTOM OF BASE RAIL RIGHT SIDE, FRONT AND BACK SIDES (36 INCHES) FOR PROPER CONDENSER AIRFLOW. OVERHEAD (60 INCHES) TO ASSURE PROPER CONDENSER AIRFLOW. BETWEEN UNIT AND CONTROL BOX (42 INCHES PER NEC) BETWEEN UNIT AND UNGROUNDED SURFACE CONTROL BOX SIDE (36 INCHES PER NEC) BETWEEN UNIT AND BLOCK OF CONCRETE WALL AND OTHER GROUNDED SURFACES CONTROL BOX SIDE (42 INCHES) PER NEC. CLEARANCE IN FRONT OF INDOOR MOTOR ACCESS FOR BLOWER SLED REMOVAL 5'4". CLEARANCE FOR COMPLETE CONDENSATE PAN REMOVAL 5'4". ON UNITS WITH ECONOMIZER ALLOW 4'0" FROM LEFT SIDE FOR SERVICE ACCESS TO ECONOMIZER.
3. HORIZONTAL SUPPLY AND RETURN, (0 INCHES) DOWN SHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THE DUCTS MUST BE SUPPORTED BY CROSS BRACES AS DONE ON ACCESSORY ROOF CURB.
4. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
5. WITH THE EXCEPTION OF CLEARANCE FOR THE CONDENSER COIL, COMBUSTIBLE SURFACES AND THE DAMPER/POWER EXHAUST AS STATED IN NOTE #2, A REMOVABLE FENCE OR BARRICADE REQUIRES NO CLEARANCE.
6. DIMENSIONS ARE FROM OUTSIDE OF BASE RAIL. ALLOW 0- 5/16 [8] ON EACH SIDE FOR TOP COVER DRIP EDGE.
7. UNITS MAY BE INSTALLED ON COMBUSTIBLE FLOORS MADE FROM CLASS A,B,C ROOF COVERING MATERIAL IF SET ON BASE RAILS.

UNIT	STD. UNIT WEIGHT		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)	
	LB	KG	LB	KG	LB	KG	LB	KG	LB	KG
48PG08	1217	552	269	122	237	108	333	151	378	171
48PG09	1224	555	271	123	238	108	335	152	380	172
48PG12	1324	601	293	133	258	117	362	164	411	187
48PG14	1400	635	310	140	273	124	383	174	435	197



C06254

Fig. 4 – Base Unit Dimensions (48PG08-14)

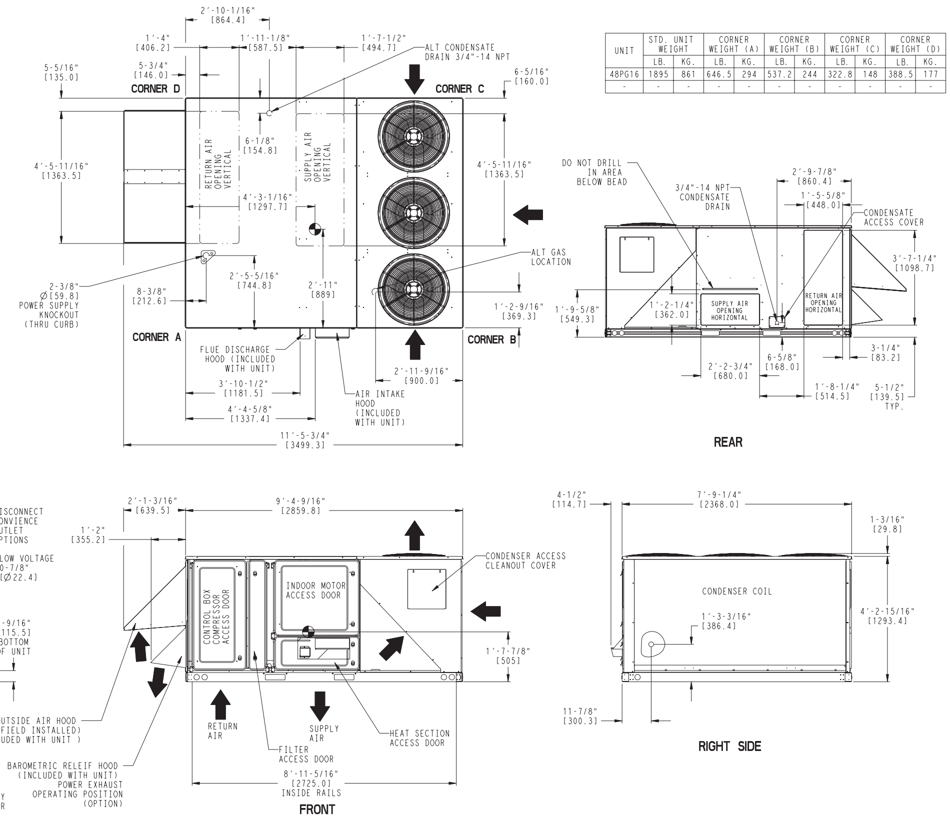
48PG08–16

NOTES:
1. WEIGHTS SHOWN ARE FOR 48PG (HI HEAT) UNIT WITH ALUMINUM COILS,AND STANDARD DRIVE. FOR WEIGHTS OF OPTIONAL EQUIPMENT CONSULT PRODUCT DATA BOOK.
2. DO NOT LOCATE ADJACENT UNITS WITH FLUE DISCHARGE FACING ECONOMIZER INLET.
   MIN. CLEARANCES TO BE :
   FRONT 48 INCHES TO COMBUSTIBLE SURFACES (18 INCHES WHEN USING ACCESSORY FLUE DISCHARGE DEFLECTOR). WHEN NOT USING ROOF CURB (1 INCH) BOTTOM OF BASE PAN TO COMBUSTIBLE SURFACES. WHEN NOT USING ROOF CURB (0 INCHES) TO BOTTOM OF BASE RAIL RIGHT SIDE,FRONT AND BACK SIDES (36 INCHES) FOR PROPER CONDENSER AIRFLOW.
   OVERHEAD (60 INCHES) TO ASSURE PROPER CONDENSER AIRFLOW. BETWEEN UNIT AND CONTROL BOX (42 INCHES PER NEC)
   BETWEEN UNIT AND UNGROUNDED SURFACE CONTROL BOX SIDE (36 INCHES PER NEC)
   BETWEEN UNIT AND BLOCK OF CONCRETE WALL AND OTHER GROUNDED SURFACES CONTROL BOX SIDE (42 INCHES) PER NEC. CLEARANCE IN FRONT OF INDOOR MOTOR ACCESS FOR BLOWER SLED REMOVAL 5'4". CLEARANCE FOR COMPLETE CONDENSATE PAN REMOVAL 7'-8". ON UNITS WITH ECONOMIZER ALLOW 4'0" FROM LEFT SIDE FOR SERVICE ACCESS TO ECONOMIZER.
3. DOWN SHOT DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY.
4. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
5. WITH THE EXCEPTION OF CLEARANCE FOR THE CONDENSER COIL, COMBUSTIBLE SURFACES AND THE DAMPER/POWER EXHAUST AS STATED IN NOTE #2. A REMOVABLE FENCE OR BARRICADE REQUIRES NO CLEARANCE.
6. DIMENSIONS ARE FROM OUTSIDE OF BASE RAIL. ALLOW 0- 5/16 [8] ON EACH SIDE FOR TOP COVER DRIP EDGE.
7. UNITS MAY BE INSTALLED ON COMBUSTIBLE FLOORS MADE FROM CLASS A,B,C ROOF COVERING MATERIAL IF SET ON BASE RAILS.

CENTER OF GRAVITY

DIRECTION OF AIR FLOW

UNIT	STD. UNIT WEIGHT		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)	
	LB.	KG.	LB.	KG.	LB.	KG.	LB.	KG.	LB.	KG.
48PG16	1895	861	646.5	294	537.2	244	322.8	148	388.5	177
-	-	-	-	-	-	-	-	-	-	-



C06289

Fig. 5 – Base Unit Dimensions (48PG16)

Step 4 —Field Fabricate Ductwork

On vertical units, secure all ducts to roof curb and building structure. *Do not connect ductwork to unit.* For horizontal applications, field-supplied flanges should be attached to horizontal discharge openings and all ductwork secured to the flanges. Insulate and weatherproof all external ductwork, joints, and roof openings with counter flashing and mastic in accordance with applicable codes.

Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

If a plenum return is used on a vertical unit, the return should be ducted through the roof deck to comply with applicable fire codes.

A minimum clearance is not required around ductwork. Cabinet return-air static pressure (a negative condition) shall not exceed 0.35 in. wg with economizer or 0.45 in. wg without economizer.

These units are designed for a minimum continuous return-air temperature in heating of 50° F (dry bulb), or an intermittent operation down to 45° F (dry bulb), such as when used with a night set-back thermostat.

To operate at lower return-air temperatures, a field-supplied outdoor-air temperature control must be used to initiate both stages of heat when the temperature is below 45° F. Indoor comfort may be compromised when these lower air temperatures are used with insufficient heating temperature rise.

Step 5 —Make Unit Duct Connections

Vertical Supply/Return Configuration

Unit is shipped in vertical supply/return configuration. Ductwork openings are shown in Fig. 1, 2, 4, and 5. Attach the ductwork to the roof curb. Do not attach duct directly to the unit.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install a 90° turn in the return ductwork between the unit and the conditioned space. If a 90° elbow cannot be installed, then a grille of sufficient strength and density should be installed to prevent objects from falling into the conditioned space.

Horizontal Supply/Return Applications (Sizes 08-14 Only)

Unit can be field-converted from vertical supply/return to horizontal supply/return. Remove all screws securing horizontal duct covers to duct panel. Save panels. Apply a bead of RTV around flange of duct cover (on painted side). Install duct covers in the vertical duct openings in the basepan with the insulation side up. Covers will drop into openings and can be secured using field-supplied self-tapping screws. Ductwork can be attached to duct flanges provided on unit. When securing ductwork to unit, do not drill in area below bead or above top edge of duct opening. For 16 size units, an accessory kit is available for field-converting vertical to horizontal supply/return. Refer to instructions provided with kit. Duct openings are shown in Fig. 1, 2, 4, and 5.

Step 6 —Install Flue Hood and Inlet Hood

Flue hood (smaller hood), inlet hood (larger hood), and screens are shipped inside the unit in the gas section. To install, open the gas section access door. The flue hood is attached to the gas section access door from the outside using the screws provided. See Fig. 6 - 9.

The inlet hood is installed by inserting the hood through the back of the gas section access door. Attach the hood by inserting the screws provided through the clearance holes in the gas section access door and into the intake hood.

NOTE: When properly installed, the flue hood will line up with the combustion fan housing exhaust. (See Fig. 10.)

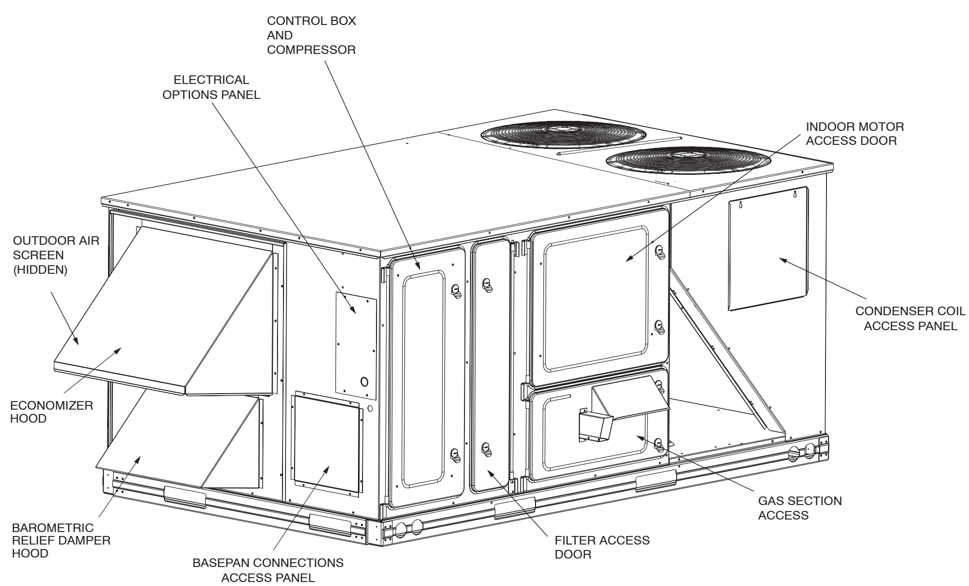
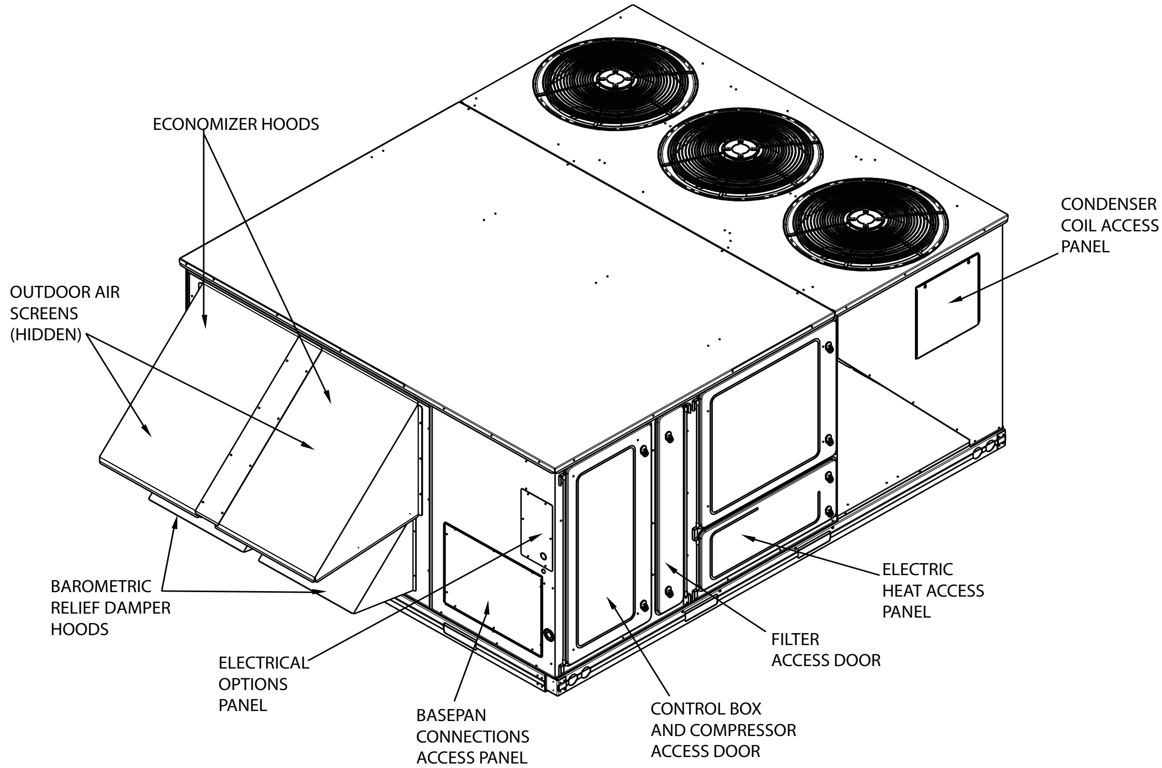
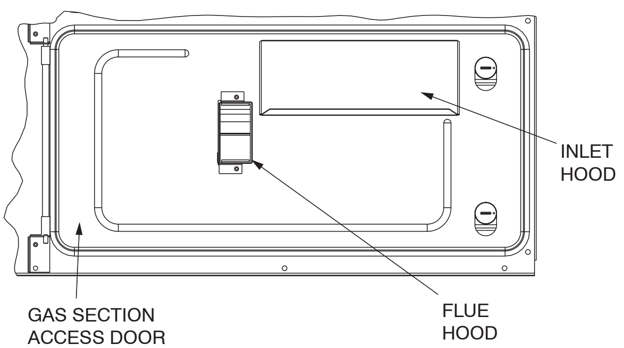


Fig. 6 — Panel and Filter Locations (48PG08-14)



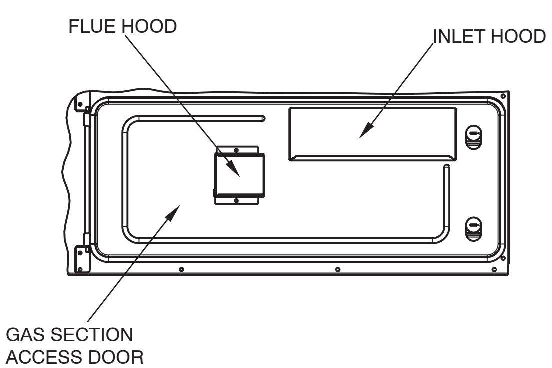
C06309

Fig. 7 – Panel and Filter Locations (48PG16)



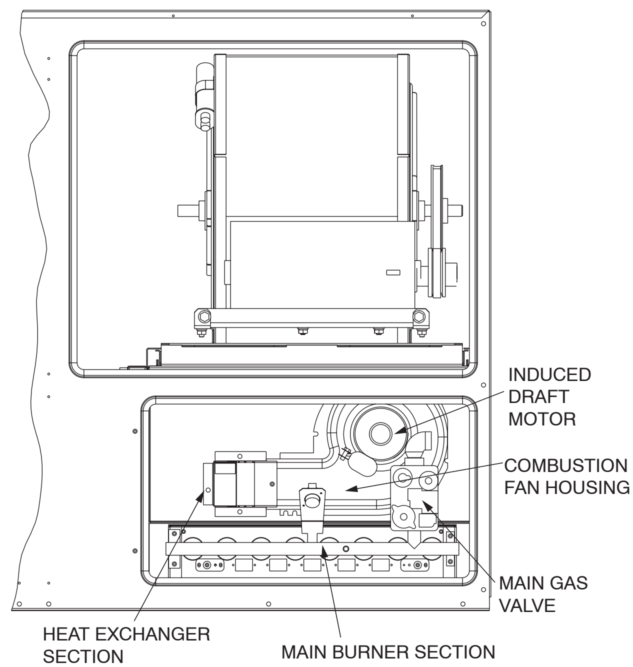
C06257

Fig. 8 – Flue and Inlet Hood Locations (48PG08-14)



C06230

Fig. 9 – Flue and Inlet Hood Locations (48PG16)



C06258

Fig. 10 – Typical Gas Heating Section (Sizes 08-14 Shown)

Step 7 —Install External Trap for Condensate Drain

The unit's 3/4-in. condensate drain connections are located on the bottom and side of the unit. Unit discharge connections do not determine the use of drain connections; either drain connection can be used with vertical or horizontal applications. See Fig. 4 and 5 for locations.

When using the standard side drain connection, make sure the plug (red) covering the alternate bottom connection is tight before installing the unit. (See Fig. 11.)

To use the bottom drain connection for a roof curb installation, relocate the factory-installed plug (red) from the bottom connection to the side connection. A 1/2-in. socket extension can be used to remove the plug. (See Fig. 11.) The piping for the condensate drain and external trap can be completed after the unit is in place.

All units must have an external trap for condensate drainage. Install a trap at least 4-in. deep and protect against freeze-up. If drain line is installed downstream from the external trap, pitch the line away from the unit at 1-in. per 10 ft of run. Do not use a pipe size smaller than the unit connection (3/4-in.). (See Fig. 12 and 13.)

The 48PG units are provided with a removable condensate pan for ease of cleaning. It is recommended that a union be placed between the unit and condensate drainage to ease the removal of the pan during servicing. Adequate clearance should be allowed if removal of condensate pan is required. Allow 64-in. (sizes 08-14) or 93-in. (size 16) between condensate pan access panel and any obstruction for complete removal.

Step 8 —Install Gas Piping

Unit is equipped for use with natural gas. Refer to local building codes, or in the absence of local codes, to ANSI Z223.1-latest year and addendum Z223.1A-latest year entitled HFGC. In Canada, installation must be in accordance with the CAN1.B149.1 and CAN1.B149.2 installation codes for gas burning appliances.

Support gas piping as shown in the table in Fig. 14. For example, a 3/4-in. gas pipe must have one field-fabricated support beam every 8 ft. Therefore, an 18-ft long gas pipe would have a minimum of 3 support beams. See Fig. 14 for typical pipe guide and locations of external manual gas shutoff valve.

Install field-supplied manual gas shutoff valve with a 1/8-in. NPT pressure tap for test gauge connection at unit. The pressure tap is located on the gas manifold, adjacent to the gas valve. Field gas piping must include sediment trap and union. (See Fig. 15.) Install a field-supplied gas regulator.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

Do not pressure test gas supply while connected to unit. Always disconnect union before servicing. High pressures can cause gas valve damage resulting in a hazardous condition.

IMPORTANT: Natural gas pressure at unit gas connection must not be less than 5.0 in. wg or greater than 13.0 in. wg for all heat sizes.

Size gas-supply piping for 0.5-in. wg maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

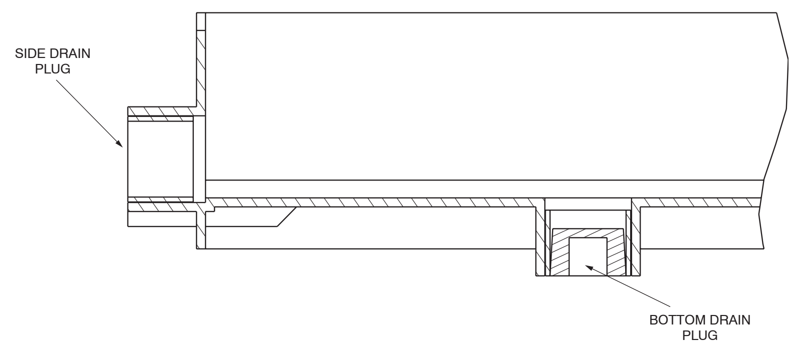


Fig. 11 — Condensate Drain Pan

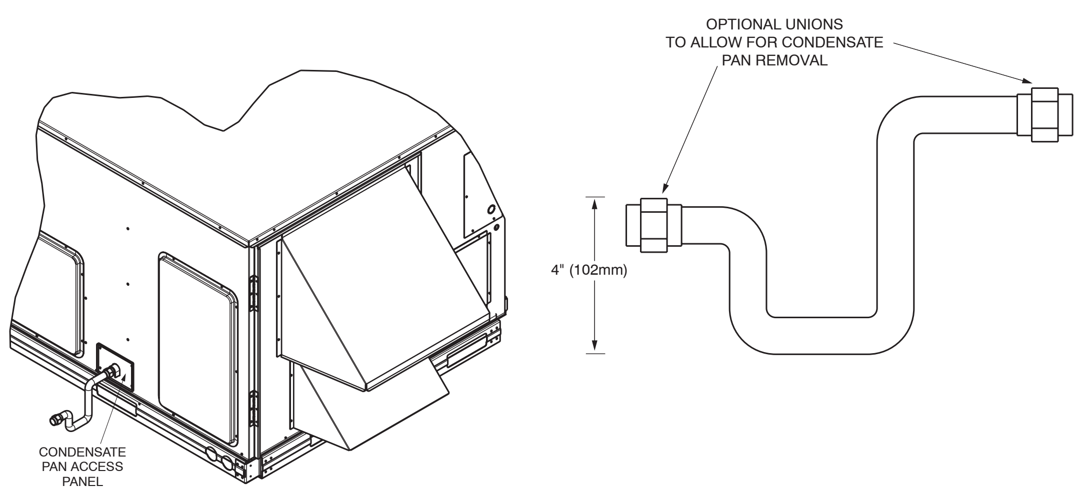
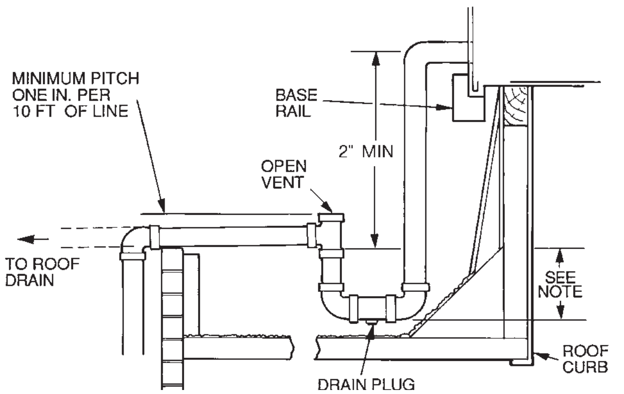


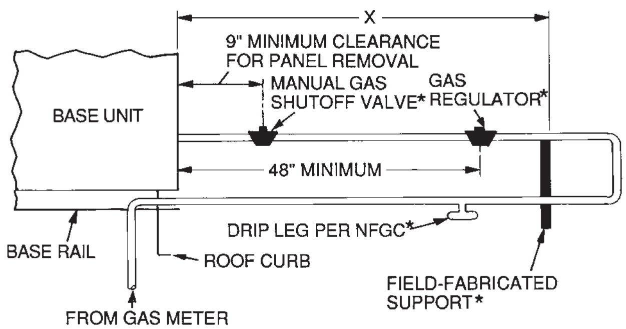
Fig. 12 — External Trap for Condensate Drain



NOTE: Trap should be deep enough to offset maximum unit static difference. A 4-in. trap is recommended.

C06235

Fig. 13 – Condensate Drain Piping Details



LEGEND

NFGC — National Fuel Gas Code

*Field supplied.

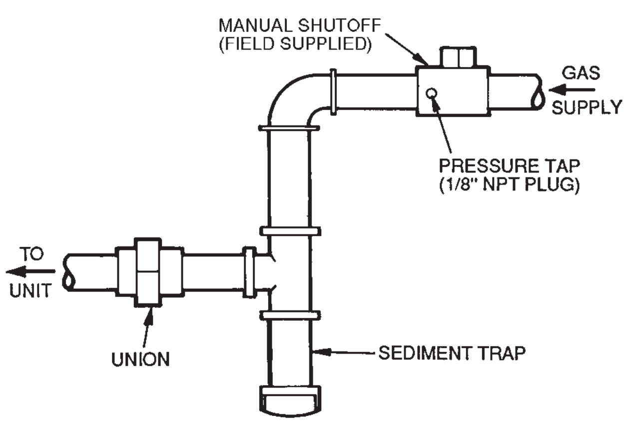
NOTE: Follow all local codes.

SPACING OF SUPPORTS

STEEL PIPE NOMINAL DIAMETER (in.)	SPACING OF SUPPORTS X DIMENSION (ft)
$^{1}/_{2}$	6
$^{3}/_{4}$ or 1	8
$1^{1}/_{4}$ or larger	10

C06115

Fig. 14 – Gas Piping Guide (With Accessory Thru-the-Curb Service Connections)



C06236

Fig. 15 – Field Gas Piping

Step 9 —Make Electrical Connections

__Field Power Supply__

All 208/230-v units are factory wired for 230-v power supply. If the 208/230-v unit is to be connected to a 208-v power supply, the transformer must be rewired by moving the black wire with the $^{1}/_{4}$-in. female quick connect from the 230-volt connection and moving to the 200-volt $^{1}/_{4}$-in. male terminal on the primary side of the transformer.

Refer to unit label diagram for additional information. All field wiring must comply with NEC (National Electrical Code) and local codes. Size wire based on MCA (Minimum Circuit Amps) on the unit informative plate on standard units. Leads are provided for field wire connections. Use UL (Underwriters' Laboratories) approved copper/aluminum connector.

When installing units, provide safety disconnect per NEC Article 440 or local codes. For non-fused disconnects, size the disconnect according to the sizing data provided in the electrical data tables. If a fused disconnect is used, determine the minimum size for the switch based on the disconnect sizing data provided in the electrical data tables and then coordinate the disconnect housing size to accommodate the Maximum Overcurrent Protection (MOCP) device size as marked on the unit informative plate. (See Table 3 and 4.)

See Fig. 16 for power wiring connection to unit leads and equipment ground.

Route power and ground lines through control box end panel or unit basepan (see Fig. 4 and 5) to connections as shown on unit wiring diagram and Fig. 16. Factory leads may be wired directly to the disconnect.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

The correct power phasing is critical to the operation of the scroll compressors. An incorrect phasing will result in compressor shutdown on thermal overload and possible damage to compressor. Should this occur, power phase correction must be made to the incoming power.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC; ANSI (American National Standards Institute)/NFPA (National Fire Protection Association), latest edition, and local electrical codes. *Do not use gas piping as an electrical ground.*

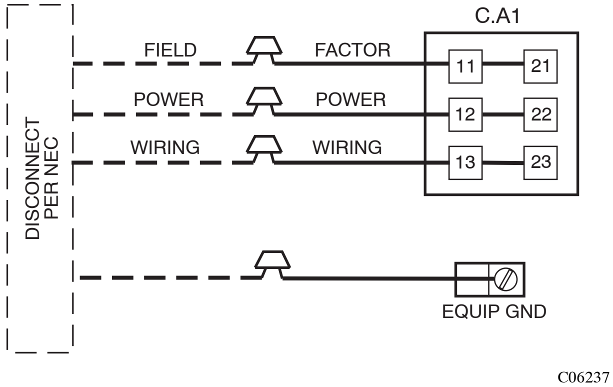


Fig. 16 − Field Power Wiring Connections

Field wiring must conform to temperature limitations for type "T" wire. All field wiring must comply with NEC and local requirements.

Operating voltage to compressor must be within voltage range indicated on unit nameplate. Voltages between phases must be balanced within 2%.

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

Field Control Wiring

Unit can be controlled with either a Carrier-approved accessory thermostat. Install thermostat according to the installation instructions included with accessory. Locate thermostat assembly on a solid interior wall in the conditioned space to sense average temperature.

Route thermostat cable or equivalent single leads of colored wire from subbase terminals through conduit into unit to low-voltage connections as shown on unit label wiring diagram and in Fig. 17.

NOTE: For wire runs up to 50 ft, use no. 18 AWG (American Wire Gauge) insulated wire (35° C minimum). For 50 to 75 ft, use no. 16 AWG insulated wire (35° C minimum). For over 75 ft, use no. 14 AWG insulated wire (35° C Minimum). All wire larger than no. 18 AWG cannot be directly connected at the thermostat and will require a junction box and splice at the thermostat.

Set heat anticipator settings as follows:

VOLTAGE	STAGE 1 (W1) ON	STAGE 1 AND 2 (W1 AND W2) ON
All	0.14	0.20

Settings may be changed slightly to provide a greater degree of comfort for a particular installation.

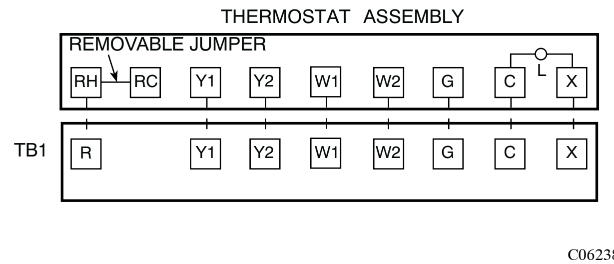


Fig. 17 − Field Control Thermostat Wiring

48PG08−16

Table 3 — Electrical Data — Units Without Optional Powered Convenience Outlet

UNIT 48PG	NOMINAL POWER SUPPLY VOLTS-PH-HZ	VOLTAGE RANGE		COMPRESSOR						OFM		IFM FLA	COMBUSTION FAN MOTOR FLA	PWR EXH FLA (ea)	IFM TYPE	POWER SUPPLY		DISCONNECT SIZE	
		Min	Max	No. 1		No. 2		No. 3								MCA	MOCP	FLA	LRA
				RLA	LRA	RLA	LRA	RLA	LRA	Qty	FLA (ea)								
08	208/230-3-60	187	253	13.5	88	13.5	88	—	—	2	1.5	5.2	0.52	—	STD	38.6/38.6	50/50	40/40	212/212
												7.5			ALT	40.9/40.9	50/50	43/43	238/238
												5.2		3.0	STD	41.6/41.6	50/50	44/44	216/216
												7.5			ALT	43.9/43.9	50/50	47/47	242/242
	460-3-60	414	506	6.4	39	6.4	39	—	—	2	0.8	2.6	0.30	—	STD	18.6	25	20	97
												3.4			ALT	19.4	25	20	110
												2.6		1.2	STD	19.8	25	21	100
												3.4			ALT	20.6	25	22	113
	575-3-60	518	633	5.1	34	5.1	34	—	—	2	0.8	2.0	0.24	—	STD	15.1	20	16	83
												2.8			ALT	15.9	20	17	94
												2.0		3.0	STD	18.1	20	19	87
												2.8			ALT	18.9	25	20	98
09	208/230-3-60	187	253	16.0	91	16.0	91	—	—	2	1.5	5.2	0.52	—	STD	44.2/44.2	60/60	46/46	218/218
												10.2			ALT	49.2/49.2	60/60	52/52	261/261
												5.2		3.0	STD	47.2/47.2	60/60	50/50	222/222
												10.2			ALT	52.2/52.2	60/60	55/55	265/265
	460-3-60	414	506	7.1	46	7.1	46	—	—	2	0.8	2.6	0.30	—	STD	20.2	25	21	111
												4.8			ALT	22.4	25	24	133
												2.6		1.2	STD	21.4	25	23	114
												4.8			ALT	23.6	30	25	136
	575-3-60	518	633	5.6	37	5.6	37	—	—	2	0.8	2.0	0.24	—	STD	16.2	20	17	89
												2.8			ALT	17	20	18	100
												2.0		3.0	STD	19.2	25	20	93
												2.8			ALT	20	25	21	104
12	208/230	187	253	17.6	123	17.6	123	—	—	2	1.9	7.5	0.52	—	STD	50.9/50.9	60/60	53/53	310/310
												10.2			ALT	53.6/53.6	60/60	57/57	327/327
												7.5		3.0	STD	53.9/53.9	60/60	57/57	314/314
												10.2			ALT	56.6/56.6	70/70	60/60	331/331
	460	414	506	7.7	50	7.7	50	—	—	2	1.0	3.4	0.30	—	STD	22.7	30	24	132
												4.8			ALT	24.1	30	26	141
												3.4		1.2	STD	23.9	30	25	135
												4.8			ALT	25.3	30	27	144
	575-3-60	518	633	6.1	40	6.1	40	—	—	2	0.8	2.8	0.24	—	STD	18.1	20	19	106
												2.8			ALT	18.1	20	19	106
												2.8		3.0	STD	21.1	25	23	110
												2.8			ALT	21.1	25	23	110
14	208/230-3-60	187	253	22.4	149	22.4	149	—	—	2	1.9	10.2	0.52	—	STD	64.4/64.4	80/80	68/68	379/379
												15.0			ALT	69.2/69.2	90/90	73/73	388/388
												10.2		3.0	STD	67.4/67.4	80/80	71/71	383/383
												15.0			ALT	72.2/72.2	90/90	77/77	392/392
	460-3-60	414	506	10.6	75	10.6	75	—	—	2	1.0	4.8	0.30	—	STD	30.7	40	32	191
												7.4			ALT	33.3	40	35	195
												4.8		1.2	STD	31.9	40	34	194
												7.4			ALT	34.5	45	37	198
	575-3-60	518	633	7.7	54	7.7	54	—	—	2	0.8	2.8	0.24	—	STD	21.7	25	23	134
												5.6			ALT	24.5	30	26	148
												2.8		3.0	STD	24.7	30	26	138
												5.6			ALT	27.5	30	29	152
16	208/230-3-60	187	253	18.1	137	18.1	137	17.6	123	3	1.9	10.2	0.52	—	STD	74.2/74.2	90/90	80/80	482/482
												15.0			ALT	79.0/79.0	90/90	86/86	491/491
												19.4			ALT	83.8/83.8	100/100	91/91	529/529
												10.2		3.0	STD	77.2/77.2	90/90	84/84	486/486
												15.0			ALT	82.0/82.0	100/100	89/89	495/495
												19.4			ALT	86.8/86.8	100/100	94/94	533/533
	460-3-60	414	506	9.0	62	9.0	62	7.7	50	3	1.0	4.8	0.30	—	STD	35.8	40	39	217
												7.4			ALT	38.4	45	42	221
												9.7			ALT	40.8	50	44	240
												4.8		1.2	STD	37	45	40	220
												7.4			ALT	39.6	45	43	224
												9.7			ALT	42	50	46	243
	575-3-60	518	633	6.8	50	6.8	50	6.1	40	3	0.8	2.8	0.24	—	STD	26.6	30	29	168
												5.6			ALT	29.4	35	32	182
												7.8			ALT	31.9	35	34	197
												2.8		3.0	STD	29.6	35	32	172
												5.6			ALT	32.4	35	35	186
												7.8			ALT	34.9	40	38	201

LEGEND

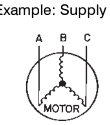
- **FLA** – Full Load Amps
- **HACR** – Heating, Air Conditioning and Refrigeration
- **IFM** – Indoor (Evaporator) Fan Motor
- **LRA** – Locked Rotor Amps
- **MCA** – Minimum Circuit Amps
- **MOCP** – Maximum Overcurrent Protection
- **NEC** – National Electrical Code
- **OFM** – Outdoor–Fan Motor
- **RLA** – Rated Load Amps

NOTES:

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

$$\text{Average Voltage} = \frac{224 + 231 + 226}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.
(AB) 227 – 223 = 3 v
(BC) 231 – 227 = 4 v
(AC) 227 – 226 = 1 v
Maximum deviation is 4 v.
Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{227} = 1.76\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

Table 4 — Electrical Data — Units With Optional Convenience Outlet

UNIT 48PG	NOMINAL POWER SUPPLY Volts-Ph-Hz	VOLTAGE RANGE		COMPRESSOR						OFM		IFM FLA	COMBUSTION FAN MOTOR FLA	PWR EXH FLA (ea)	IFM TYPE	POWER SUPPLY		DISCONNECT SIZE	
				No. 1		No. 2		No. 3											
		Min	Max	RLA	LRA	RLA	LRA	RLA	LRA	Qty	FLA (ea)					MCA	MOCP	FLA	LRA
08	208/230-3-60	187	253	13.5	88	13.5	88	—	—	2	1.5	5.2	0.52	—	STD	43.4/43.4	50/50	46/46	217/217
												7.5			ALT	45.7/45.7	50/50	49/49	243/243
												5.2		3.0	STD	46.4/46.4	50/50	49/49	221/221
												7.5			ALT	48.7/48.7	60/60	52/52	247/247
	460-3-60	414	506	6.4	39	6.4	39	—	—	2	0.8	2.6	0.30	—	STD	20.8	25	22	99
												3.4			ALT	21.6	25	23	112
												2.6		1.2	STD	22	25	23	102
												3.4			ALT	22.8	25	24	115
	575-3-60	518	633	5.1	34	5.1	34	—	—	2	0.8	2.0	0.24	—	STD	16.8	20	18	85
												2.8			ALT	17.6	20	19	96
												2.0		3.0	STD	19.8	25	21	89
												2.8			ALT	20.6	25	22	100
09	208/230-3-60	187	253	16.0	91	16.0	91	—	—	2	1.5	5.2	0.52	—	STD	49.0/49.0	60/60	52/52	223/223
												10.2			ALT	54.0/54.0	60/60	58/58	266/266
												5.2		3.0	STD	52.0/52.0	60/60	55/55	227/227
												10.2			ALT	57.0/57.0	70/70	61/61	270/270
	460-3-60	414	506	7.1	46	7.1	46	—	—	2	0.8	2.6	0.30	—	STD	22.4	25	24	113
												4.8			ALT	24.6	30	26	135
												2.6		1.2	STD	23.6	30	25	116
												4.8			ALT	25.8	30	28	138
	575-3-60	518	633	5.6	37	5.6	37	—	—	2	0.8	2.0	0.24	—	STD	17.9	20	19	91
												2.8			ALT	18.7	25	20	102
												2.0		3.0	STD	20.9	25	22	95
												2.8			ALT	21.7	25	23	106
12	208/230-3-60	187	253	17.6	123	17.6	123	—	—	2	1.9	7.5	0.52	—	STD	55.7/55.7	70/70	59/59	315/315
												10.2			ALT	58.4/58.4	70/70	62/62	332/332
												7.5		3.0	STD	58.7/58.7	70/70	62/62	319/319
												10.2			ALT	61.4/61.4	70/70	66/66	336/336
	460-3-60	414	506	7.7	50	7.7	50	—	—	2	1.0	3.4	0.30	—	STD	24.9	30	26	134
												4.8			ALT	26.3	30	28	143
												3.4		1.2	STD	26.1	30	28	137
												4.8			ALT	27.5	30	29	146
	575-3-60	518	633	6.1	40	6.1	40	—	—	2	0.8	2.8	0.24	—	STD	19.8	25	21	108
												2.8			ALT	19.8	25	21	108
												2.8		3.0	STD	22.8	25	24	112
												2.8			ALT	22.8	25	24	112
14	208/230-3-60	187	253	22.4	149	22.4	149	—	—	2	1.9	10.2	0.52	—	STD	69.2/69.2	90/90	73/73	384/384
												15.0			ALT	74.0/74.0	90/90	79/79	393/393
												10.2		3.0	STD	72.2/72.2	90/90	77/77	388/388
												15.0			ALT	77.0/77.0	90/90	82/82	397/397
	460-3-60	414	506	10.6	75	10.6	75	—	—	2	1.0	4.8	0.30	—	STD	32.9	40	35	193
												7.4			ALT	35.5	45	38	197
												4.8		1.2	STD	34.1	40	36	196
												7.4			ALT	36.7	45	39	200
	575-3-60	518	633	7.7	54	7.7	54	—	—	2	0.8	2.8	0.24	—	STD	23.4	30	25	136
												5.6			ALT	26.2	30	28	150
												2.8		3.0	STD	26.4	30	28	140
												5.6			ALT	29.2	35	31	154
16	208/230-3-60	187	253	18.1	137	18.1	137	17.6	123	3	1.9	10.2	0.52	—	STD	79.0/79.0	90/90	86/ 86	487/487
												15.0			ALT	83.8/83.8	100/100	91/ 91	496/496
												19.4			ALT	88.6/88.6	100/100	96/ 96	534/534
												10.2		3.0	STD	82.0/82.0	100/100	89/ 89	491/491
												15.0			ALT	86.8/86.8	100/100	95/ 95	500/500
												19.4			ALT	91.6/91.6	100/100	100/100	538/538
	460-3-60	414	506	9.0	62	9.0	62	7.7	50	3	1.0	4.8	0.30	—	STD	38	45	41	219
												7.4			ALT	40.6	45	44	223
												9.7			ALT	43	50	47	242
												4.8		1.2	STD	39.2	45	42	222
												7.4			ALT	41.8	50	45	226
												9.7			ALT	44.2	50	48	245
	575-3-60	518	633	6.8	50	6.8	50	6.1	40	3	0.8	2.8	0.24	—	STD	28.3	35	31	170
												5.6			ALT	31.1	35	34	184
												7.8			ALT	33.6	40	36	199
												2.8		3.0	STD	31.3	35	34	174
												5.6			ALT	34.1	40	37	188
												7.8			ALT	36.6	40	40	203

LEGEND

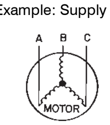
FLA – Full Load Amps
HACR – Heating, Air Conditioning and Refrigeration
IFM – Indoor (Evaporator) Fan Motor
LRA – Locked Rotor Amps
MCA – Minimum Circuit Amps
MOCP – Maximum Overcurrent Protection
NEC – National Electrical Code
OFM – Outdoor−Fan Motor
RLA – Rated Load Amps

NOTES:

1. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker.
2. **Unbalanced 3-Phase Supply Voltage**
   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

$$\text{Average Voltage} = \frac{224 + 231 + 226}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.
(AB) 227 − 223 = 3 v
(BC) 231 − 227 = 4 v
(AC) 227 − 226 = 1 v
Maximum deviation is 4 v.
Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{227} = 1.76\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

48PG08–16

Step 10 —Optional EconoMi$er IV

The optional EconoMi$er IV comes from the factory fully wired. The outdoor air hoods must be installed. No field wiring is required for standard outdoor dry bulb changeover operation. Field-wiring of accessory sensors is required for different operational modes.

Install Outdoor-Air Hoods

Perform the following procedure to install the outdoor-air hoods:

1. Economizer and barometric relief hoods are stored in the condenser section under the slanted coil for shipping. (See Fig. 18 and 19.) Size 16 units also have two 1-in. cleanable filters and a baffle stored between the economizer hoods. Barometric relief/power exhaust hood is shipped inside of economizer hood. Remove screws that secure the wooden rails of the hood assemblies to the unit. Save screws. Slide complete assembly from condenser section. On size 16 units, remove the baffle and save screws.
2. Remove the screws that secure the economizer and barometric relief/power exhaust hoods to the wooden railing. Discard or recycle wooden rails. Save screws.
3. The barometric relief damper is secured to the economizer panel for shipping. Remove the screw holding the barometric relief damper to the economizer panel. Damper should be free to swing open during operation. (See Fig. 20 and 21.) On size 16 units, repeat for second hood.
4. Hang the barometric relief/power exhaust hood on the mounting flange on the economizer panel. Secure hood to panel with screws saved from Step 2. See Fig. 20 - 22. On size 16 units, repeat for second hood.
5. Align hole in flange of economizer panel with left edge of hood. Hang economizer hood on the top flange of the economizer panel by rotating hood until top flange of the economizer hood engages the bent flange on the economizer panel. Rotate hood until hood is flush with the economizer panel. Hood will support itself from flange. Align holes in hood with holes in panel and secure hood to panel with screws saved from Step 2. (See Fig. 20, 21, and 23.)

   Size 16 Only — Loosen screws securing the clip on top of the flange of each opening. Rotate clip 180° and tighten screw. Install 1-in. filter provided by inserting under the clip on the flange and letting filter drop behind bracket holding barometric relief hoods. Repeat for second hood.
6. On size 16 units, install baffle between the outdoor air hoods with the screws saved from Step 1. (See Fig. 21.)

Economi$er IV Standard Sensors

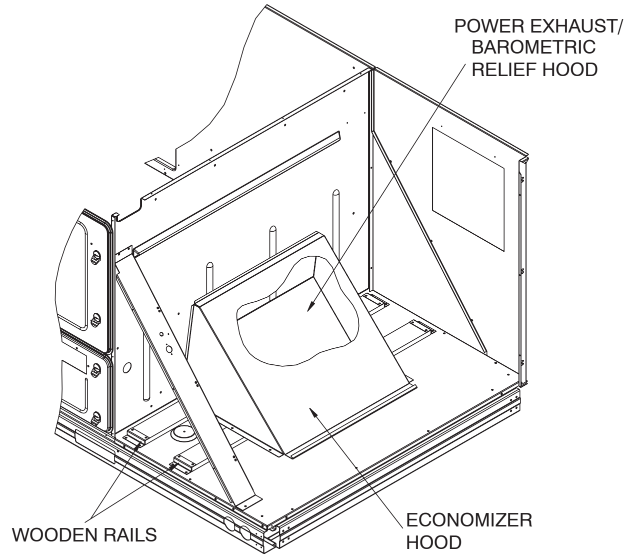
Outdoor Air Temperature (OAT) Sensor

The outdoor air temperature sensor is a 10 to 20 mA device used to measure the outdoor-air temperature. The outdoor-air temperature is used to determine when the EconoMi$er IV can be used for free cooling. The sensor is factory-installed on the EconoMi$er IV in the outdoor airstream. The operating range of temperature measurement is 40° to 100° F.

Mixed-Air Temperature (MAT) Sensor

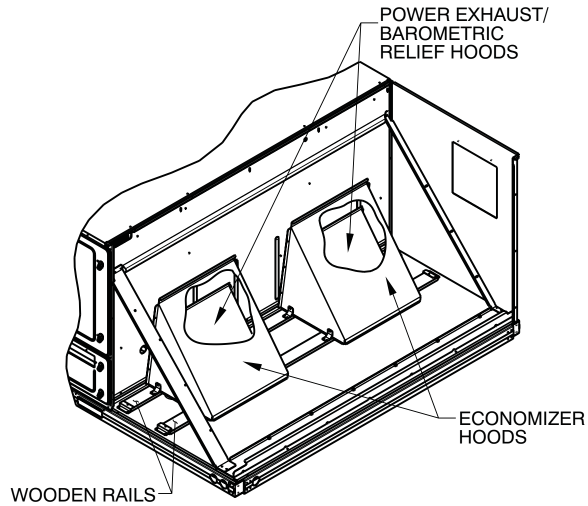
The mixed-air temperature sensor is a 3 K thermistor located at the discharge of the indoor fan. The sensor is mounted through the side plate of the blower. This sensor is factory installed. The operating range of temperature measurement is 0° to 158° F.

The temperature sensor looks like a probe with blue leads running to it. The sensor is sealed from moisture.



C06290

Fig. 18 – Economizer and Barometric Relief/Power Exhaust Hoods Shipping Positions (48PG08-14)



C06259

Fig. 19 – Economizer and Barometric Relief/Power Exhaust Hoods Shipping Positions (48PG16)

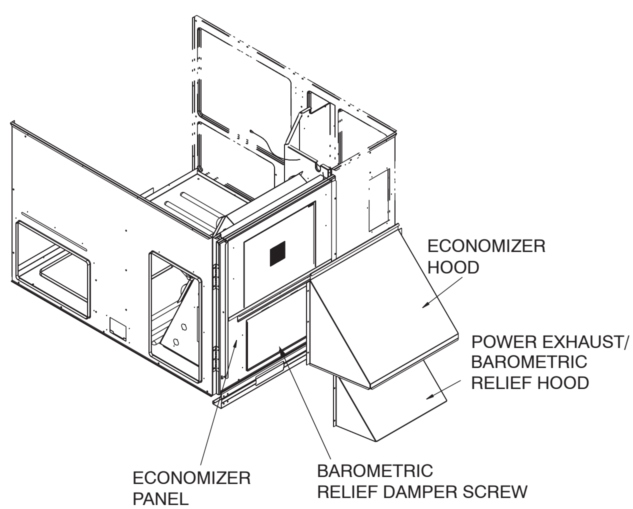


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Fig. 20 – Hood Installation (48PG08-14)

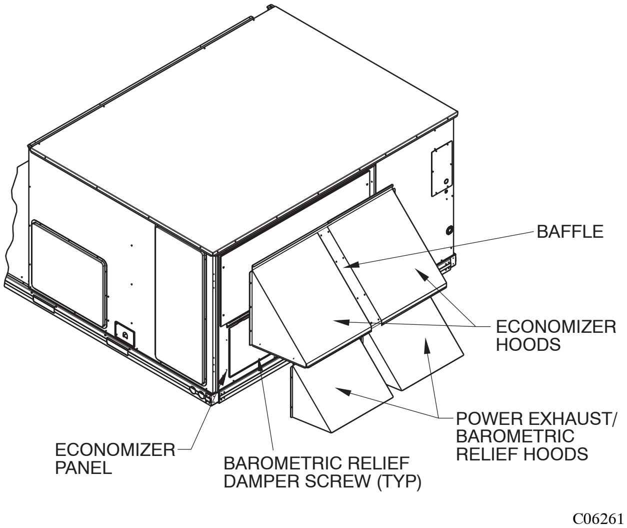


Fig. 21 — Hood Installation (48PG16)

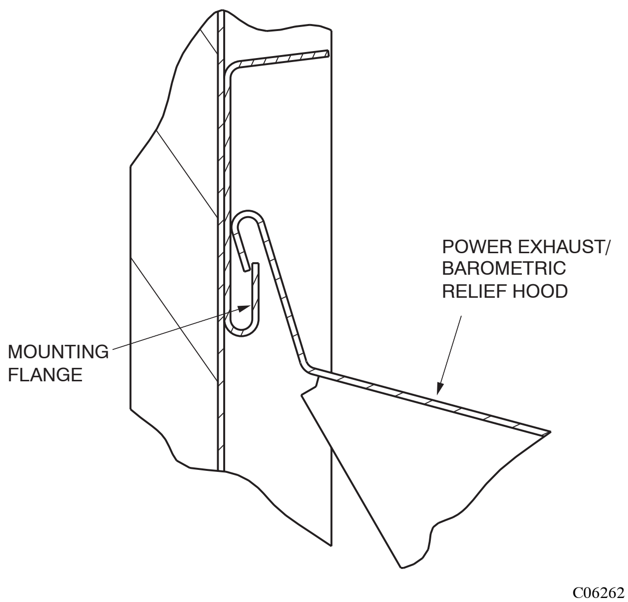


Fig. 22 — Barometric Relief/Power Exhaust Hood Flange

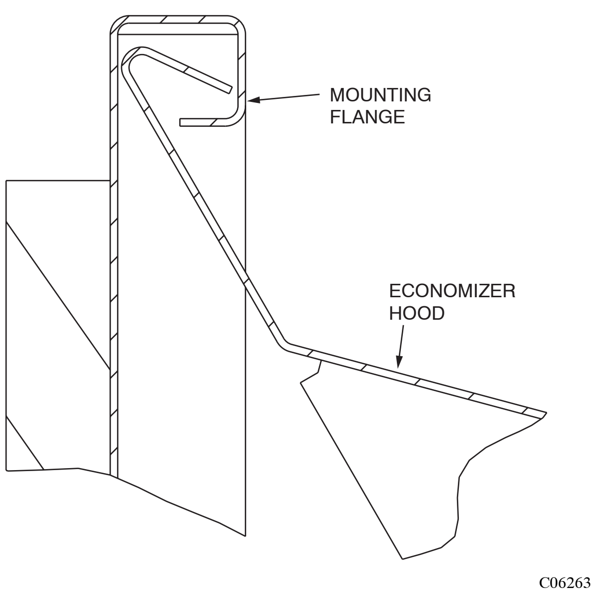


Fig. 23 — Economizer Flange

Outdoor Air Lockout Sensor

The EconoMi$er IV is equipped with a temperature limit switch located in the outdoor airstream which is used to lock out the compressors below a 50° F ambient temperature.

Economi$er IV Controller Wiring and Operational Mode

Determine the EconoMi$er IV control mode before installing sensors and accessories. Different sensors are required for different control modes, and a number of accessories are available. Refer to Table 5. The EconoMi$er IV is supplied from the factory with a mixed air temperature sensor and an outdoor air temperature sensor. This allows for operation of the EconoMi$er IV with outdoor air dry bulb changeover control. Additional accessories can be added to allow for different types of changeover control and operation of the EconoMi$er IV and unit. See Fig. 24 for wiring.

Outdoor Dry Bulb Changeover

The standard controller is shipped from the factory configured for outdoor dry bulb changeover control. The outdoor air and mixed air temperature sensors are included as standard. For this control mode, the outdoor temperature is compared to an adjustable set point selected on the control. If the outdoor-air temperature is above the set point, the EconoMi$er IV will adjust the outside air dampers to minimum position. If the outdoor-air temperature is below the set point, the position of the outside air dampers will be controlled to provided free cooling using outdoor air. When in this mode, the LED next to the free cooling set point potentiometer will be on. The changeover temperature set point is controlled by the free cooling set point potentiometer located on the control. The scale on the potentiometer is A, B, C, and D. See Fig. 25 for the corresponding temperature changeover values.

Differential Dry Bulb Control

For differential dry bulb control the standard outdoor dry bulb sensor is used in conjunction with an additional accessory dry bulb sensor (part number CRTEMPSN002A00). The accessory sensor must be mounted in the return airstream. Connect the return air temperature sensor to the S_R terminal (after removing the 620-ohm resistor) and to the + terminal on the controller. (See Fig. 26.)

In this mode of operation, the outdoor-air temperature is compared to the return air temperature and the lower temperature airstream is used for cooling. When using this mode of changeover control, turn the enthalpy set point potentiometer fully clockwise to the D setting. (See Fig. 27.)

Outdoor Enthalpy Changeover

For enthalpy control, accessory enthalpy sensor (part number HH57AC078) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. When the outdoor air enthalpy rises above the outdoor enthalpy changeover set point, the outdoor-air damper moves to its minimum position. The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the EconoMi$er IV controller. The set points are A, B, C, and D. (See Fig. 28.) The factory-installed 620-ohm jumper must be in place across terminals S_R and + on the EconoMi$er IV controller. (See Fig. 26.)

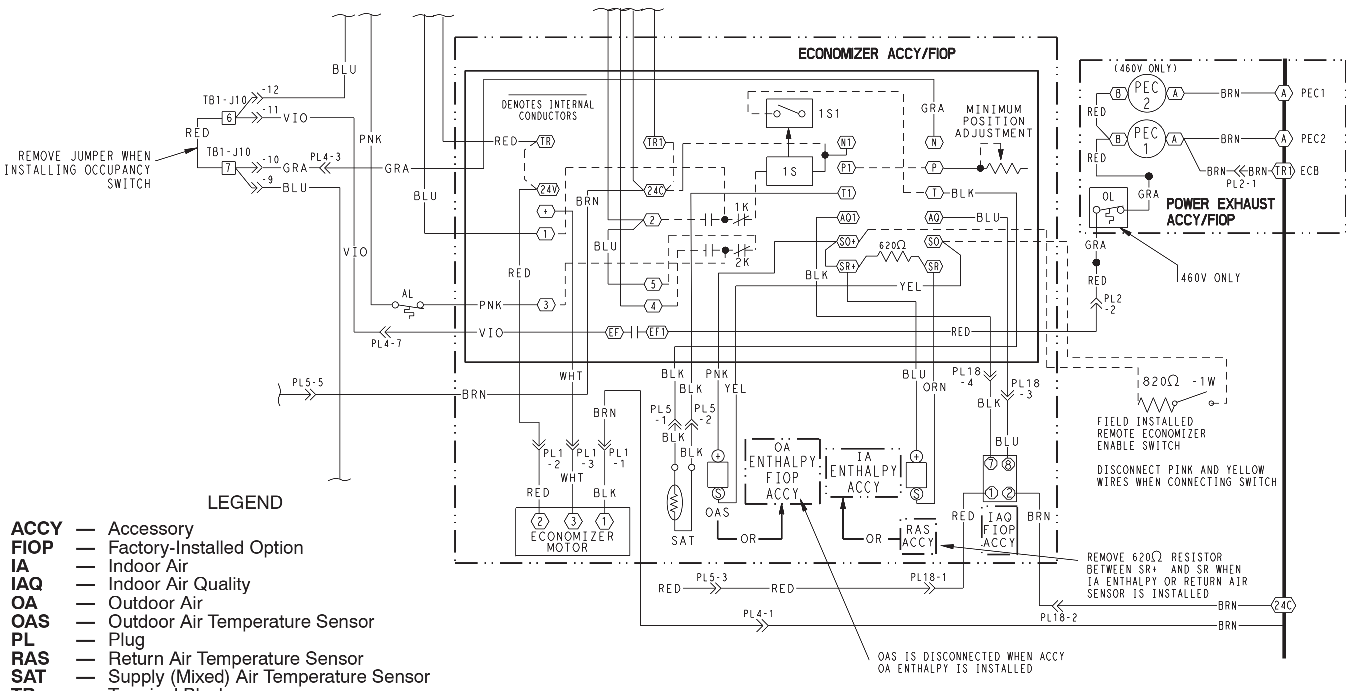
Differential Enthalpy Control

For differential enthalpy control, the EconoMi$er IV controller uses two enthalpy sensors (CRENTDIF004A00), one in the outside air and one in the return air duct. The EconoMi$er IV controller compares the outdoor air enthalpy to the return air enthalpy to determine EconoMi$er IV use. The controller selects the lower enthalpy air (return or outdoor) for cooling. For example, when the outdoor air has a lower enthalpy than the return air, the EconoMi$er IV opens to bring in outdoor air for free cooling.

Table 5 — EconoMi$er IV Sensor Usage

APPLICATION	ECONOMI$ER IV WITH OUTDOOR AIR DRY BULB SENSOR			ECONOMI$ER IV WITH SINGLE ENTHALPY SENSOR		
	Accessories Required			**Accessories Required**		
Outdoor Air Dry Bulb	None. The outdoor air dry bulb sensor is factory installed.			CRTEMPSN002A00*		
Differential Dry Bulb	CRTEMPSN002A00*			(2) CRTEMPSN002A00*		
Single Enthalpy	HH57AC078			None. The single enthalpy sensor is factory installed.		
Differential Enthalpy	HH57AC078 and CRENTDIF004A00*			CRENTDIF004A00*		
CO_2 for DCV Control using a Wall-Mounted CO_2 Sensor	33ZCSENCO2			33ZCSENCO2		
CO_2 for DCV Control using a Duct-Mounted CO_2 Sensor	33ZCSENCO2† and 33ZCASPCO2**	OR	CRCBDIOX005A00††	33ZCSENCO2† and 33ZCASPCO2**	OR	CRCBDIOX005A00††

* CRENTDIF004A00 and CRTEMPSN002A00 accessories are used on many different base units. As such, these kits may contain parts that will not be needed for installation.
† 33ZCSENCO2 is an accessory CO_2 sensor.
** 33ZCASPCO2 is an accessory aspirator box required for duct-mounted applications.
†† CRCBDIOX005A00 is an accessory that contains both 33ZCSENCO2 and 33ZCASPCO2 accessories.

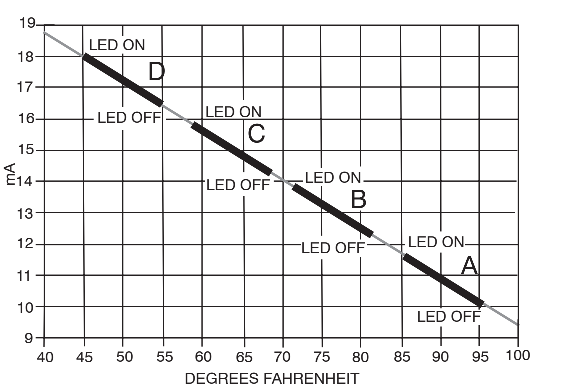


LEGEND

ACCY — Accessory
FIOP — Factory-Installed Option
IA — Indoor Air
IAQ — Indoor Air Quality
OA — Outdoor Air
OAS — Outdoor Air Temperature Sensor
PL — Plug
RAS — Return Air Temperature Sensor
SAT — Supply (Mixed) Air Temperature Sensor
TB — Terminal Block

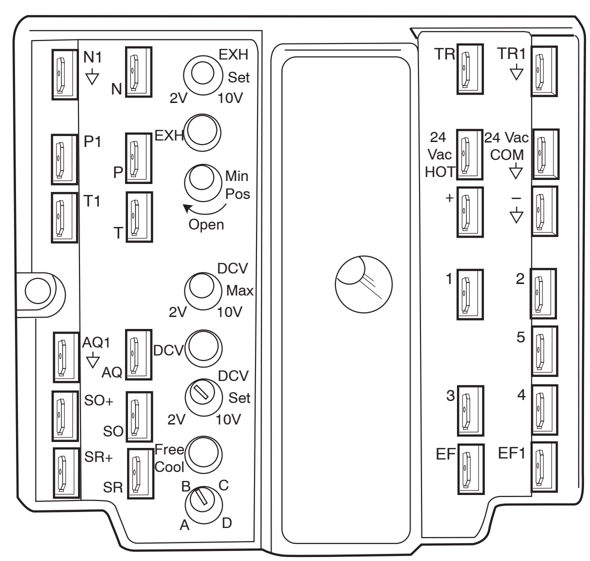
C06163

Fig. 24 — EconoMi$er IV Wiring



C06035

Fig. 25 — Temperature Changeover Set Points



C06038

Fig. 26 — Economi$er IV Control

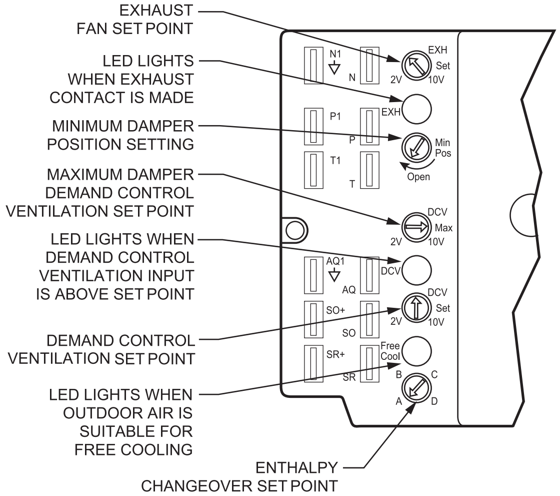


Fig. 27 − Economi$er IV Controller Potentiometer and LED Locations

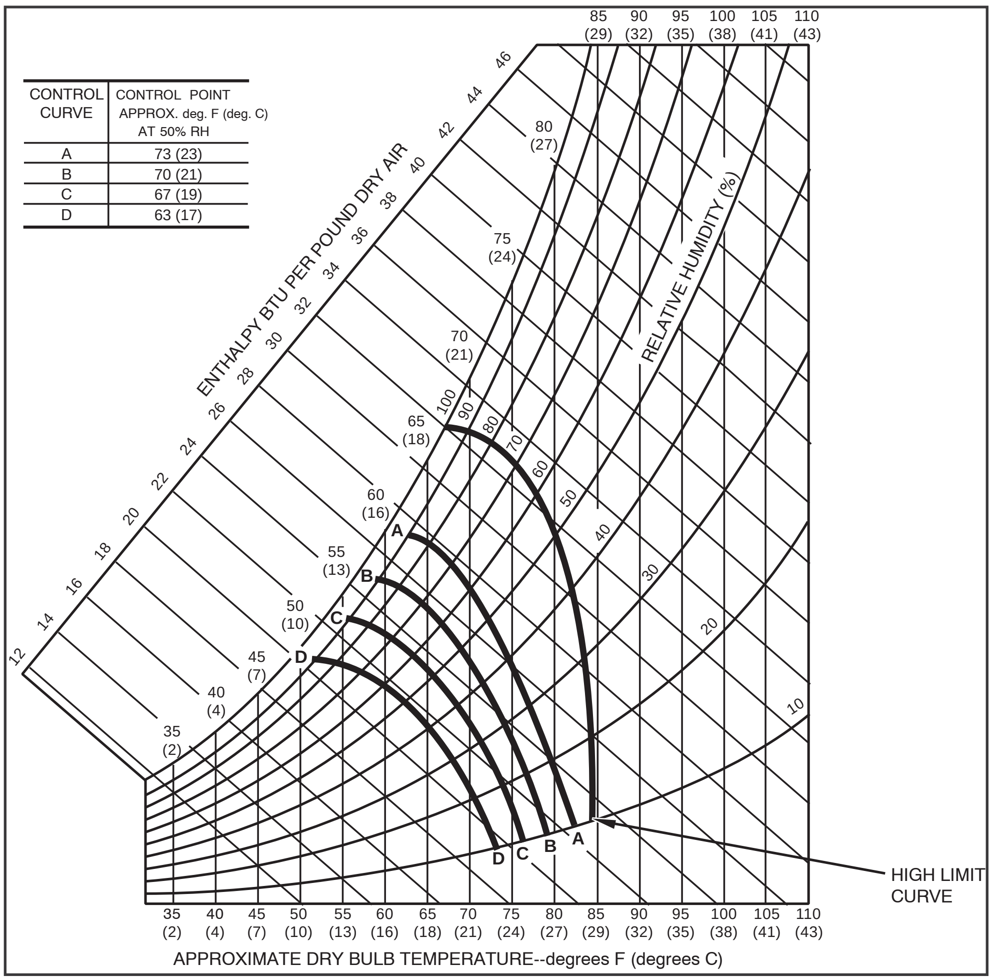


Fig. 28 − Enthalpy Changeover Set Points

Replace the standard outside air dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. Mount the return air enthalpy sensor in the return air duct. The return air enthalpy sensor is wired to terminals S_R and + on the EconoMi$er IV controller. (See Fig. 26.) The outdoor enthalpy changeover set point is set with the outdoor enthalpy set point potentiometer on the EconoMi$er IV controller. When using this mode of changeover control, turn the enthalpy set point potentiometer fully clockwise to the D setting.

Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO_2 measured in the space or return air duct.

Mount the optional IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV (demand controlled ventilation) potentiometers to correspond to the DCV voltage output of the indoor air quality sensor at the user-determined set point. (See Fig. 29.)

If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the EconoMi$er IV control board will be damaged. (See Fig. 24.)

Power Exhaust

The factory-installed power exhaust will be factory wired and installed. If an accessory power exhaust is to be installed, see the accessory power exhaust installation instructions included with the power exhaust for installation and wiring. The wiring plug on the power exhaust is connected to wiring harness plug PL1-3,4.

Exhaust Set Point Adjustment

The exhaust set point will determine when the exhaust fan runs based on damper position (if accessory power exhaust is installed). The set point is modified with the Exhaust Fan Set Point (EXH SET) potentiometer. The set point represents the damper position above which the exhaust fans will be turned on. When there is a call for exhaust, the EconoMi$er IV controller provides a 45 ± 15 second delay before exhaust fan activation to allow the dampers to open. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

Minimum Position Control

There is a minimum damper position potentiometer on the EconoMi$er IV controller. (See Fig. 27.) The minimum damper position maintains the minimum airflow into the building during the occupied period.

When using demand ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compounds) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand ventilation control is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local codes, to enter the building. Make minimum position adjustments with at least 10°F temperature difference between the outdoor and return-air temperatures.

To determine the minimum position setting, perform the following procedure:

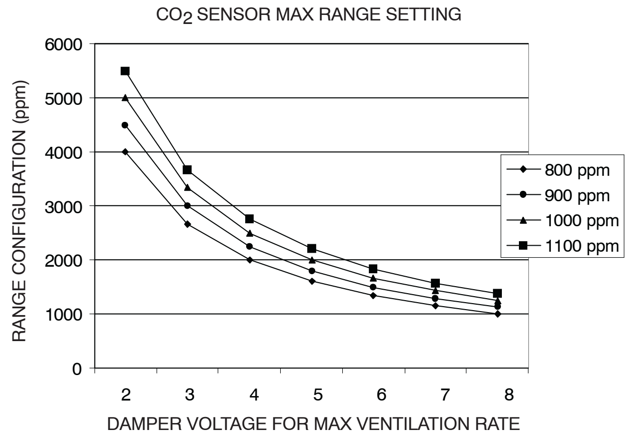
1. Calculate the appropriate mixed-air temperature using the following formula:
   $(T_O \text{ x } OA) + (T_R \text{ x } RA) = T_M$
   T_O = Outdoor-Air Temperature
   OA = Percent of Outdoor Air
   T_R = Return-Air Temperature
   RA = Percent of Return Air
   T_M = Mixed-Air Temperature

   As an example, if local codes require 10% outdoor air during occupied conditions, outdoor-air temperature is 60° F, and return-air temperature is 75° F.

   (60 x .10) + (75 x .90) = 73.5 F
2. Disconnect the mixed-air sensor from terminals T and T1.
3. Ensure that the factory-installed jumper is in place across terminals P and P1. If remote damper positioning is being used, make sure that the terminals are wired according to Fig. 24 and that the minimum position potentiometer is turned fully clockwise.
4. Connect 24 vac across terminals TR and TR1.
5. Carefully adjust the minimum position potentiometer until the measured mixed-air temperature matches the calculated value.
6. Reconnect the mixed-air sensor to terminals T and T1.

Remote control of the EconoMi$er IV damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer (Honeywell part number S963B1128) is wired to the EconoMi$er IV controller, the minimum position of the damper can be controlled from a remote location.

To control the minimum damper position remotely, remove the factory-installed jumper on the P and P1 terminals on the EconoMi$er IV controller. Wire the field-supplied potentiometer to the P and P1 terminals on the EconoMi$er IV controller. (See Fig. 26.)



C06039

Fig. 29 — CO_2 Sensor Maximum Range Setting

Damper Movement

When the EconoMi$er IV board receives initial power, it can take the damper up to $2^1/_2$ minutes before it begins to position itself. After the initial positioning, subsequent changes to damper position will take up to 30 seconds to initiate. Damper movement from full open to full closed (or vice versa) takes $2^1/_2$ minutes.

Thermostats

The EconoMi$er IV control works with conventional thermostats that have a Y1 (cool stage 1), Y2 (cool stage 2), W1 (heat stage 1), W2 (heat stage 2), and G (fan). The EconoMi$er IV control does not support space temperature sensors. Connections are made at the thermostat terminal connection board located in the main control box.

Pressure Drop

See Fig. 30-32 for EconoMi$er IV pressure drop. Evaporator fan may need to be adjusted.

Demand Control Ventilation (DCV)

When using the EconoMi$er IV for demand control ventilation, there are some equipment selection criteria which should be considered. When selecting the heat capacity and cool capacity of the equipment, the maximum ventilation rate must be evaluated for design conditions. The maximum damper position must be calculated to provide the desired fresh air.

Typically the maximum ventilation rate will be about 5 to 10% more than the typical cfm required per person, using normal outside air design criteria.

A proportional anticipatory strategy should be taken with the following conditions: a zone with a large area, varied occupancy, and equipment that cannot exceed the required ventilation rate at design conditions. Exceeding the required ventilation rate means the equipment can condition air at a maximum ventilation rate that is greater than the required ventilation rate for maximum occupancy. A proportional-anticipatory strategy will cause the fresh air supplied to increase as the room CO_2 level increases even though the CO_2 set point has not been reached. By the time the CO_2 level reaches the set point, the damper will be at maximum ventilation and should maintain the set point.

In order to have the CO_2 sensor control the economizer damper in this manner, first determine the damper voltage output for minimum or base ventilation. Base ventilation is the ventilation required to remove contaminants during unoccupied periods. The following equation may be used to determine the percent of outside air entering the building for a given damper position. For best results there should be at least a 10° difference in outside and return-air temperatures.

$(T_O \times OA) + (T_R \times RA) = T_M$

T_O = Outdoor-Air Temperature

OA = Percent of Outdoor Air

T_R = Return-Air Temperature

RA = Percent of Return Air

T_M = Mixed-Air Temperature

Once base ventilation has been determined, set the minimum damper position potentiometer to the correct position.

The same equation can be used to determine the occupied or maximum ventilation rate to the building. For example, an output of 3.6 volts to the actuator provides a base ventilation rate of 5% and an output of 6.7 volts provides the maximum ventilation rate of 20% (or base plus 15 cfm per person). Use Fig. 29 to determine the maximum setting of the CO_2 sensor. For example, a 1100 ppm set point relates to a 15 cfm per person design. Use the 1100 ppm curve on Fig. 29 to find the point when the CO_2 sensor output will be 6.7 volts. Line up the point on the graph with the left side of the chart to determine that the range configuration for the CO_2 sensor should be 1800 ppm. The EconoMi$er IV controller will output the 6.7 volts from the CO_2 sensor to the actuator when the CO_2 concentration in the space is at 1100 ppm. The DCV set point may be left at 2 volts since the CO_2 sensor voltage will be ignored by the EconoMi$er IV controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Once the fully occupied damper position has been determined, set the maximum damper demand control ventilation potentiometer to this position. Do not set to the maximum position as this can result in over-ventilation to the space and potential high humidity levels.

CO_2 Sensor Configuration

The CO_2 sensor has preset standard voltage settings that can be selected anytime after the sensor is powered up. (See Table 6.)

Use setting 1 or 2 for Carrier equipment.

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to select the preset number. See Table 6.
4. Press Enter to lock in the selection.
5. Press Mode to exit and resume normal operation.

The custom settings of the CO_2 sensor can be changed anytime after the sensor is energized. Follow the steps below to change the non-standard settings:

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to toggle to the NONSTD menu and press Enter.
4. Use the Up/Down button to toggle through each of the nine variables, starting with Altitude, until the desired setting is reached.
5. Press Mode to move through the variables.
6. Press Enter to lock in the selection, then press Mode to continue to the next variable.

Dehumidification of Fresh Air with DCV Control

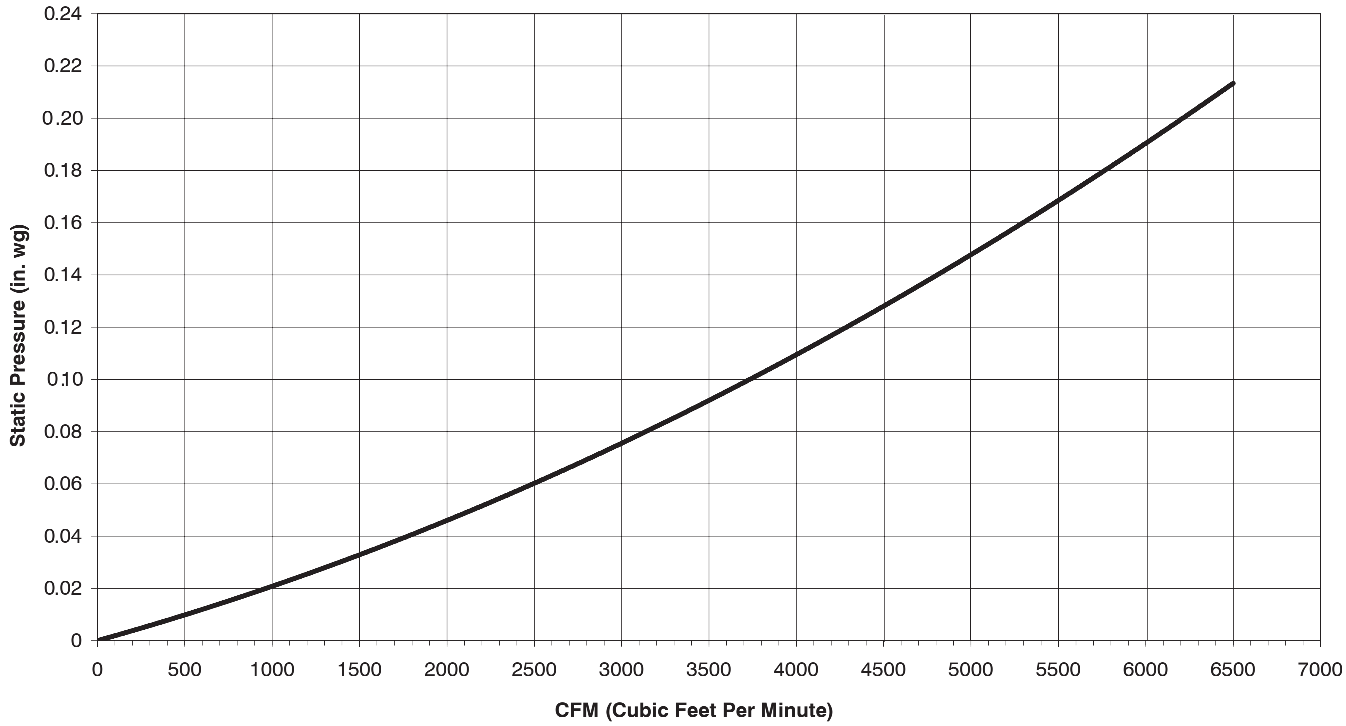
Information from ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) indicates that the largest humidity load on any zone is the fresh air introduced. For some applications, a device such as a 62AQ energy recovery unit is added to reduce the moisture content of the fresh air being brought into the building when the enthalpy is high. In most cases, the normal heating and cooling processes are more than adequate to remove the humidity loads for most commercial applications.

This makes the control of the of the dehumidification device simple when using the enthalpy or differential enthalpy sensor. The enthalpy sensor or differential enthalpy sensor is installed on the equipment to determine economizer operation. The high enthalpy signal from the enthalpy sensor or differential enthalpy sensor can be used to turn on the outdoor air moisture removal device any time fresh air is required for the space.

The energy recovery device should be sized for maximum latent and sensible conditioning at maximum ventilation on a design day. A calculation for leaving-air temperature on a low ambient, low ventilation day should also be done to determine the mixed-air temperature of the return and pre-conditioned outside air. The design should produce an air temperature somewhat near room conditions to prevent reheat of the air mixture. The energy recovery device should be interlocked with the heat to turn off the device when in the heat mode.

Step 11 —Install All Accessories

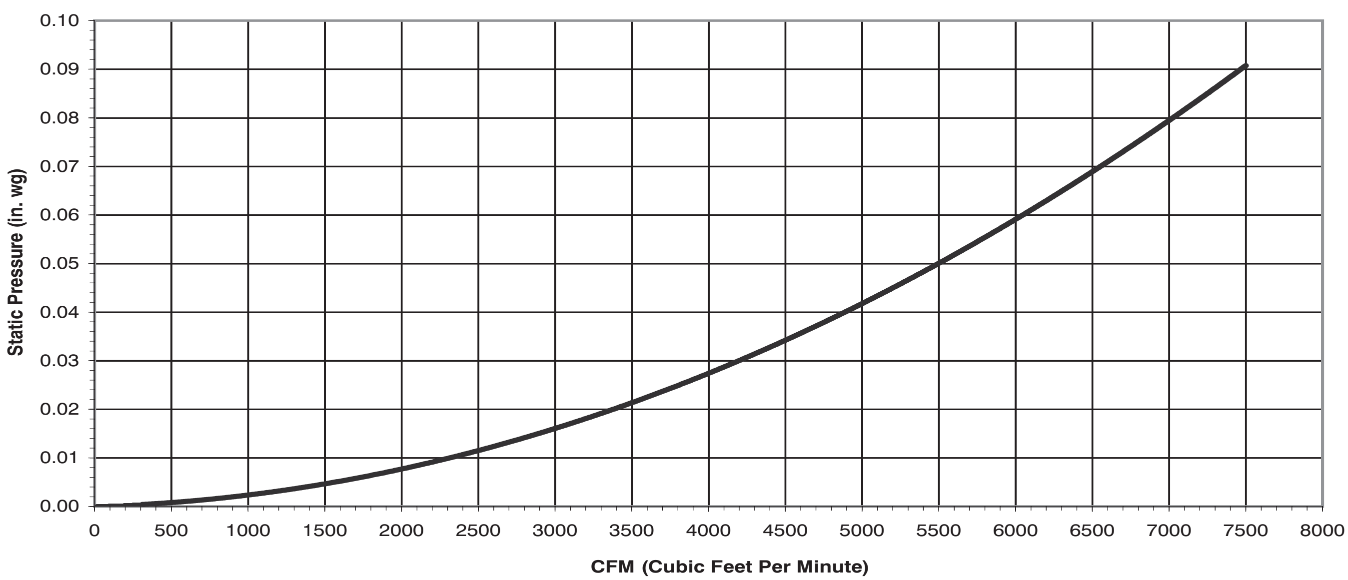
After all of the factory-installed options have been adjusted, install all field-installed accessories. Refer to the accessory installation instructions included with each accessory. Consult the Carrier Price Pages or RTU (rooftop unit) Builder software for accessory package numbers for particular applications. For applications with high outdoor air requirements it is recommended that the outdoor filter accessory be used to eliminate water entrainment during rainfall.



NOTE: Economizer damper pressure drop is with outdoor air damper totally closed and return air damper fully open.

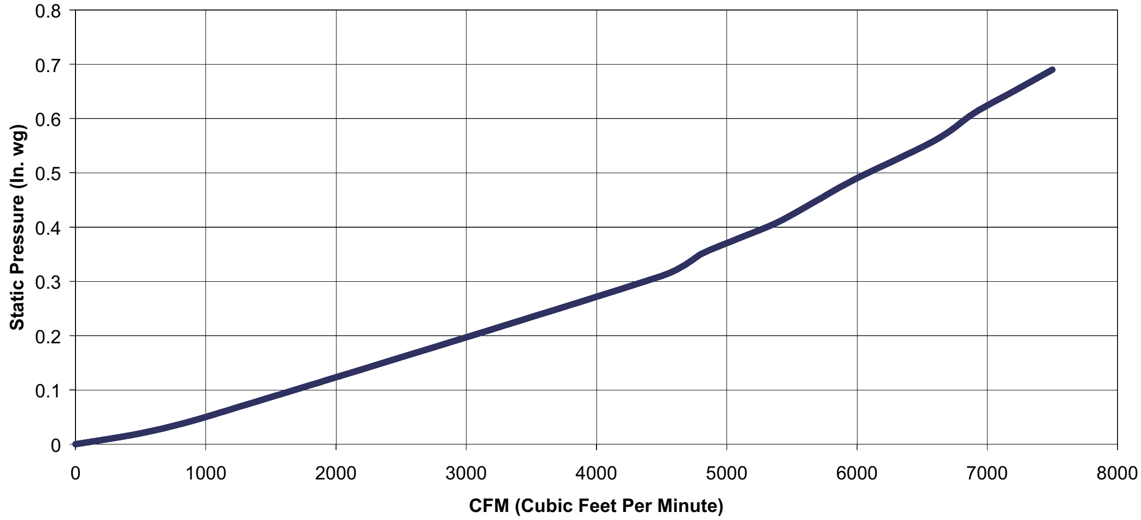
C06177

Fig. 30 — Pressure Drop for Vertical Economizer (48PG08-14)



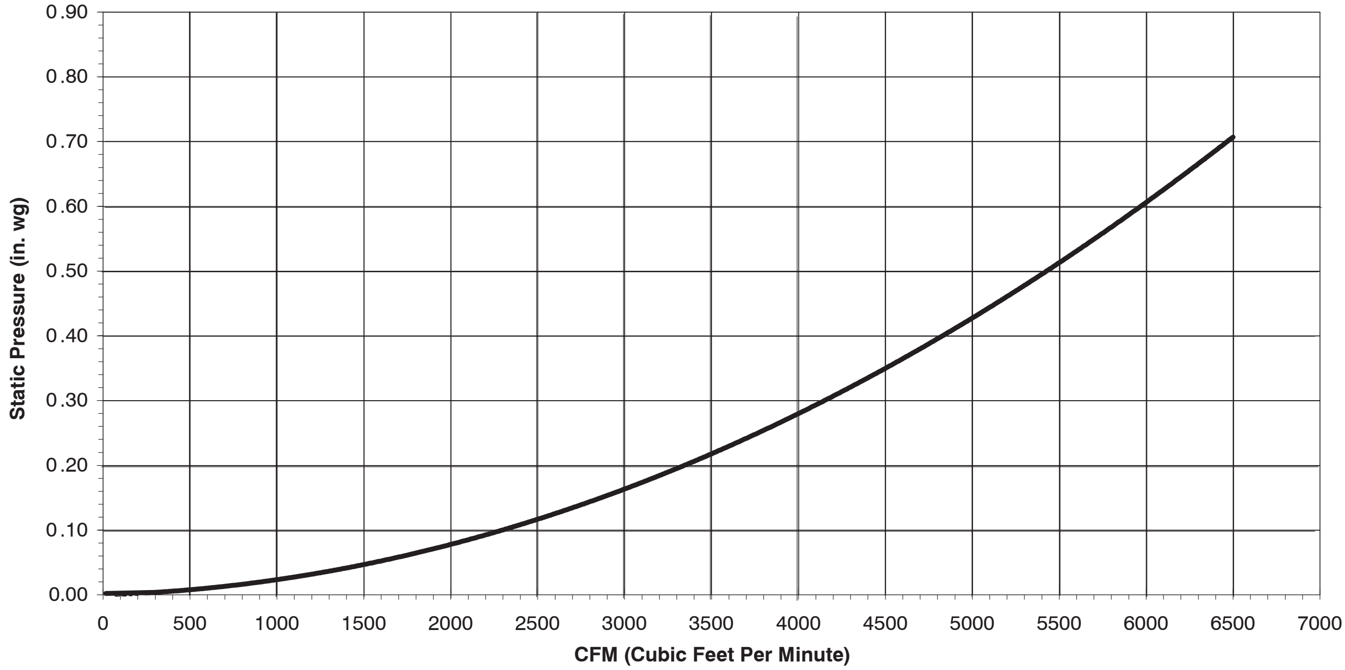
C06249

Fig. 31 — Pressure Drop for Vertical Economizer (48PG16)



C06181

Fig. 32 – Pressure Drop for Horizontal Economizer (48PG16)



NOTE: Economizer damper pressure drop is with outdoor air damper totally closed and return air damper fully open.

C06180

Fig. 33 – Pressure Drop for Horizontal Economizer (48PG08-14)

Table 6 — CO_2 Sensor Standard Settings

SETTING	EQUIPMENT	OUTPUT	VENTILATION RATE (cfm/Person)	ANALOG OUTPUT	CO_2 CONTROL RANGE (ppm)	OPTIONAL RELAY SET-POINT (ppm)	RELAY HYSTERESIS (ppm)
1	Interface With Standard Building Control System	Proportional	Any	0-10V 4-20 mA	0-2000	1000	50
2		Proportional	Any	2-10V 7-20 mA	0-2000	1000	50
3		Exponential	Any	0-10V 4-20 mA	0-2000	1100	50
4	Economizer	Proportional	15	0-10V 4-20 mA	0-1100	1100	50
5		Proportional	20	0-10V 4-20 mA	0- 900	900	50
6		Exponential	15	0-10V 4-20 mA	0-1100	1100	50
7		Exponential	20	0-10V 4-20 mA	0- 900	900	50
8	Health and Safety	Proportional	—	0-10V 4-20 mA	0-9999	5000	500
9	Parking/Air Intakes/ Loading Docks	Proportional	—	0-10V 4-20 mA	0-2000	700	50

PRE-START-UP

⚠ WARNING

PERSONAL INJURY HAZARD

Failure to follow this warning could result in personal injury.

Follow recognized safety practices and wear protective goggles when checking or the servicing refrigerant system.
Do not operate the compressor or provide any electric power to the unit unless the compressor terminal cover is in place and secured.
Do not remove the compressor terminal cover until all electrical sources are disconnected.
Relieve all pressure from the system before touching or disturbing anything inside the compressor terminal box if refrigerant leak is suspected around the compressor terminals.
Never attempt to repair a soldered connection while the refrigerant system is under pressure.
Do not use torch to remove any component. The system contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
Shut off gas and then electrical power to the unit. Install lockout tag.
Relieve all pressure from the system using both high-pressure and low-pressure ports.
Cut the component connection tubing with a tubing cutter, and remove the component from the unit.
Carefully unsweat the remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

Proceed as follows to inspect and prepare the unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, the unit.
3. Make the following inspections:
   a. Inspect for shipping and handling damages such as broken lines, loose parts, or disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using an electronic leak detector, halide torch, or liquid-soap solution.
   c. Inspect all field-wiring and factory-wiring connections. Be sure that connections are completed and tight.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten the fins with a fin comb.
4. Verify the following conditions:
   a. Make sure that condenser fan blade is correctly positioned in the fan orifice. See Condenser-Fan Adjustment section for more details.
   b. Make sure that air filter(s) is in place.
   c. Make sure that condensate drain trap is filled with water to ensure proper drainage.
   d. Make sure that all tools and miscellaneous loose parts have been removed.

START-UP

Unit Preparation

Make sure that unit has been installed in accordance with installation instructions and applicable codes. Complete the Start-Up Checklist, located on the back page of this booklet.

Return-Air Filters

Make sure correct filters are installed in filter tracks (see Tables 1 and 2). Do not operate unit without return-air filters.

Outdoor-Air Inlet Screens

Outdoor-air inlet screen(s) must be in place before operating unit.

Compressor Mounting

Compressors are internally spring mounted. Do not loosen or remove compressor hold-down bolts.

Internal Wiring

Check all electrical connections in unit control boxes. Tighten as required.

Gas Piping

Check gas piping for leaks.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

Disconnect gas piping from unit when leak testing at pressure greater than $^1/_2$ psig. Pressures greater than $^1/_2$ psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than $^1/_2$ psig, it *must* be replaced before use. When pressure testing field- supplied gas piping at pressures of $^1/_2$ psig or less, a unit connected to such piping must be isolated by manually closing the gas valve.

Refrigerant Service Ports

Each independent refrigerant system has a total of 4 Schrader-type service gauge ports per circuit. One port is located on the suction line, one on the compressor discharge line, and 2 on the liquid line on both sides of the filter drier. Be sure that caps on the ports are tight.

Crankcase Heater

Crankcase heaters are energized if compressor B1 is not operating.

High Flow Refrigerant Valves

Three high flow refrigerant valves are located on the compressor hot gas tube, suction tube, and the liquid line leaving the condenser. Large black plastic caps distinguish these valves with O-rings located inside the caps. These valves cannot be accessed for service in the field. Ensure that the plastic caps are in place and tight or the possibility of refrigerant leakage could occur.

Compressor Rotation

It is important to be certain that the compressors are rotating in the proper direction. To determine whether or not compressors are rotating in the proper direction:

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

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Note that the evaporator fan is probably also rotating in the wrong direction.
2. Turn off power to the unit and install lockout tag.
3. Reverse any two of the unit power leads.
4. Reapply power to the compressor.

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

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

When the compressors are rotating in the wrong direction, the unit will have increased noise levels and will not provide heating and cooling. Compressor failure will occur if the unit continues to operate in this condition.

Evaporator Fan

Fan belt and variable pitch pulleys are factory-installed. See Tables 7-36 for fan performance data. Be sure that fans rotate in the proper direction. See Table 37 for air quantity limits. See Table 38 for evaporator fan motor specifications. See Table 39 for fan rpm at various motor pulley settings. To alter fan performance, see Evaporator Fan Performance Adjustment section.

Cooling

To start unit, turn on main power supply. Set system selector switch at COOL position and fan switch at AUTO. position. Adjust thermostat to a setting below room temperature. Compressor starts on closure of contactors.

Check unit charge. Refer to Refrigerant Charge section.

Reset thermostat at a position above room temperature. Compressor will shut off. Evaporator fan will shut off after 30-second delay.

TO SHUT OFF UNIT — Set system switch at OFF position. Resetting thermostat at a position above room temperature shuts unit off temporarily until space temperature exceeds thermostat setting. Units are equipped with Cycle-LOC™ protection device. Unit shuts down on any safety trip and remains off; an indicator light on the thermostat comes on. Check reason for safety trip.

Compressor restart is accomplished by manual reset at the thermostat by turning the selector switch to OFF position and then to ON position.

Main Burners

Main burners are factory set and should require no adjustment.

To check ignition of main burners and heating controls, move thermostat set point above room temperature and verify that the burners light and evaporator fan is energized. After ensuring that the unit continues to heat the building, lower the thermostat setting below room temperature and verify that the burners and evaporator fan turn off.

NOTE: Upon a call for heat the main burners will remain on for a minimum of 60 seconds.

Heating

1. Purge gas supply line of air by opening union ahead of gas valve. When gas odor is detected, tighten union and wait 5 minutes before proceeding.
2. Turn on electrical supply and open manual gas valve.
3. Set system switch selector at HEAT position and fan switch at AUTO. or ON position. Set heating temperature lever above room temperature.
4. The induced-draft motor will start.
5. After a call for heating, the main burners should light within 5 seconds. If the burners do not light, then there is a 22-second delay before another 5-second try. If the burners still do not light, the time delay is repeated. If the burners do not light within 15 minutes, there is a lockout. To reset the control, break the 24 v power to W1.
6. The evaporator fan will turn on 45 seconds after a call for heating.
7. The evaporator fan will turn off 45 seconds after the thermostat temperature is satisfied.
8. Adjust airflow to obtain a temperature rise within the range specified on the unit nameplate and Tables 1 and 2.

NOTE: The default value for the evaporator-fan motor on/off delay is 45 seconds. The Integrated Gas Unit Controller (IGC) modifies this value when abnormal limit switch cycles occur. Based upon unit operating conditions, the on delay can be reduced to 0 seconds and the off delay can be extended to 180 seconds. When one flash of the LED is observed, the evaporator-fan on/off delay has been modified.

If the limit switch trips at the start of the heating cycle during the evaporator on delay, the time period of the on delay for the next cycle will be 5 seconds less than the time at which the switch tripped. (Example: If the limit switch trips at 30 seconds, the evaporator-fan on delay for the next cycle will occur at 25 seconds.) To prevent short-cycling, a 5-second reduction will only occur if a minimum of 10 minutes has elapsed since the last call for heating.

The evaporator-fan off delay can also be modified. Once the call for heating has ended, there is a 10-minute period during which the modification can occur. If the limit switch trips during this period, the evaporator-fan off delay will increase by 15 seconds. A maximum of 9 trips can occur, extending the evaporator-fan off delay to 180 seconds.

To restore the original default value, reset the power to the unit.

TO SHUT OFF UNIT — Set system selector switch at OFF position. Resetting heating selector lever below room temperature will temporarily shut off unit until space temperature falls below thermostat setting.

Safety Relief

A soft-solder joint at the suction-line Schrader port provides pressure relief under abnormal temperature and pressure conditions.

Ventilation (Continuous Fan)

Set fan and system selector switches at ON and OFF positions, respectively. Evaporator fan operates continuously to provide constant air circulation. When the evaporator fan selector switch is turned to the OFF position, there is a 30-second delay before the fan turns off.

Operating Sequence

Cooling, Units Without Economizer

When thermostat calls for cooling, terminals G and Y1 are energized. The indoor-fan contactor (IFC) and compressor contactor (CA.1) are energized and indoor-fan motor, compressor, and outdoor fan starts. The outdoor-fan motor runs continuously while unit is cooling.

If the thermostat is satisfied, Y1 and G deenergize. The compressor stops immediately and the indoor fan will continue to operate for 30 seconds.

If the thermostat calls for a second stage of cooling by energizing Y2, compressor contactor no. 2 (CB.1) is energized and compressor no. 2 starts. When the thermostat is satisfied, Y2 deenergizes, stopping compressor no. 2.

Size 16 units have 3 compressors and 2 stages of cooling. Compressors 1 and 2 are controlled by Y1 and compressor no. 3 is controlled by Y2.

Heating, Units Without Economizer

When the thermostat calls for heating, terminal W1 is energized. To prevent thermostat short-cycling, the unit is locked into the Heating mode for at least 1 minute when W1 is energized. The induced-draft motor is energized and the burner ignition sequence begins. The indoor (evaporator) fan motor (IFM) is energized 45 seconds after a flame is ignited. On units equipped for two stages of heat, when additional heat is needed, W2 (if equipped) is energized and the high-fire solenoid on the main gas valve (MGV) is energized. When the thermostat is satisfied and W1 is deenergized, the IFM stops after a 45-second time-off delay.

Cooling, Units with Economi$er IV

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the EconoMi$er IV control to provide a 50° to 55°F mixed-air temperature into the zone. As the mixed-air temperature fluctuates above 55° or below 50° F, the dampers will be modulated (open or close) to bring the mixed-air temperature back within control.

If the load is high and Y2 is energized, then the first stage of mechanical cooling will be used to supplement the free cooling provided by the economizer. If mechanical cooling is utilized with free cooling, the outdoor-air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the mixed-air temperature to drop below 45°F, then the outdoor-air damper position will be decreased to the minimum position. If the mixed-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the mixed-air temperature rises above 48°F.

If optional power exhaust is installed, as the outdoor-air damper opens and closes, the power exhaust fans will be energized and deenergized if the position goes above or below the power exhaust set point. When the exhaust fan is required to be on, the LED on the control will be energized.

If field-installed accessory CO_2 sensors are connected to the EconoMi$er IV control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 set point, the minimum position of the damper will be increased proportionally from the minimum damper position to the maximum demand ventilation damper position. As the CO_2 level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed.

If there is no G signal then the control will drive the damper to the fully closed position.

The control is also equipped with an occupied/unoccupied input. If the input is closed, then the damper will be driven to the minimum position when G is energized. If the input is open then the damper will remain in the fully closed position unless there is a demand for free cooling of DCV ventilation.

On the initial power to the EconoMi$er IV control, it will take the damper up to $2^1/_2$ minutes before it begins to position itself. Any change in damper position will take up to 30 seconds to initiate. Damper movement from full closed to full open (or vice versa) will take between $1^1/_2$ to $2^1/_2$ minutes.

If free cooling can be used as determined from the appropriate changeover command (switch, dry bulb, enthalpy curve, differential dry bulb, or differential enthalpy), then the control will modulate the dampers open to maintain the mixed air temperature set point at 50° to 55° F.

If there is a further demand for cooling (cooling second stage — Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed air temperature set point. The EconoMi$er IV damper will be open at maximum position. EconoMi$er IV operation is limited to a single compressor.

Heating, Units With Economi$er IV

When the room temperature calls for heat, the heating controls are energized as described in the Heating, Units Without Economizer section. The IFM is energized and the EconoMi$er IV damper modulates to the minimum position. When the thermostat is satisfied, the damper modulates closed.

Table 7 — Fan Performance — 48PGD08 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	464	0.35	541	0.46	612	0.58	677	0.70	739	0.83
2400	479	0.40	554	0.52	622	0.64	686	0.77	745	0.90
2550	496	0.46	568	0.58	633	0.71	695	0.84	753	0.98
2700	512	0.53	582	0.65	646	0.79	705	0.92	762	1.07
2850	530	0.60	597	0.73	658	0.87	716	1.01	771	1.16
3000	547	0.68	612	0.82	672	0.96	728	1.11	782	1.26
3150	565	0.77	628	0.91	686	1.06	741	1.21	793	1.37
3300	583	0.86	644	1.01	701	1.17	754	1.32	805	1.49
3450	602	0.97	661	1.12	716	1.28	768	1.44	817	1.61
3600	621	1.08	678	1.24	732	1.41	782	1.57	831	1.75
3750	640	1.20	696	1.37	748	1.54	797	1.71	844	1.89

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	797	0.96	852	1.10	905	1.25	955	1.40	1003	1.55
2400	802	1.04	856	1.19	908	1.34	957	1.49	1005	1.65
2550	808	1.13	861	1.28	912	1.43	960	1.59	1007	1.75
2700	816	1.22	867	1.37	917	1.53	965	1.70	1011	1.86
2850	824	1.31	874	1.47	923	1.64	970	1.81	1015	1.98
3000	833	1.42	882	1.58	930	1.75	976	1.93	1020	2.11
3150	843	1.53	891	1.70	937	1.88	982	2.05	1026	2.24
3300	854	1.66	900	1.83	946	2.01	990	2.19	1033	2.38
3450	865	1.79	911	1.97	955	2.15	998	2.34	1040	2.53
3600	877	1.93	922	2.11	965	2.30	1007	2.49	1048	2.69
3750	889	2.08	933	2.26	976	2.46	1017	2.65	1057	2.86

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 8 — Fan Performance — 48PGE08 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	463	0.35	541	0.46	611	0.58	677	0.70	738	0.83
2400	481	0.41	556	0.52	623	0.64	687	0.77	747	0.90
2550	499	0.47	571	0.59	637	0.72	698	0.85	756	0.99
2700	518	0.54	587	0.66	650	0.80	710	0.93	766	1.08
2850	537	0.62	603	0.75	665	0.88	722	1.03	777	1.18
3000	556	0.70	620	0.84	680	0.98	735	1.13	789	1.28
3150	575	0.79	637	0.93	695	1.08	749	1.24	801	1.40
3300	595	0.89	655	1.04	711	1.19	764	1.35	814	1.52
3450	615	1.00	673	1.16	727	1.32	778	1.48	828	1.65
3600	635	1.12	691	1.28	744	1.44	794	1.62	842	1.79
3750	655	1.24	710	1.41	761	1.58	810	1.76	856	1.94

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	797	0.96	852	1.10	904	1.25	954	1.40	1002	1.55
2400	803	1.04	857	1.19	909	1.34	958	1.49	1006	1.65
2550	811	1.13	864	1.28	914	1.44	963	1.60	1009	1.76
2700	820	1.23	871	1.38	921	1.54	968	1.71	1014	1.88
2850	829	1.33	879	1.49	928	1.66	974	1.83	1019	2.00
3000	840	1.44	888	1.61	936	1.78	981	1.95	1026	2.13
3150	851	1.56	898	1.73	944	1.90	989	2.08	1033	2.27
3300	862	1.69	909	1.86	954	2.04	998	2.23	1040	2.41
3450	875	1.82	920	2.00	964	2.19	1007	2.38	1049	2.57
3600	888	1.97	932	2.15	975	2.34	1017	2.54	1058	2.73
3750	901	2.12	944	2.31	987	2.51	1028	2.71	1068	2.91

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 9 — Fan Performance — 48PGF08 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	468	0.36	545	0.46	615	0.58	680	0.71	741	0.83
2400	486	0.41	560	0.53	627	0.65	691	0.78	750	0.91
2550	505	0.48	576	0.60	641	0.72	702	0.86	760	1.00
2700	524	0.55	592	0.68	655	0.81	714	0.95	771	1.09
2850	544	0.63	609	0.76	670	0.90	728	1.04	782	1.19
3000	564	0.71	627	0.85	686	1.00	741	1.14	794	1.30
3150	584	0.81	645	0.95	702	1.10	756	1.26	807	1.42
3300	604	0.91	663	1.06	719	1.22	771	1.38	821	1.54
3450	625	1.02	682	1.18	736	1.34	787	1.51	835	1.68
3600	646	1.15	701	1.31	753	1.48	803	1.65	850	1.82
3750	667	1.28	720	1.45	771	1.62	819	1.80	865	1.98

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	799	0.97	854	1.11	907	1.26	957	1.40	1005	1.56
2400	807	1.05	860	1.20	912	1.35	961	1.50	1008	1.66
2550	815	1.14	867	1.29	918	1.45	966	1.61	1013	1.77
2700	824	1.24	875	1.40	925	1.56	972	1.72	1018	1.89
2850	834	1.35	884	1.51	932	1.67	979	1.84	1024	2.02
3000	845	1.46	894	1.63	941	1.80	986	1.97	1030	2.15
3150	857	1.58	904	1.75	950	1.93	995	2.11	1038	2.29
3300	869	1.71	916	1.89	960	2.07	1004	2.25	1046	2.44
3450	882	1.85	928	2.03	971	2.22	1014	2.41	1055	2.60
3600	896	2.00	940	2.19	983	2.38	1025	2.57	1065	2.77
3750	910	2.16	953	2.35	995	2.55	1036	2.75	1076	2.95

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 10 — Fan Performance — 48PGD09 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	496	0.46	568	0.58	633	0.71	695	0.84	753	0.98
2700	512	0.53	582	0.65	646	0.79	705	0.92	762	1.07
2850	530	0.60	597	0.73	658	0.87	716	1.01	771	1.16
3000	547	0.68	612	0.82	672	0.96	728	1.11	782	1.26
3150	565	0.77	628	0.91	686	1.06	741	1.21	793	1.37
3300	583	0.86	644	1.01	701	1.17	754	1.32	805	1.49
3450	602	0.97	661	1.12	716	1.28	768	1.44	817	1.61
3600	621	1.08	678	1.24	732	1.41	782	1.57	831	1.75
3750	640	1.20	696	1.37	748	1.54	797	1.71	844	1.89
3900	659	1.33	713	1.50	764	1.68	812	1.86	858	2.05
4050	679	1.47	731	1.65	781	1.83	828	2.02	873	2.21
4200	698	1.62	750	1.81	798	2.00	844	2.19	888	2.38

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	808	1.13	861	1.28	912	1.43	960	1.59	1007	1.75
2700	816	1.22	867	1.37	917	1.53	965	1.70	1011	1.86
2850	824	1.31	874	1.47	923	1.64	970	1.81	1015	1.98
3000	833	1.42	882	1.58	930	1.75	976	1.93	1020	2.11
3150	843	1.53	891	1.70	937	1.88	982	2.05	1026	2.24
3300	854	1.66	900	1.83	946	2.01	990	2.19	1033	2.38
3450	865	1.79	911	1.97	955	2.15	998	2.34	1040	2.53
3600	877	1.93	922	2.11	965	2.30	1007	2.49	1048	2.69
3750	889	2.08	933	2.26	976	2.46	1017	2.65	1057	2.86
3900	903	2.24	945	2.43	987	2.63	1027	2.83	1067	3.03
4050	916	2.40	958	2.60	999	2.81	1038	3.01	1077	3.22
4200	930	2.58	971	2.79	1011	3.00	1050	3.21	1088	3.42

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 11 — Fan Performance — 48PGE09 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	499	0.47	571	0.59	637	0.72	698	0.85	756	0.99
2700	518	0.54	587	0.66	650	0.80	710	0.93	766	1.08
2850	537	0.62	603	0.75	665	0.88	722	1.03	777	1.18
3000	556	0.70	620	0.84	680	0.98	735	1.13	789	1.28
3150	575	0.79	637	0.93	695	1.08	749	1.24	801	1.40
3300	595	0.89	655	1.04	711	1.19	764	1.35	814	1.52
3450	615	1.00	673	1.16	727	1.32	778	1.48	828	1.65
3600	635	1.12	691	1.28	744	1.44	794	1.62	842	1.79
3750	655	1.24	710	1.41	761	1.58	810	1.76	856	1.94
3900	675	1.38	728	1.55	778	1.73	826	1.91	871	2.10
4050	695	1.52	747	1.71	796	1.89	842	2.08	886	2.27
4200	716	1.68	766	1.87	814	2.06	859	2.25	902	2.45

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	811	1.13	864	1.28	914	1.44	963	1.60	1009	1.76
2700	820	1.23	871	1.38	921	1.54	968	1.71	1014	1.88
2850	829	1.33	879	1.49	928	1.66	974	1.83	1019	2.00
3000	840	1.44	888	1.61	936	1.78	981	1.95	1026	2.13
3150	851	1.56	898	1.73	944	1.90	989	2.08	1033	2.27
3300	862	1.69	909	1.86	954	2.04	998	2.23	1040	2.41
3450	875	1.82	920	2.00	964	2.19	1007	2.38	1049	2.57
3600	888	1.97	932	2.15	975	2.34	1017	2.54	1058	2.73
3750	901	2.12	944	2.31	987	2.51	1028	2.71	1068	2.91
3900	915	2.29	957	2.48	999	2.68	1039	2.89	1078	3.09
4050	929	2.47	971	2.67	1011	2.87	1051	3.08	1089	3.29
4200	944	2.65	985	2.86	1024	3.07	1063	3.28	1100	3.50

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 12 — Fan Performance — 48PGF09 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	505	0.48	576	0.60	641	0.72	702	0.86	760	1.00
2700	524	0.55	592	0.68	655	0.81	714	0.95	771	1.09
2850	544	0.63	609	0.76	670	0.90	728	1.04	782	1.19
3000	564	0.71	627	0.85	686	1.00	741	1.14	794	1.30
3150	584	0.81	645	0.95	702	1.10	756	1.26	807	1.42
3300	604	0.91	663	1.06	719	1.22	771	1.38	821	1.54
3450	625	1.02	682	1.18	736	1.34	787	1.51	835	1.68
3600	646	1.15	701	1.31	753	1.48	803	1.65	850	1.82
3750	667	1.28	720	1.45	771	1.62	819	1.80	865	1.98
3900	688	1.42	740	1.60	789	1.77	836	1.96	881	2.14
4050	709	1.57	760	1.75	808	1.94	854	2.13	898	2.32
4200	730	1.73	780	1.92	827	2.12	871	2.31	914	2.51

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	815	1.14	867	1.29	918	1.45	966	1.61	1013	1.77
2700	824	1.24	875	1.40	925	1.56	972	1.72	1018	1.89
2850	834	1.35	884	1.51	932	1.67	979	1.84	1024	2.02
3000	845	1.46	894	1.63	941	1.80	986	1.97	1030	2.15
3150	857	1.58	904	1.75	950	1.93	995	2.11	1038	2.29
3300	869	1.71	916	1.89	960	2.07	1004	2.25	1046	2.44
3450	882	1.85	928	2.03	971	2.22	1014	2.41	1055	2.60
3600	896	2.00	940	2.19	983	2.38	1025	2.57	1065	2.77
3750	910	2.16	953	2.35	995	2.55	1036	2.75	1076	2.95
3900	925	2.33	967	2.53	1008	2.73	1048	2.93	1087	3.14
4050	940	2.52	981	2.72	1021	2.92	1060	3.13	1099	3.35
4200	956	2.71	996	2.92	1035	3.13	1074	3.34	1111	3.56

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 13 — Fan Performance — 48PGD12 Vertical Units

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	566	0.72	630	0.86	688	1.00	744	1.15	797	1.31
3200	593	0.85	653	0.99	710	1.15	763	1.30	814	1.46
3400	620	0.99	678	1.15	732	1.30	783	1.47	832	1.64
3600	647	1.15	702	1.31	754	1.48	804	1.65	851	1.83
3800	674	1.33	728	1.50	778	1.67	825	1.85	871	2.03
4000	702	1.52	753	1.70	802	1.88	848	2.07	892	2.26
4200	729	1.73	779	1.92	826	2.11	870	2.31	913	2.50
4400	757	1.96	805	2.16	850	2.36	894	2.56	935	2.77
4600	785	2.21	832	2.42	875	2.63	917	2.84	958	3.05
4800	814	2.49	858	2.70	901	2.92	941	3.14	981	3.36
5000	842	2.78	885	3.01	926	3.23	966	3.46	1004	3.69

Airflow (Cfm)	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	847	1.47	896	1.63	943	1.80	988	1.98	1032	2.16
3200	863	1.63	910	1.80	955	1.98	999	2.16	1042	2.35
3400	879	1.81	925	1.99	969	2.17	1012	2.36	1054	2.55
3600	897	2.01	941	2.19	984	2.38	1026	2.58	1066	2.78
3800	915	2.22	958	2.41	1000	2.61	1040	2.81	1080	3.02
4000	935	2.45	976	2.65	1017	2.86	1056	3.06	1095	3.28
4200	955	2.71	995	2.91	1035	3.12	1073	3.34	1110	3.55
4400	976	2.98	1015	3.19	1053	3.41	1090	3.63	—	—
4600	997	3.27	1035	3.49	—	—	—	—	—	—
4800	1019	3.59	—	—	—	—	—	—	—	—
5000	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

▬ High Range Motor/Drive Required

NOTES:
1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 14 — Fan Performance — 48PGE12 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	574	0.74	636	0.87	695	1.02	750	1.17	802	1.32
3200	601	0.87	661	1.01	717	1.17	770	1.32	820	1.49
3400	629	1.02	686	1.17	740	1.33	791	1.49	840	1.66
3600	657	1.18	712	1.34	764	1.51	813	1.68	860	1.86
3800	686	1.36	739	1.53	788	1.71	836	1.89	881	2.07
4000	715	1.56	765	1.74	813	1.93	859	2.12	903	2.31
4200	744	1.78	792	1.97	839	2.17	883	2.36	925	2.56
4400	773	2.03	820	2.22	864	2.43	907	2.63	949	2.84
4600	802	2.29	848	2.50	891	2.71	932	2.92	972	3.13
4800	832	2.58	876	2.79	917	3.01	958	3.23	996	3.45
5000	862	2.88	904	3.11	944	3.34	983	3.56	–	–

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	853	1.48	901	1.65	948	1.82	993	2.00	1037	2.18
3200	869	1.65	916	1.83	961	2.00	1005	2.19	1048	2.37
3400	887	1.84	932	2.02	976	2.20	1019	2.39	1060	2.58
3600	905	2.04	949	2.23	992	2.42	1033	2.61	1074	2.81
3800	925	2.26	967	2.46	1009	2.65	1049	2.86	1088	3.06
4000	945	2.50	987	2.70	1027	2.91	1066	3.12	1104	3.33
4200	967	2.76	1007	2.97	1046	3.18	1084	3.40	1121	3.62
4400	988	3.05	1027	3.26	1065	3.48	1102	3.70	–	–
4600	1011	3.35	1049	3.57	–	–	–	–	–	–
4800	1034	3.68	–	–	–	–	–	–	–	–
5000	–	–	–	–	–	–	–	–	–	–

LEGEND

Bhp — Brake Horsepower

▬ High Range Motor/Drive Required

NOTES:
1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 15 — Fan Performance — 48PGF12 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	578	0.74	640	0.88	698	1.03	753	1.18	805	1.33
3200	606	0.88	665	1.03	721	1.18	774	1.34	824	1.50
3400	635	1.03	691	1.18	745	1.34	795	1.51	844	1.68
3600	663	1.20	718	1.36	769	1.53	818	1.70	865	1.88
3800	693	1.38	745	1.56	794	1.73	841	1.91	886	2.10
4000	722	1.59	772	1.77	820	1.95	865	2.14	909	2.33
4200	752	1.81	800	2.00	846	2.20	889	2.39	932	2.59
4400	781	2.06	828	2.26	872	2.46	914	2.66	955	2.87
4600	811	2.33	856	2.54	899	2.75	940	2.96	980	3.17
4800	841	2.62	884	2.84	926	3.05	966	3.28	1004	3.50
5000	871	2.94	913	3.16	953	3.39	992	3.62	–	–

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	856	1.49	904	1.66	951	1.83	996	2.01	1040	2.19
3200	873	1.67	919	1.84	965	2.02	1008	2.20	1051	2.39
3400	891	1.85	936	2.03	980	2.22	1022	2.41	1064	2.60
3600	910	2.06	954	2.25	996	2.44	1037	2.63	1078	2.83
3800	930	2.29	972	2.48	1014	2.68	1054	2.88	1093	3.09
4000	951	2.53	992	2.73	1032	2.94	1071	3.15	1109	3.36
4200	973	2.80	1013	3.00	1051	3.22	1089	3.43	1126	3.65
4400	995	3.08	1034	3.30	1072	3.52	–	–	–	–
4600	1018	3.39	1056	3.61	–	–	–	–	–	–
4800	–	–	–	–	–	–	–	–	–	–
5000	–	–	–	–		–	–	–	–	–

LEGEND

Bhp — Brake Horsepower

▬ High Range Motor/Drive Required

NOTES:
1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 16 — Fan Performance — 48PGD14 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	667	1.28	721	1.45	772	1.62	820	1.80	866	1.98
3950	695	1.47	747	1.65	796	1.83	842	2.01	887	2.20
4150	723	1.68	772	1.86	820	2.05	865	2.25	908	2.44
4350	750	1.90	799	2.10	844	2.30	888	2.50	930	2.70
4550	778	2.15	825	2.35	869	2.56	911	2.77	952	2.98
4750	807	2.42	851	2.63	894	2.85	935	3.06	975	3.28
4950	835	2.71	878	2.93	920	3.15	960	3.38	998	3.61
5150	863	3.02	905	3.25	946	3.48	984	3.72	1022	3.95
5350	892	3.36	933	3.60	972	3.84	1009	4.08	1046	4.32
5550	920	3.72	960	3.97	998	4.22	1035	4.47	1070	4.72
5750	949	4.10	987	4.36	1024	4.62	1060	4.88	1095	5.14
5950	978	4.52	1015	4.78	1051	5.05	–	–	–	–
6150	1006	4.96	1043	5.23	–	–	—	—	—	—
6250	1021	5.19	–	–	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	911	2.17	954	2.36	996	2.55	1037	2.75	1076	2.95
3950	930	2.39	972	2.59	1012	2.79	1052	3.00	1091	3.21
4150	950	2.64	991	2.85	1030	3.05	1069	3.27	1106	3.48
4350	971	2.91	1010	3.12	1048	3.34	1086	3.55	1123	3.78
4550	992	3.20	1030	3.41	1068	3.64	1104	3.86	1140	4.09
4750	1013	3.50	1051	3.73	1087	3.96	1123	4.19	1158	4.43
4950	1036	3.84	1072	4.07	1108	4.31	1142	4.55	1176	4.79
5150	1058	4.19	1094	4.43	1129	4.68	1162	4.93	1196	5.18
5350	1082	4.57	1116	4.82	1150	5.07	–	–	–	–
5550	1105	4.98	1139	5.23	–	–	—	—	—	—
5750	–	–	–	–	—	—	—	—	—	—
5950	—	—	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 17 — Fan Performance — 48PGE14 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	679	1.31	732	1.49	782	1.66	830	1.84	876	2.02
3950	708	1.51	759	1.69	807	1.87	853	2.06	897	2.25
4150	737	1.73	786	1.92	832	2.11	877	2.30	920	2.50
4350	766	1.96	813	2.16	858	2.36	901	2.56	943	2.76
4550	795	2.22	841	2.43	884	2.63	926	2.84	966	3.06
4750	825	2.50	869	2.72	911	2.93	951	3.15	990	3.37
4950	854	2.80	897	3.03	938	3.25	977	3.48	1015	3.71
5150	884	3.13	925	3.36	965	3.60	1003	3.83	1040	4.07
5350	914	3.49	954	3.73	992	3.97	1029	4.21	1065	4.46
5550	944	3.86	982	4.11	1020	4.36	1056	4.62	1091	4.87
5750	974	4.27	1011	4.53	1048	4.79	1083	5.05	–	–
5950	1004	4.70	1040	4.97	1076	5.24	–	–	–	–
6150	1034	5.17	–	–	–	–	–	–	–	–
6250	–	–	–	–	—	—	–	–	–	–

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	920	2.21	963	2.40	1004	2.59	1045	2.79	1084	3.00
3950	940	2.44	982	2.64	1022	2.84	1061	3.05	1100	3.26
4150	961	2.70	1001	2.90	1041	3.11	1079	3.33	1116	3.54
4350	983	2.97	1022	3.19	1060	3.40	1097	3.62	1134	3.85
4550	1005	3.27	1043	3.49	1080	3.72	1117	3.94	1152	4.17
4750	1028	3.59	1065	3.82	1101	4.05	1137	4.29	1171	4.52
4950	1052	3.94	1088	4.17	1123	4.41	1157	4.65	1191	4.90
5150	1076	4.31	1111	4.55	1145	4.80	1179	5.05	—	—
5350	1100	4.70	1134	4.95	1168	5.21	—	—	—	—
5550	1125	5.13	—	—	—	—	—	—	—	—
5750	—	—	—	—	—	—	—	—	—	—
5950	—	—	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

▬ High Range Motor/Drive Required

NOTES:
1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.710 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

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Table 18 — Fan Performance — 48PGF14 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	685	1.33	738	1.51	788	1.68	835	1.86	881	2.04
3950	715	1.54	765	1.71	813	1.90	859	2.08	903	2.27
4150	744	1.76	793	1.94	839	2.13	883	2.33	926	2.53
4350	774	2.00	821	2.19	865	2.39	908	2.59	950	2.80
4550	804	2.26	849	2.47	892	2.67	934	2.88	974	3.10
4750	834	2.54	877	2.76	919	2.98	959	3.19	998	3.42
4950	864	2.85	906	3.08	946	3.30	985	3.53	1023	3.76
5150	894	3.19	935	3.42	974	3.65	1012	3.89	1049	4.13
5350	924	3.55	964	3.79	1002	4.03	1039	4.28	1074	4.52
5550	955	3.94	993	4.19	1030	4.44	1066	4.69	1101	4.94
5750	985	4.35	1023	4.61	1058	4.87	1093	5.13	—	—
5950	1016	4.79	1052	5.06	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	925	2.23	968	2.42	1009	2.62	1050	2.82	1089	3.02
3950	946	2.47	987	2.67	1027	2.87	1067	3.08	1105	3.29
4150	967	2.73	1007	2.93	1047	3.14	1085	3.36	1122	3.58
4350	990	3.01	1029	3.22	1067	3.44	1104	3.66	1140	3.89
4550	1012	3.31	1050	3.53	1087	3.76	1123	3.99	1159	4.22
4750	1036	3.64	1073	3.87	1109	4.10	1144	4.34	1178	4.57
4950	1060	3.99	1096	4.23	1131	4.47	1165	4.71	1199	4.96
5150	1084	4.37	1119	4.61	1153	4.86	1187	5.11	—	—
5350	1109	4.77	1143	5.02	—	—	—	—	—	—
5550	1135	5.20	—	—	—	—	—	—	—	—
5750	—	—	—	—	—	—	—	—	—	—
5950	—	—	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 19 — Fan Performance — 48PGD16 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	606	0.91	693	1.25	764	1.58	827	1.91	884	2.23
4800	633	1.05	718	1.41	789	1.77	851	2.12	907	2.47
5100	661	1.21	744	1.60	814	1.98	875	2.35	930	2.73
5400	689	1.39	771	1.80	839	2.20	899	2.60	954	3.00
5700	717	1.58	797	2.01	864	2.44	924	2.87	978	3.29
6000	745	1.80	824	2.25	890	2.70	949	3.15	1002	3.60
6300	774	2.04	851	2.51	916	2.98	974	3.46	1027	3.93
6600	803	2.30	878	2.78	942	3.28	1000	3.78	1052	4.27
6900	832	2.58	906	3.08	969	3.61	1025	4.13	1077	4.65
7200	861	2.89	933	3.41	996	3.95	1051	4.50	1102	5.04
7500	891	3.22	961	3.76	1023	4.32	1078	4.89	1128	5.46

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	937	2.56	987	2.88	1034	3.21	1079	3.53	1122	3.86
4800	959	2.82	1008	3.16	1054	3.51	1098	3.85	1141	4.20
5100	981	3.09	1030	3.46	1075	3.83	1119	4.20	1161	4.56
5400	1004	3.39	1052	3.78	1097	4.17	1140	4.56	1181	4.95
5700	1028	3.70	1075	4.12	1119	4.53	1161	4.94	1202	5.35
6000	1051	4.04	1098	4.47	1142	4.91	1183	5.34	1224	5.77
6300	1075	4.39	1121	4.85	1165	5.31	1206	5.76	1246	6.22
6600	1100	4.76	1145	5.25	1188	5.73	1229	6.21	1268	6.68
6900	1125	5.16	1169	5.67	1212	6.17	1252	6.67	1291	7.17
7200	1149	5.58	1194	6.11	1236	6.64	1276	7.16	—	—
7500	1175	6.02	1219	6.58	1260	7.13	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid−Low Range Motor/Drive Required

High Range Motor Required

NOTES:

1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid−low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid−low range motor/drive and 7.50 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 20 — Fan Performance — 48PGE16 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	646	1.05	727	1.40	795	1.74	856	2.07	911	2.40
4800	678	1.23	756	1.60	822	1.96	882	2.31	937	2.67
5100	709	1.42	785	1.82	851	2.20	909	2.58	962	2.96
5400	741	1.64	815	2.06	879	2.47	936	2.87	989	3.27
5700	774	1.88	846	2.32	908	2.75	964	3.18	1016	3.60
6000	806	2.14	876	2.60	937	3.06	993	3.52	1043	3.96
6300	839	2.42	907	2.91	967	3.40	1021	3.88	1071	4.35
6600	872	2.74	938	3.25	997	3.76	1050	4.26	1100	4.76
6900	905	3.08	970	3.61	1027	4.15	1080	4.68	1128	5.20
7200	938	3.45	1002	4.01	1058	4.57	1109	5.12	1157	5.66
7500	972	3.85	1034	4.43	1089	5.01	1139	5.59	1186	6.16

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	963	2.72	1012	3.05	1058	3.38	1103	3.71	1145	4.05
4800	988	3.02	1036	3.37	1081	3.72	1125	4.07	1167	4.42
5100	1012	3.33	1060	3.70	1105	4.07	1147	4.45	1189	4.82
5400	1038	3.67	1085	4.06	1129	4.45	1171	4.85	1211	5.24
5700	1064	4.02	1110	4.44	1153	4.86	1195	5.27	1235	5.69
6000	1091	4.41	1136	4.85	1179	5.29	1219	5.72	1259	6.16
6300	1118	4.82	1162	5.28	1204	5.74	1245	6.20	1283	6.66
6600	1146	5.25	1189	5.74	1231	6.23	1270	6.71	—	—
6900	1173	5.72	1216	6.23	1257	6.74	1296	7.24	—	—
7200	1202	6.21	1244	6.74	1284	7.28	—	—	—	—
7500	1230	6.73	1272	7.29	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid−Low Range Motor/Drive Required

High Range Motor Required

NOTES:

1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid−low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid−low range motor/drive and 7.50 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 21 — Fan Performance — 48PGF16 Vertical Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	660	1.11	739	1.46	806	1.80	867	2.13	922	2.46
4800	693	1.29	769	1.67	835	2.03	894	2.39	948	2.74
5100	725	1.50	800	1.90	864	2.29	922	2.67	975	3.05
5400	759	1.73	831	2.15	894	2.57	950	2.97	1002	3.37
5700	792	1.98	862	2.43	924	2.87	979	3.30	1030	3.73
6000	826	2.26	894	2.73	954	3.20	1009	3.65	1059	4.11
6300	860	2.57	926	3.06	985	3.55	1038	4.04	1088	4.51
6600	894	2.90	959	3.42	1016	3.94	1069	4.44	1117	4.94
6900	929	3.26	992	3.81	1048	4.35	1099	4.88	1147	5.41
7200	963	3.66	1024	4.23	1079	4.79	1130	5.35	1177	5.90
7500	998	4.08	1058	4.68	1111	5.27	1161	5.85	1207	6.42

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	974	2.79	1022	3.12	1069	3.46	1113	3.79	1155	4.13
4800	999	3.10	1047	3.45	1092	3.80	1135	4.16	1177	4.51
5100	1025	3.42	1072	3.80	1116	4.17	1159	4.55	1200	4.93
5400	1051	3.77	1097	4.17	1141	4.57	1183	4.97	1224	5.36
5700	1078	4.15	1124	4.57	1167	4.99	1208	5.41	1248	5.83
6000	1106	4.55	1151	5.00	1193	5.44	1234	5.88	1273	6.32
6300	1134	4.98	1178	5.45	1220	5.92	1260	6.38	1298	6.84
6600	1163	5.44	1206	5.93	1247	6.42	1286	6.91	—	—
6900	1191	5.93	1234	6.44	1274	6.96	—	—	—	—
7200	1221	6.45	1263	6.99	—	—	—	—	—	—
7500	1250	7.00	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid–Low Range Motor/Drive Required

High Range Motor Required

NOTES:
1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid–low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid–low range motor/drive and 7.50 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 22 — Fan Performance — 48PGD08 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	409	0.29	493	0.39	567	0.50	636	0.62	700	0.75
2400	422	0.33	503	0.44	576	0.56	642	0.68	704	0.81
2550	436	0.38	515	0.49	585	0.62	650	0.74	710	0.88
2700	450	0.43	527	0.55	595	0.68	658	0.81	717	0.95
2850	465	0.49	539	0.62	606	0.75	667	0.89	724	1.03
3000	480	0.56	552	0.69	617	0.83	676	0.97	732	1.12
3150	496	0.63	566	0.77	629	0.91	687	1.06	741	1.21
3300	511	0.70	579	0.85	641	1.00	698	1.16	751	1.31
3450	527	0.79	593	0.94	653	1.10	709	1.26	761	1.42
3600	543	0.88	608	1.04	666	1.21	721	1.37	772	1.54
3750	560	0.98	622	1.15	680	1.32	733	1.49	783	1.66

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	760	0.88	817	1.01	871	1.16	923	1.30	972	1.45
2400	763	0.94	819	1.09	872	1.23	923	1.38	972	1.54
2550	768	1.02	822	1.16	874	1.32	924	1.47	973	1.63
2700	773	1.10	826	1.25	877	1.40	927	1.56	974	1.73
2850	779	1.18	831	1.34	881	1.50	929	1.66	976	1.83
3000	786	1.27	837	1.43	886	1.60	933	1.77	979	1.94
3150	793	1.37	843	1.54	891	1.70	938	1.88	983	2.06
3300	802	1.48	851	1.65	898	1.82	943	2.00	987	2.18
3450	811	1.59	859	1.76	905	1.94	949	2.12	992	2.31
3600	820	1.71	867	1.89	912	2.07	956	2.26	998	2.45
3750	830	1.84	876	2.02	920	2.21	963	2.40	1005	2.60

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 23 — Fan Performance — 48PGE08 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	408	0.28	492	0.39	567	0.50	635	0.62	699	0.74
2400	424	0.33	505	0.44	577	0.56	644	0.68	706	0.81
2550	440	0.38	519	0.50	588	0.62	653	0.75	713	0.88
2700	457	0.44	532	0.56	600	0.69	662	0.82	721	0.96
2850	473	0.50	547	0.63	612	0.77	673	0.90	730	1.05
3000	490	0.57	561	0.71	625	0.85	684	0.99	740	1.14
3150	507	0.65	576	0.79	638	0.94	695	1.08	750	1.24
3300	524	0.73	591	0.88	651	1.03	708	1.19	760	1.34
3450	542	0.82	606	0.98	665	1.13	720	1.29	772	1.46
3600	559	0.92	622	1.08	679	1.24	733	1.41	783	1.58
3750	577	1.02	638	1.19	694	1.36	746	1.53	795	1.71

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	760	0.88	817	1.01	871	1.16	923	1.30	972	1.45
2400	765	0.95	820	1.09	874	1.24	924	1.39	973	1.54
2550	770	1.03	825	1.17	877	1.32	927	1.48	975	1.64
2700	777	1.11	830	1.26	881	1.42	930	1.58	977	1.74
2850	784	1.20	836	1.35	886	1.51	934	1.68	981	1.85
3000	793	1.29	843	1.45	892	1.62	939	1.79	985	1.96
3150	801	1.40	851	1.56	899	1.73	945	1.91	990	2.09
3300	811	1.51	859	1.68	906	1.85	951	2.03	995	2.21
3450	821	1.63	868	1.80	914	1.98	958	2.16	1001	2.35
3600	831	1.75	878	1.93	923	2.11	966	2.30	1008	2.49
3750	843	1.89	888	2.07	932	2.26	974	2.45	1016	2.65

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 24 — Fan Performance — 48PGF08 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	413	0.29	496	0.39	571	0.51	639	0.63	703	0.75
2400	429	0.34	510	0.45	581	0.57	647	0.69	709	0.82
2550	446	0.39	524	0.51	593	0.63	657	0.76	717	0.89
2700	464	0.45	538	0.57	605	0.70	667	0.83	726	0.97
2850	481	0.52	553	0.65	618	0.78	678	0.92	735	1.06
3000	499	0.59	569	0.72	632	0.86	690	1.01	746	1.16
3150	517	0.67	584	0.81	646	0.95	703	1.10	756	1.26
3300	535	0.75	600	0.90	660	1.05	715	1.21	768	1.37
3450	553	0.85	617	1.00	675	1.16	729	1.32	780	1.48
3600	571	0.95	633	1.11	690	1.27	742	1.44	792	1.61
3750	590	1.06	650	1.23	705	1.40	756	1.57	805	1.74

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2250	763	0.88	820	1.02	874	1.16	925	1.31	974	1.46
2400	768	0.96	824	1.10	877	1.25	927	1.40	976	1.55
2550	774	1.04	829	1.18	881	1.33	930	1.49	978	1.65
2700	781	1.12	834	1.27	885	1.43	934	1.59	981	1.75
2850	789	1.21	841	1.37	891	1.53	939	1.70	985	1.87
3000	798	1.31	849	1.47	897	1.64	944	1.81	990	1.98
3150	808	1.42	857	1.58	905	1.75	951	1.93	995	2.11
3300	818	1.53	866	1.70	913	1.88	958	2.06	1001	2.24
3450	829	1.65	876	1.83	921	2.01	965	2.19	1008	2.38
3600	840	1.78	886	1.96	931	2.15	974	2.34	1016	2.53
3750	852	1.92	897	2.11	941	2.30	983	2.49	1024	2.69

LEGEND
Bhp — Brake Horsepower
High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.10 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 25 — Fan Performance — 48PGD09 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	436	0.38	515	0.49	585	0.62	650	0.74	710	0.88
2700	450	0.43	527	0.55	595	0.68	658	0.81	717	0.95
2850	465	0.49	539	0.62	606	0.75	667	0.89	724	1.03
3000	480	0.56	552	0.69	617	0.83	676	0.97	732	1.12
3150	496	0.63	566	0.77	629	0.91	687	1.06	741	1.21
3300	511	0.70	579	0.85	641	1.00	698	1.16	751	1.31
3450	527	0.79	593	0.94	653	1.10	709	1.26	761	1.42
3600	543	0.88	608	1.04	666	1.21	721	1.37	772	1.54
3750	560	0.98	622	1.15	680	1.32	733	1.49	783	1.66
3900	576	1.08	637	1.26	693	1.44	745	1.61	794	1.79
4050	593	1.19	652	1.38	707	1.56	758	1.75	806	1.93
4200	610	1.32	668	1.51	721	1.70	771	1.89	818	2.08

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	768	1.02	822	1.16	874	1.32	924	1.47	973	1.63
2700	773	1.10	826	1.25	877	1.40	927	1.56	974	1.73
2850	779	1.18	831	1.34	881	1.50	929	1.66	976	1.83
3000	786	1.27	837	1.43	886	1.60	933	1.77	979	1.94
3150	793	1.37	843	1.54	891	1.70	938	1.88	983	2.06
3300	802	1.48	851	1.65	898	1.82	943	2.00	987	2.18
3450	811	1.59	859	1.76	905	1.94	949	2.12	992	2.31
3600	820	1.71	867	1.89	912	2.07	956	2.26	998	2.45
3750	830	1.84	876	2.02	920	2.21	963	2.40	1005	2.60
3900	841	1.98	886	2.16	929	2.35	971	2.55	1012	2.75
4050	852	2.12	896	2.31	938	2.51	980	2.71	1020	2.91
4200	863	2.27	906	2.47	948	2.67	989	2.88	1028	3.09

LEGEND
Bhp — Brake Horsepower
High Range Motor/Drive Required

NOTES:
1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 26 — Fan Performance — 48PGE09 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	440	0.38	519	0.50	588	0.62	653	0.75	713	0.88
2700	457	0.44	532	0.56	600	0.69	662	0.82	721	0.96
2850	473	0.50	547	0.63	612	0.77	673	0.90	730	1.05
3000	490	0.57	561	0.71	625	0.85	684	0.99	740	1.14
3150	507	0.65	576	0.79	638	0.94	695	1.08	750	1.24
3300	524	0.73	591	0.88	651	1.03	708	1.19	760	1.34
3450	542	0.82	606	0.98	665	1.13	720	1.29	772	1.46
3600	559	0.92	622	1.08	679	1.24	733	1.41	783	1.58
3750	577	1.02	638	1.19	694	1.36	746	1.53	795	1.71
3900	594	1.13	654	1.31	708	1.49	759	1.66	808	1.84
4050	612	1.25	670	1.44	723	1.62	773	1.80	821	1.99
4200	630	1.38	686	1.57	738	1.76	787	1.95	834	2.14

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	770	1.03	825	1.17	877	1.32	927	1.48	975	1.64
2700	777	1.11	830	1.26	881	1.42	930	1.58	977	1.74
2850	784	1.20	836	1.35	886	1.51	934	1.68	981	1.85
3000	793	1.29	843	1.45	892	1.62	939	1.79	985	1.96
3150	801	1.40	851	1.56	899	1.73	945	1.91	990	2.09
3300	811	1.51	859	1.68	906	1.85	951	2.03	995	2.21
3450	821	1.63	868	1.80	914	1.98	958	2.16	1001	2.35
3600	831	1.75	878	1.93	923	2.11	966	2.30	1008	2.49
3750	843	1.89	888	2.07	932	2.26	974	2.45	1016	2.65
3900	854	2.03	898	2.22	941	2.41	983	2.61	1024	2.81
4050	866	2.18	909	2.37	951	2.57	992	2.77	1032	2.98
4200	878	2.34	921	2.54	962	2.74	1002	2.95	1041	3.16

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 27 — Fan Performance — 48PGF09 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	446	0.39	524	0.51	593	0.63	657	0.76	717	0.89
2700	464	0.45	538	0.57	605	0.70	667	0.83	726	0.97
2850	481	0.52	553	0.65	618	0.78	678	0.92	735	1.06
3000	499	0.59	569	0.72	632	0.86	690	1.01	746	1.16
3150	517	0.67	584	0.81	646	0.95	703	1.10	756	1.26
3300	535	0.75	600	0.90	660	1.05	715	1.21	768	1.37
3450	553	0.85	617	1.00	675	1.16	729	1.32	780	1.48
3600	571	0.95	633	1.11	690	1.27	742	1.44	792	1.61
3750	590	1.06	650	1.23	705	1.40	756	1.57	805	1.74
3900	608	1.18	667	1.35	720	1.53	771	1.71	819	1.89
4050	627	1.30	684	1.49	736	1.67	786	1.85	832	2.04
4200	646	1.44	701	1.63	752	1.82	801	2.01	846	2.20

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
2550	774	1.04	829	1.18	881	1.33	930	1.49	978	1.65
2700	781	1.12	834	1.27	885	1.43	934	1.59	981	1.75
2850	789	1.21	841	1.37	891	1.53	939	1.70	985	1.87
3000	798	1.31	849	1.47	897	1.64	944	1.81	990	1.98
3150	808	1.42	857	1.58	905	1.75	951	1.93	995	2.11
3300	818	1.53	866	1.70	913	1.88	958	2.06	1001	2.24
3450	829	1.65	876	1.83	921	2.01	965	2.19	1008	2.38
3600	840	1.78	886	1.96	931	2.15	974	2.34	1016	2.53
3750	852	1.92	897	2.11	941	2.30	983	2.49	1024	2.69
3900	864	2.07	908	2.26	951	2.46	993	2.65	1033	2.86
4050	877	2.23	920	2.42	962	2.62	1003	2.83	1042	3.03
4200	890	2.40	933	2.60	974	2.80	1013	3.01	1052	3.22

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 568 to 771 rpm for low range motor/drive and 812 to 1015 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 2.40 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 28 — Fan Performance — 48PGD12 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	502	0.60	571	0.73	634	0.87	693	1.01	748	1.16
3200	525	0.70	592	0.85	652	0.99	709	1.14	762	1.30
3400	549	0.82	613	0.97	671	1.13	726	1.29	777	1.45
3600	573	0.95	634	1.11	691	1.28	743	1.44	793	1.61
3800	597	1.10	656	1.27	711	1.44	762	1.62	810	1.79
4000	621	1.26	678	1.44	731	1.62	781	1.80	828	1.99
4200	645	1.43	700	1.62	752	1.81	800	2.00	846	2.20
4400	669	1.62	723	1.83	772	2.02	819	2.22	864	2.42
4600	694	1.83	745	2.04	794	2.25	839	2.46	883	2.67
4800	719	2.06	768	2.28	815	2.50	860	2.71	902	2.93
5000	743	2.30	791	2.53	837	2.76	880	2.98	922	3.21

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	800	1.32	851	1.48	899	1.64	946	1.82	992	1.99
3200	813	1.46	862	1.63	909	1.80	955	1.98	999	2.16
3400	827	1.62	874	1.79	920	1.97	964	2.15	1007	2.34
3600	841	1.79	887	1.97	932	2.15	975	2.34	1017	2.53
3800	857	1.97	901	2.16	945	2.35	986	2.55	1027	2.75
4000	873	2.18	916	2.37	958	2.56	999	2.77	1039	2.97
4200	889	2.39	932	2.59	973	2.80	1013	3.00	1051	3.22
4400	907	2.63	948	2.83	988	3.04	1027	3.26	1065	3.48
4600	925	2.88	965	3.09	1004	3.31	1042	3.53	–	–
4800	943	3.15	982	3.37	1020	3.59	–	–	–	–
5000	962	3.44	1000	3.67	–	–	–	–	–	–

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 29 — Fan Performance — 48PGE12 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	510	0.61	579	0.75	641	0.89	699	1.03	754	1.18
3200	535	0.72	600	0.87	660	1.01	716	1.16	769	1.32
3400	560	0.84	623	1.00	680	1.15	734	1.31	785	1.48
3600	585	0.98	645	1.14	701	1.31	753	1.47	802	1.65
3800	610	1.14	668	1.31	722	1.48	772	1.65	820	1.83
4000	635	1.30	691	1.48	743	1.66	792	1.85	839	2.03
4200	661	1.49	715	1.68	765	1.87	813	2.06	858	2.25
4400	687	1.69	739	1.89	788	2.09	834	2.29	878	2.49
4600	713	1.91	763	2.12	811	2.33	855	2.53	898	2.74
4800	739	2.15	788	2.37	834	2.58	877	2.80	919	3.02
5000	765	2.41	812	2.63	857	2.86	899	3.08	940	3.31

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	806	1.34	856	1.50	905	1.66	951	1.84	997	2.01
3200	820	1.48	868	1.65	915	1.82	961	2.00	1005	2.18
3400	834	1.64	881	1.82	927	2.00	971	2.18	1014	2.37
3600	850	1.82	896	2.00	940	2.19	983	2.38	1024	2.57
3800	866	2.01	911	2.20	954	2.39	995	2.59	1036	2.79
4000	884	2.22	927	2.42	969	2.61	1009	2.82	1049	3.02
4200	902	2.45	944	2.65	984	2.85	1024	3.06	1062	3.28
4400	920	2.69	961	2.90	1001	3.11	1039	3.33	1077	3.55
4600	939	2.96	979	3.17	1018	3.39	1055	3.61	–	–
4800	959	3.24	998	3.46	1035	3.69	–	–	–	–
5000	979	3.54	–	–	–	–	–	–	–	–

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 30 — Fan Performance — 48PGF12 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	514	0.62	583	0.75	645	0.89	702	1.04	757	1.19
3200	540	0.73	605	0.88	665	1.02	720	1.18	773	1.33
3400	565	0.86	628	1.01	685	1.17	739	1.33	790	1.49
3600	591	1.00	651	1.16	706	1.33	758	1.49	808	1.66
3800	617	1.16	675	1.33	728	1.50	778	1.67	826	1.85
4000	643	1.33	699	1.51	750	1.69	799	1.87	845	2.06
4200	670	1.52	723	1.71	773	1.90	820	2.09	865	2.28
4400	696	1.72	748	1.92	796	2.12	842	2.32	885	2.52
4600	723	1.95	772	2.16	819	2.37	864	2.57	906	2.78
4800	749	2.19	797	2.41	843	2.63	886	2.84	927	3.06
5000	776	2.46	823	2.69	867	2.91	909	3.14	949	3.36

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3000	809	1.35	859	1.51	908	1.67	954	1.85	999	2.02
3200	823	1.50	872	1.66	919	1.84	964	2.01	1008	2.20
3400	839	1.66	886	1.83	931	2.01	975	2.20	1018	2.39
3600	855	1.84	900	2.02	944	2.21	987	2.40	1029	2.59
3800	872	2.04	916	2.22	959	2.42	1000	2.61	1041	2.81
4000	890	2.25	933	2.44	974	2.64	1015	2.85	1054	3.05
4200	908	2.48	950	2.68	990	2.89	1030	3.10	1068	3.31
4400	927	2.73	968	2.94	1007	3.15	1046	3.37	1083	3.59
4600	947	3.00	987	3.21	1025	3.43	1062	3.65	–	–
4800	967	3.28	1006	3.51	–	–	–	–	–	–
5000	988	3.59	–	–	–	–	–	–	–	–

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.10 for low range motor/drive and 3.70 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 31 — Fan Performance — 48PGD14 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	591	1.06	651	1.23	706	1.40	757	1.57	806	1.75
3950	615	1.22	672	1.40	726	1.57	776	1.75	823	1.94
4150	639	1.39	695	1.58	746	1.76	795	1.95	841	2.14
4350	663	1.58	717	1.77	767	1.97	814	2.17	859	2.36
4550	688	1.78	740	1.99	788	2.19	834	2.40	878	2.60
4750	712	2.00	763	2.22	810	2.43	855	2.65	897	2.86
4950	737	2.24	786	2.47	832	2.69	875	2.91	917	3.14
5150	762	2.50	809	2.73	853	2.97	896	3.20	937	3.43
5350	787	2.77	832	3.02	876	3.26	917	3.50	957	3.75
5550	811	3.07	856	3.33	898	3.58	938	3.83	977	4.08
5750	836	3.39	879	3.65	920	3.92	960	4.18	998	4.44
5950	861	3.72	903	4.00	943	4.28	982	4.55	1019	4.81
6150	886	4.09	927	4.37	966	4.66	1004	4.94	1040	5.21
6250	899	4.28	939	4.57	977	4.85	1015	5.14	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	853	1.93	898	2.11	941	2.30	983	2.49	1025	2.69
3950	869	2.12	912	2.31	955	2.51	996	2.71	1036	2.91
4150	885	2.34	928	2.53	969	2.74	1009	2.94	1048	3.15
4350	902	2.57	944	2.77	984	2.98	1023	3.19	1061	3.41
4550	920	2.81	961	3.03	1000	3.24	1038	3.46	1075	3.68
4750	938	3.08	978	3.30	1016	3.52	1053	3.75	1090	3.98
4950	957	3.36	996	3.59	1033	3.82	1069	4.05	1105	4.29
5150	976	3.67	1014	3.90	1050	4.14	1086	4.38	1121	4.62
5350	995	3.99	1032	4.23	1068	4.48	1103	4.72	1137	4.97
5550	1015	4.33	1051	4.58	1086	4.84	1120	5.09	—	—
5750	1035	4.70	1070	4.96	1105	5.22	—	—	—	—
5950	1055	5.08	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:
1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 32 — Fan Performance — 48PGE14 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	604	1.10	662	1.26	717	1.43	767	1.61	816	1.78
3950	629	1.26	686	1.44	738	1.62	787	1.80	834	1.98
4150	655	1.44	709	1.63	760	1.82	808	2.00	853	2.20
4350	681	1.64	733	1.83	782	2.03	829	2.23	873	2.43
4550	706	1.85	757	2.06	805	2.26	850	2.47	893	2.68
4750	732	2.09	782	2.30	828	2.52	872	2.73	914	2.95
4950	759	2.34	806	2.56	851	2.79	894	3.01	935	3.24
5150	785	2.61	831	2.85	874	3.08	916	3.31	956	3.54
5350	811	2.91	856	3.15	898	3.39	939	3.63	978	3.88
5550	838	3.22	881	3.48	922	3.73	961	3.98	999	4.23
5750	864	3.56	906	3.82	946	4.08	985	4.34	1022	4.60
5950	891	3.92	931	4.19	970	4.46	1008	4.73	1044	5.00
6150	917	4.31	957	4.59	995	4.87	1032	5.15	—	—
6250	931	4.51	970	4.80	1007	5.08	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	862	1.96	907	2.15	950	2.34	992	2.53	1033	2.73
3950	879	2.17	923	2.36	965	2.56	1006	2.76	1045	2.96
4150	897	2.39	939	2.59	980	2.79	1020	3.00	1059	3.21
4350	915	2.63	957	2.84	996	3.05	1035	3.26	1073	3.48
4550	934	2.89	975	3.10	1013	3.32	1051	3.54	1088	3.76
4750	954	3.16	993	3.39	1031	3.61	1068	3.84	1104	4.07
4950	974	3.46	1012	3.69	1049	3.92	1085	4.16	1120	4.39
5150	994	3.78	1032	4.02	1068	4.25	1103	4.50	1137	4.74
5350	1015	4.12	1051	4.36	1087	4.61	1121	4.86	1155	5.11
5550	1036	4.48	1072	4.73	1106	4.99	1140	5.24	—	—
5750	1058	4.86	1092	5.12	—	—	—	—	—	—
5950	—	—	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

▬▬ High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 33 — Fan Performance — 48PGF14 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	611	1.12	669	1.28	723	1.45	773	1.63	821	1.80
3950	637	1.28	693	1.46	745	1.64	794	1.82	840	2.01
4150	663	1.47	717	1.66	767	1.84	815	2.03	860	2.22
4350	690	1.67	742	1.87	790	2.06	836	2.26	880	2.46
4550	716	1.89	766	2.10	813	2.30	858	2.51	901	2.72
4750	743	2.13	791	2.35	837	2.56	880	2.77	922	2.99
4950	770	2.39	816	2.62	861	2.84	903	3.06	944	3.29
5150	796	2.67	842	2.90	885	3.14	926	3.37	965	3.60
5350	823	2.97	867	3.22	909	3.46	949	3.70	988	3.94
5550	850	3.29	893	3.55	933	3.80	972	4.05	1010	4.30
5750	877	3.64	918	3.90	958	4.16	996	4.42	1033	4.68
5950	904	4.01	944	4.28	983	4.55	1020	4.82	1056	5.09
6150	931	4.41	970	4.69	1008	4.97	1044	5.24	—	—
6250	945	4.61	983	4.90	1020	5.18	—	—	—	—

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
3750	868	1.99	912	2.17	955	2.36	997	2.56	1038	2.76
3950	885	2.19	928	2.39	970	2.58	1011	2.79	1051	2.99
4150	904	2.42	946	2.62	986	2.82	1026	3.03	1065	3.24
4350	923	2.66	963	2.87	1003	3.08	1042	3.30	1079	3.52
4550	942	2.93	982	3.14	1021	3.36	1058	3.58	1095	3.81
4750	962	3.21	1001	3.43	1039	3.66	1075	3.88	1111	4.12
4950	983	3.51	1020	3.74	1057	3.97	1093	4.21	1128	4.45
5150	1004	3.84	1040	4.07	1076	4.31	1111	4.56	1146	4.80
5350	1025	4.18	1061	4.43	1096	4.67	1130	4.92	1164	5.18
5550	1046	4.55	1082	4.80	1116	5.06	—	—	—	—
5750	1068	4.94	1103	5.20	—	—	—	—	—	—
5950	—	—	—	—	—	—	—	—	—	—
6150	—	—	—	—	—	—	—	—	—	—
6250	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 690 to 893 rpm for low range motor/drive and 852 to 1055 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

48PG08–16

Table 34 — Fan Performance — 48PGD16 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	633	1.01	709	1.32	771	1.62	826	1.91	877	2.20
4800	663	1.18	738	1.52	799	1.84	853	2.15	903	2.46
5100	694	1.37	768	1.73	828	2.07	881	2.41	930	2.74
5400	725	1.57	797	1.96	857	2.33	909	2.68	957	3.04
5700	757	1.80	828	2.22	886	2.61	938	2.99	985	3.36
6000	788	2.05	858	2.49	916	2.91	967	3.31	1013	3.71
6300	820	2.33	888	2.79	945	3.24	996	3.66	1042	4.08
6600	852	2.63	919	3.12	975	3.59	1025	4.04	1070	4.48
6900	884	2.95	949	3.47	1005	3.96	1055	4.44	1099	4.90
7200	916	3.31	980	3.85	1036	4.37	1084	4.87	1129	5.36
7500	949	3.69	1011	4.25	1066	4.80	1114	5.33	1158	5.84

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	925	2.50	971	2.80	1015	3.10	1059	3.41	1101	3.73
4800	950	2.77	994	3.09	1037	3.41	1079	3.73	1120	4.06
5100	975	3.07	1019	3.40	1060	3.74	1101	4.08	1140	4.42
5400	1002	3.39	1044	3.74	1085	4.09	1124	4.45	1162	4.81
5700	1029	3.73	1070	4.10	1110	4.47	1148	4.84	1185	5.22
6000	1056	4.10	1097	4.49	1136	4.88	1173	5.27	1210	5.66
6300	1084	4.49	1124	4.90	1162	5.31	1199	5.72	1235	6.13
6600	1112	4.91	1152	5.34	1189	5.77	1226	6.20	1260	6.63
6900	1141	5.36	1180	5.81	1217	6.26	1252	6.71	1287	7.15
7200	1170	5.84	1208	6.31	1245	6.78	1280	7.25	—	—
7500	1199	6.35	1237	6.84	1273	7.33	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid−Low Range Motor/Drive Required

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid−low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid−low range motor/drive and 7.50 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 35 — Fan Performance — 48PGE16 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	664	1.13	735	1.44	795	1.74	849	2.04	900	2.34
4800	698	1.33	767	1.66	826	1.99	878	2.30	927	2.62
5100	732	1.55	800	1.91	857	2.25	908	2.59	956	2.93
5400	767	1.79	832	2.17	889	2.54	939	2.90	985	3.26
5700	801	2.05	865	2.46	920	2.86	970	3.24	1015	3.61
6000	836	2.35	899	2.78	953	3.20	1001	3.60	1046	4.00
6300	871	2.67	932	3.13	985	3.57	1033	4.00	1077	4.42
6600	906	3.02	966	3.50	1018	3.97	1065	4.42	1108	4.87
6900	941	3.40	1000	3.91	1051	4.40	1097	4.88	1140	5.35
7200	977	3.81	1034	4.35	1084	4.87	1130	5.37	1171	5.86
7500	1012	4.26	1068	4.83	1118	5.37	1162	5.89	1203	6.41

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	947	2.64	993	2.95	1038	3.26	1081	3.58	1123	3.90
4800	974	2.94	1018	3.26	1061	3.59	1102	3.92	1143	4.26
5100	1001	3.26	1044	3.60	1086	3.95	1126	4.29	1165	4.65
5400	1029	3.61	1071	3.97	1112	4.33	1151	4.69	1189	5.06
5700	1058	3.99	1099	4.37	1139	4.75	1177	5.13	1214	5.51
6000	1088	4.40	1128	4.79	1166	5.19	1203	5.59	1239	5.99
6300	1118	4.84	1157	5.25	1195	5.67	1231	6.08	1266	6.50
6600	1148	5.31	1187	5.74	1224	6.18	1259	6.61	1294	7.05
6900	1179	5.81	1217	6.26	1253	6.72	1288	7.17	—	—
7200	1211	6.34	1248	6.82	1283	7.30	—	—	—	—
7500	1242	6.91	1279	7.41	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid−Low Range Motor/Drive Required

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid−low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid−low range motor/drive and 7.50 for high range motor/drive.
3. See page 48 for General Fan Performance Notes.

Table 36 — Fan Performance — 48PGF16 Horizontal Units

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	705	1.31	771	1.62	828	1.92	881	2.23	931	2.54
4800	743	1.54	806	1.87	862	2.20	913	2.53	961	2.85
5100	781	1.80	842	2.16	896	2.51	946	2.85	993	3.20
5400	819	2.09	878	2.47	931	2.84	979	3.21	1025	3.57
5700	857	2.41	915	2.82	966	3.21	1013	3.60	1057	3.98
6000	896	2.76	952	3.19	1002	3.61	1048	4.02	1091	4.43
6300	935	3.15	989	3.60	1038	4.05	1083	4.48	1125	4.91
6600	974	3.57	1027	4.05	1074	4.52	1118	4.97	1159	5.42
6900	1013	4.03	1064	4.54	1111	5.03	1153	5.51	1194	5.98
7200	1052	4.54	1102	5.06	1148	5.58	1189	6.08	1229	6.57
7500	1092	5.08	1140	5.63	1185	6.17	1226	6.69	1264	7.21

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
4500	979	2.85	1024	3.16	1069	3.49	1112	3.82	1154	4.15
4800	1007	3.18	1051	3.51	1094	3.85	1136	4.20	1176	4.55
5100	1037	3.54	1080	3.90	1121	4.25	1161	4.61	1200	4.97
5400	1068	3.94	1109	4.31	1149	4.68	1188	5.06	1226	5.44
5700	1099	4.37	1140	4.76	1178	5.15	1216	5.54	1253	5.94
6000	1132	4.83	1171	5.24	1209	5.65	1245	6.06	1281	6.47
6300	1165	5.33	1203	5.76	1240	6.19	1275	6.61	—	—
6600	1198	5.87	1235	6.32	1271	6.76	—	—	—	—
6900	1232	6.45	1268	6.91	—	—	—	—	—	—
7200	1266	7.06	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—

LEGEND

Bhp — Brake Horsepower

Mid–Low Range Motor/Drive Required

High Range Motor/Drive Required

NOTES:

1. Motor drive range is 710 to 879 rpm for low range motor/drive and 872 to 1066 rpm for mid–low range motor/drive, and 1066 to 1260 rpm for high range motor/drive. All other rpms require a field-supplied drive.
2. Maximum continuous bhp is 3.70 for low range motor/drive and 5.25 for mid–low range motor/drive and 7.50 for high range motor/drive.
3. See below for General Fan Performance Notes.

GENERAL NOTES FOR FAN PERFORMANCE DATA TABLES

1. Static pressure losses (i.e., economizer, etc.) must be added to external static pressure before entering Fan Performance table.
2. Interpolation is permissible. Do not extrapolate.
3. Fan performance is based on wet coils, clean filters, and casing losses. See Accessory/FIOP Static Pressure information in Fig. 30-32.
4. Extensive motor and drive testing on these units ensures that the full horsepower range of the motor can be utilized with confidence. Using fan motors up to the bhp rating shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
5. Use of a field-supplied motor may affect wire size. Recalculate the unit power supply MCA and MOCP if required. Contact Carrier representative for details.
6. Use the following formula to calculate input watts:
   Input Watts = Bhp x (746/Motor Eff)

Table 37 — Operation Air Quantity Limits

UNIT 48PG	COOLING (cfm)		HEATING (cfm)†	
	Min	Max	Min	Max
08 (Low Heat)	2250	3750	2060	5160
08 (Med Heat)	2250	3750	2110	6870
08 (High Heat)	2250	3750	2450	4900
09 (Low Heat)	2550	4250	2060	5160
09 (Med Heat)	2550	4250	2110	6870
09 (High Heat)	2550	4250	2450	4900
12 (Low Heat)	3000	5000	2110	6870
12 (Med Heat)	3000	5000	2450	4900
12 (High Heat)	3000	5000	3150	6300
14 (Low Heat)	3750	6250	2110	6870
14 (Med Heat)	3750	6250	2450	4900
14 (High Heat)	3750	6250	3150	6300
16 (Low Heat)	4500	7500	3040	6680
16 (Med Heat)	4500	7500	3870	7750
16 (High Heat)	4500	7500	4670	8680

Table 38 — Evaporator Fan Motor Specifications

48PG	DRIVE	VOLTAGE/PHASE	MOTOR P/N	EFFICIENCY	MAX BHP	MAX AMPS
08	Low	208/3ph	HD56FE652	0.80	2.4	6.4
		230/3ph	HD56FE652	0.80	2.4	6.4
		460/3ph	HD56FE652	0.80	2.4	3.2
		575/3ph	HD56FE575	0.80	2.4	2.4
	High	208/3ph	HD58FE653	0.84	3.1	8.8
		230/3ph	HD58FE653	0.84	3.1	8.8
		460/3ph	HD58FE653	0.84	3.1	4.4
		575/3ph	HD58FE576	0.82	3.7	4.2
09	Low	208/3ph	HD56FE652	0.80	2.4	6.4
		230/3ph	HD56FE652	0.80	2.4	6.4
		460/3ph	HD56FE652	0.80	2.4	3.2
		575/3ph	HD56FE575	0.80	2.4	2.4
	High	208/3ph	HD60FE655	0.83	3.7	11.0
		230/3ph	HD60FE655	0.83	3.7	11.0
		460/3ph	HD60FE655	0.83	3.7	5.5
		575/3ph	HD58FE576	0.82	3.7	4.2
12	Low	208/3ph	HD58FE653	0.84	3.1	8.8
		230/3ph	HD58FE653	0.84	3.1	8.8
		460/3ph	HD58FE653	0.84	3.1	4.4
		575/3ph	HD58FE576	0.82	3.7	4.2
	High	208/3ph	HD60FE655	0.83	3.7	11.0
		230/3ph	HD60FE655	0.83	3.7	11.0
		460/3ph	HD60FE655	0.83	3.7	5.5
		575/3ph	HD58FE576	0.82	3.7	4.2
14	Low	208/3ph	HD60FE655	0.83	3.7	11.0
		230/3ph	HD60FE655	0.83	3.7	11.0
		460/3ph	HD60FE655	0.83	3.7	5.5
		575/3ph	HD58FE576	0.82	3.7	4.2
	High	208/3ph	HD60FK650	0.81	5.25	14.8
		230/3ph	HD60FK650	0.81	5.25	14.8
		460/3ph	HD60FK650	0.81	5.25	7.4
		575/3ph	HD60FE575	0.81	5.25	5.9
16	Low	208/3ph	HD60FE655	0.83	3.7	11.0
		230/3ph	HD60FE655	0.83	3.7	11.0
		460/3ph	HD60FE655	0.83	3.7	5.5
		575/3ph	HD58FE576	0.83	3.7	4.2
	Mid-Low	208/3ph	HD60FK650	0.81	5.25	14.8
		230/3ph	HD60FK650	0.81	5.25	14.8
		460/3ph	HD60FK650	0.81	5.25	7.4
		575/3ph	HD60FE575	0.81	5.25	5.9
	High	208/3ph	HD60FL650	0.89	7.5	19.4
		230/3ph	HD60FL650	0.89	7.5	19.4
		460/3ph	HD60FL650	0.89	7.5	9.7
		575/3ph	HD60FL575	0.81	7.5	7.8

NOTES:
1. Extensive motor and electrical testing ensures that the motors can be utilized with confidence up to the maximum applied bhp, watts, and amps. Using the fan motor up to the maximum ratings shown will not result in nuisance tripping or premature motor failure. Unit warranty will not be affected.
2. Convert bhp to watts using the following formula:

$$\text{watts} = \frac{\text{bhp (746)}}{\text{motor efficiency}}$$

3. The EPACT (Energy Policy Act of 1992) regulates energy requirements for specific types of indoor fan motors. Motors regulated by EPACT include any general purpose, T-frame (three-digit, 143 and larger), single-speed, foot mounted, polyphase, squirrel cage induction motors of NEMA (National Electrical Manufacturers Association) design A and B, manu- factured for use in the United States. Ranging from 1 to 200 Hp, these continuous-duty motors operate on 230 and 460 volt, 60 Hz power. If a motor does not fit into these specifications, the motor does not have to be replaced by an EPACT-compliant energy-efficient motor. Variable-speed motors are exempt from EPACT compliance requirements. Therefore, the indoor fan motors for Carrier 48PG08-16 units are exempt from these requirements.

Table 39 — Fan Rpm at Motor Pulley Settings*

UNIT 48PG	DRIVE	MOTOR PULLEY TURNS OPEN										
		0	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5
08	Low	771	751	731	710	690	670	649	629	609	589	568
	High	1015	994	974	954	934	913	893	873	852	832	812
09	Low	771	751	731	710	690	670	649	629	609	589	568
	High	1015	994	974	954	934	913	893	873	852	832	812
12	Low	893	873	852	832	812	791	771	751	731	710	690
	High	1055	1035	1015	994	974	954	934	913	893	873	852
14	Low	893	873	852	832	812	791	771	751	731	710	690
	High	1055	1035	1015	994	974	954	934	913	893	873	852
16	Low	879	863	846	829	812	795	778	761	744	727	710
	Mid-Low	1066	1047	1027	1008	988	969	950	930	911	892	872
	High	1260	1240	1221	1202	1182	1163	1144	1124	1105	1085	1066

*Approximate fan rpm shown, based on 1725 rpm motor.

SERVICE

⚠ WARNING

ELECTRICAL OPERATION HAZARD

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

Before performing service or maintenance operations on unit, always turn off all power to unit. There may be more than 1 disconnect switch.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

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

Puron® (R-410A)refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron refrigerant equipment.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. What to do if you smell gas:

DO NOT try to light any appliance.
DO NOT touch any electrical switch, or use any phone in your building.
IMMEDIATELY call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
If you cannot reach your gas supplier, call the fire department.

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

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

⚠ WARNING

FIRE, EXPLOSION HAZARD

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

Disconnect gas piping from unit when leak testing at pressure greater than $^1/_2$ psig. Pressures greater than $^1/_2$ psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than $^1/_2$ psig, it *must* be replaced before use. When pressure testing field- supplied gas piping at pressures of $^1/_2$ psig or less, a unit connected to such piping must be isolated by manually closing the gas valve.

Cleaning

Inspect unit interior at beginning of each heating and cooling season and as operating conditions require. Remove unit top panel and/or side panels for access to unit interior.

Coil Maintenance and Cleaning Recommendation

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

Remove Surface Loaded Fibers

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

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

Periodic Clean Water Rinse

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

Routine Cleaning of Coil Surfaces

Monthly cleaning with Totaline® environmentally sound coil cleaner is essential to extend the life of coils. This cleaner is available from Carrier Replacement parts division as part number P902-0301 for a one gallon container, and part number P902-0305 for a 5 gallon container. It is recommended that all coils, including standard aluminum, pre-coated, copper/copper or E-coated coils be cleaned with the Totaline environmentally sound coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

Avoid the use of:

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

Totaline environmentally sound coil cleaner is non-flammable, hypoallergenic, nonbacterial, and a USDA accepted biodegradable agent that will not harm the coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non-recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

Totaline Environmentally Sound Coil Cleaner Application Equipment

- $2^1/_2$ gallon garden sprayer
- water rinse with low velocity spray nozzle

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indorr coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Totaline environmentally sound coil cleaner as described above.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

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

Totaline Environmentally Sound Coil Cleaner Application Instructions

1. Proper eye protection such as safety glasses is recommended during mixing and application.
2. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
3. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
4. Mix Totaline environmentally sound coil cleaner in a $2^1/_2$ gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100° F.

NOTE: Do NOT USE water in excess of 130°F, as the enzymatic activity will be destroyed.

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

Condensate Drain Pan

Check and clean each year at the start of the cooling season.

To clean the condensate pan:

1. Disconnect condensate drain system from side or bottom drain connection.
2. Remove and clean trap.
3. Remove 4 screws securing condensate pan access cover to unit. Save screws and panel.
4. Slide condensate pan out from unit and clean. Pan is made of non-corrosive plastic. Use a mild cleaner to remove heavy deposits of dirt and grime.
5. Replace pan in unit.
6. Replace condensate pan access cover with 4 screws saved from Step 3.
7. Re-attach and prime condensate trap.
8. Connect condensate drainage system.

NOTE: During winter in low (subfreezing) temperature regions, add antifreeze solutions to the drain. Protect against contact with children, pets and animals.

Filters

Clean or replace at start of each heating and cooling season, or more often if operating conditions require. Refer to Tables 1 and 2 for type and size.

Outdoor-Air Inlet Screens

Clean screens with steam or hot water and a mild detergent.

Main Burner

At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames. Refer to Main Burners section.

Flue Gas Passageways

The flue collector box and heat exchanger cells may be inspected by opening heat section access door (Fig. 10), flue box cover, and main burner assembly (Fig. 33). Refer to Main Burners section on page 56 for burner removal sequence. If cleaning is required, clean tubes with a wire brush.

Combustion-Air Blower

Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, open heat section door. Using a flashlight, look into the flue exhaust duct to inspect. If cleaning is required, remove motor and wheel assembly by removing the screws holding the flue box cover to the flue box. See Fig. 33. Remove the screws holding the inducer housing to the inlet plate. The wheel can then be removed from the motor shaft and cleaned with a detergent or solvent. Replace the wheel onto the motor shaft in the correct position and reassemble the flue cover onto the flue box.

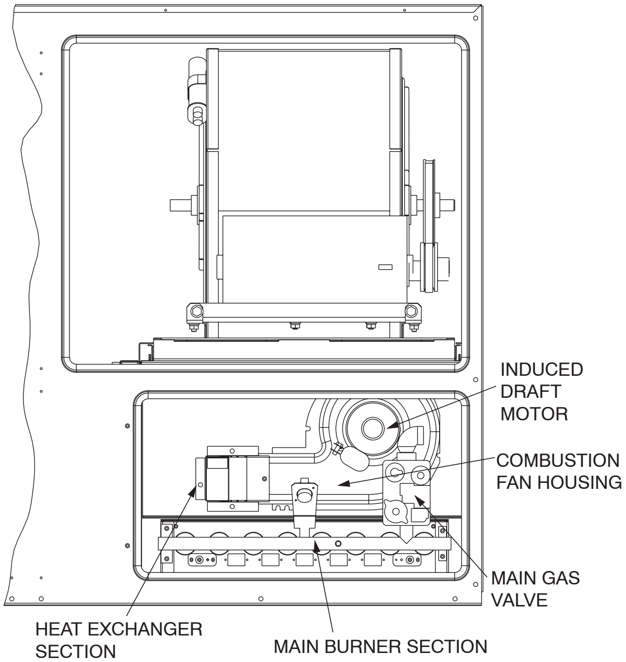

Fig. 34 — Typical Gas Heating Section (Sizes 08-14 Shown)

Lubrication

Compressors

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

> **⚠ CAUTION**
>
> **UNIT DAMAGE HAZARD**
>
> Failure to follow this caution may result in equipment damage.
>
> The compressor is in a Puron® refrigerant system and uses a polyolester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Avoid exposure of the oil to the atmosphere. Damage to components could result.

Polyolester (POE) compressor lubricants are known to cause long term damage to some synthetic roofing materials. Exposure, even if immediately cleaned up, may cause roofing materials to become brittle (leading to cracking) within a year. When performing any service which may risk exposure of compressor oil to the roof, take appropriate precautions to protect roofing. Procedures which risk oil leakage include compressor replacement, repairing refrigerant leaks, and replacing refrigerant components. To prepare rooftop:

1. Cover extended roof work area with an impermeable plastic dropcloth or tarp. Make sure a 10 x 10 ft area around the work area is covered.
2. Cover area in front of the unit service panel with a terry cloth shop towel to absorb lubricant spills and prevent run-offs. Towel will also protect dropcloth from tears caused by tools or components.
3. Place terry cloth shop towel inside the unit directly under components to be serviced to prevent spills through the bottom of the unit.
4. Perform the required service.
5. Remove an dispose of any oil contaminated material per local codes.

Indoor Fan Shaft Bearings

The indoor fan has permanently sealed bearings. No field lubrication is necessary.

Indoor Fan Shaft Bearings (Size 16)

Lubricate bearings at least every 6 months with suitable bearing grease. Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

Condcnser and Evaporator-Fan Motor Bearings

The condenser-fan and evaporator-fan motors have permanently sealed bearings, so no field lubrication is necessary.

Evaporator Fan Service and Replacement

The 48PG units feature a slide-out fan deck for easy servicing of the indoor-fan motor, pulleys, belt, and bearings. To service components in this section, perform the following procedure:

1. Turn off unit power.
2. Open the fan section access door.
3. Remove two no. 10 screws at front of slide-out fan deck. Save screws. (See Fig. 35.)
4. Disconnect the electrical wires connected to the slide-out fan deck (supply air thermistor and fan status switch if installed). Wires may be damaged if not disconnected.
5. Fan deck can now be slid out to access serviceable components.

> **⚠ CAUTION**
>
> **UNIT DAMAGE HAZARD**
>
> Failure to follow this caution may result in equipment damge.
>
> DO NOT SLIDE FAN DECK OUT PAST THE FAN DECK STOP. If further access is required, the fan deck must be supported. Make sure plugs and wiring are not pinched between fan housing and unit sheet metal post.

6. To replace fan deck to operating position, slide fan deck back into the unit. Secure with the two no. 10 screws removed in Step 3.
7. Re-attach electrical wires.
8. Close fan section access door.
9. Restore power to unit.

Evaporator Fan Performance Adjustment (Fig. 35 and 36)

Fan motor pulleys are factory set for speed shown in Table 39.

To change fan speeds:

1. Shut off unit power supply.
2. Loosen nuts on the 4 carriage bolts in the mounting base. Using adjusting bolts and plate, slide motor and remove belt.
3. Loosen movable-pulley flange setscrew. (See Fig. 36.)
4. Screw movable flange toward fixed flange to increase speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum speed specified in Table 39.
   See Table 37 for air quantity limits.
5. Set movable flange at nearest keyway of pulley hub and tighten setscrew. (See Table 39 for speed change for each full turn of pulley flange.)

6. Replace belts.
7. Realign fan and motor pulleys:
   a. Loosen fan pulley setscrews.
   b. Slide fan pulley along fan shaft.
   c. Make angular alignment by loosening motor from mounting plate.
8. Tighten belts.
9. Restore power to unit.

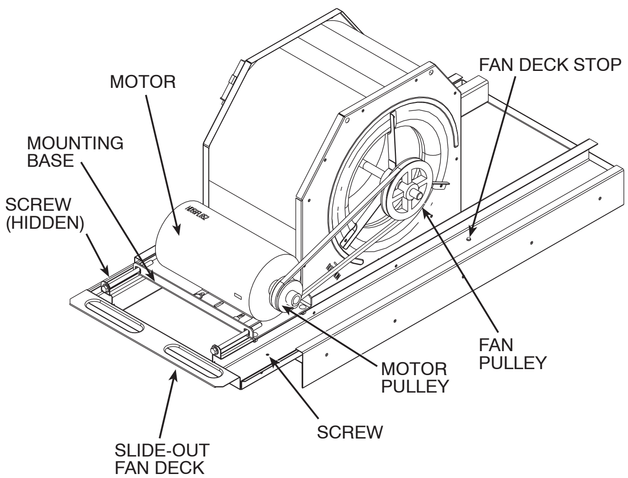

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Fig. 35 – Evaporator-Fan Motor Adjustment (Sizes 08-14 Shown)

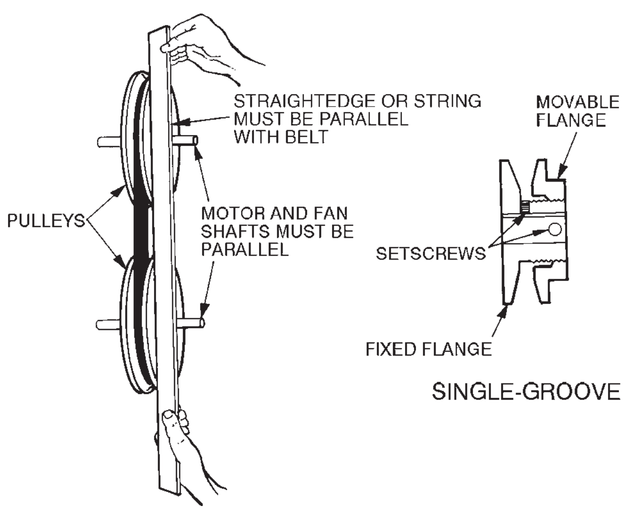

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Fig. 36 – Evaporator-Fan Alignment and Adjustment

Evaporator Fan Belt Tension Adjustment

To adjust belt tension:

1. Turn off unit power.
2. Slide out fan deck to service position as shown in Evaporator Fan Service and Replacement section above.
3. Loosen motor mounting plate bolts.
4. Move motor mounting plate to adjust to proper belt tension. Motor adjuster bolts may be used to tighten belts. (See Fig. 30.) **Do not overtighten belt.**
5. Check for proper belt alignment. Adjust if necessary.
6. Tighten motor mounting plate bolts to lock motor in proper position.
7. Return fan deck back into operating position.
8. Restore power to unit.Condenser-Fan Adjustment (Fig. 37)

1. Shut off unit power supply.
2. Remove condenser-fan assembly (grille, motor, motor cover, and fan) and loosen fan hub setscrews.
3. Adjust fan height as shown in Fig. 37.
4. Tighten setscrews and replace condenser-fan assembly.
5. Turn on power to unit.

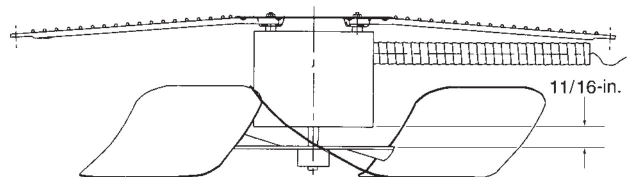

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Fig. 37 – Evaporator-Fan Alignment and Adjustment

Verify Sensor Performance

Using an ohmmeter and a thermometer, compare measured temperature to the resistance shown in Table 40.

Table 40 — Sensor Temperature/Resistance Values

TEMPERATURE (F)	RESISTANCE (ohms)
–58	200,250
–40	100,680
–22	53,010
–4	29,091
14	16,590
32	9,795
50	5,970
68	3,747
77	3,000
86	2,416
104	1,597
122	1,080
140	746
158	525
176	376
185	321
194	274
212	203
230	153
248	116
257	102
266	89
284	70
302	55

Economizer Operation During Power Failure

Dampers have a spring return. In event of power failure, dampers will return to fully closed position until power is restored. *Do not manually operate damper motor.*

Evacuation

Proper evacuation of the system will remove noncondensables and ensure a tight, dry system before charging. Evacuate from both high and low side ports. Never use the system compressor as a vacuum pump. Refrigerant tubes and indoor coil should be evacuated to 500 microns. Always break a vacuum with dry nitrogen. The two possible methods are the deep vacuum method and the triple evacuation method.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a minimum vacuum of 500 microns and a vacuum gauge capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. (See Fig. 38.)

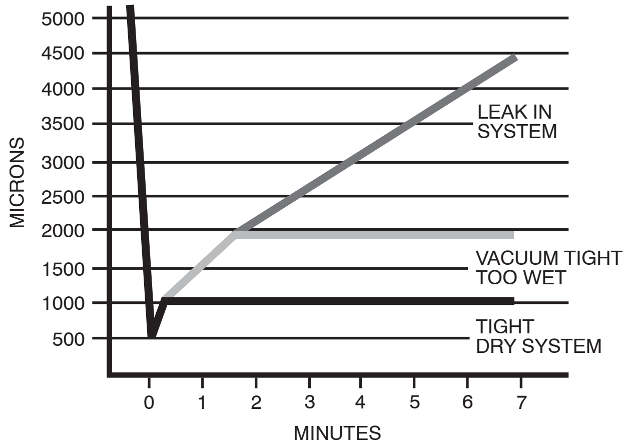


Fig. 38 – Deep Vacuum Graph

Triple Evacuation Method

The triple evacuation method should only be used when vacuum pump is capable of pumping down to 28 in. of mercury and system does not contain any liquid water. Proceed as follows:

1. Pump system down to 28 in. of mercury and allow pump to continue operating for an additional 15 minutes.
2. Close service valves and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and open until system pressure is 2 psig.
4. Close service valve and allow system to stand for 1 hr. During this time, dry nitrogen will be able to diffuse throughout the system, absorbing moisture.
5. Repeat this procedure. System will then contain minimal amounts of contaminants and water vapor.

Refrigerant Charge

Amount of refrigerant charge is listed on unit nameplate. Refer to Carrier GTAC II; Module 5; Charging, Recovery, Recycling, and Reclamation section for charging methods and procedures. Unit panels must be in place when unit is operating during charging procedure.

Puron® (R-410A) refrigerant cylinders contain a dip tube which allows liquid refrigerant to flow from the cylinder in an upright position. Charge units with cylinder in the upright position and a commercial type metering device in the manifold hose.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

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

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

NOTE: Do not use recycled refrigerant as it may contain contaminants.

No Charge

Use standard evacuating techniques. After evacuating system, weigh in the specified amount of refrigerant (refer to unit nameplate).

Low Charge Cooling

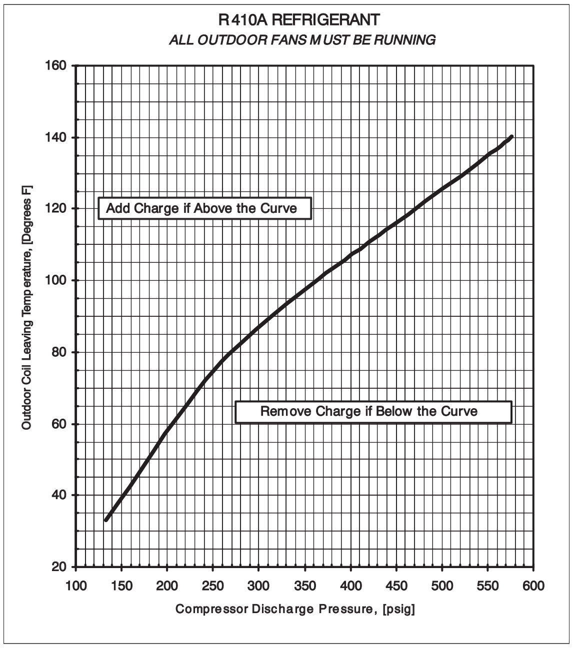
Using cooling charging chart (see Fig. 39-42), add or remove refrigerant until conditions of the chart are met. An accurate pressure gauge and temperature-sensing device is required. Charging is accomplished by ensuring the proper amount of liquid subcooling. Connect pressure gauge to the compressor discharge service valve. Connect temperature sensing device to the liquid line between the condenser and the TXV (thermostatic expansion valve) and insulate it so that ambient temperature does not affect reading.

To Use The Cooling Charging Chart

Use the above temperature and pressure readings, and find the intersection point on the cooling charging chart. If intersection point on chart is above line, add refrigerant. If intersection point on chart is below line, carefully recover some of the charge. Recheck suction pressure as charge is adjusted.

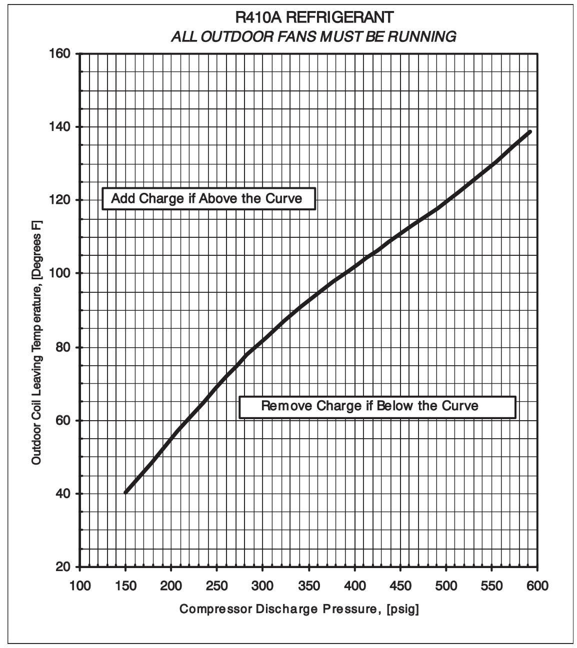
NOTE: Indoor-air cfm must be within normal operating range of unit. All outdoor fans must be operating.

The TXV is set to maintain between 10 and 15° of superheat at the compressors. The valves are factory set and cannot be adjusted. Do not use a TXV designed for use with R-22 refrigerant.



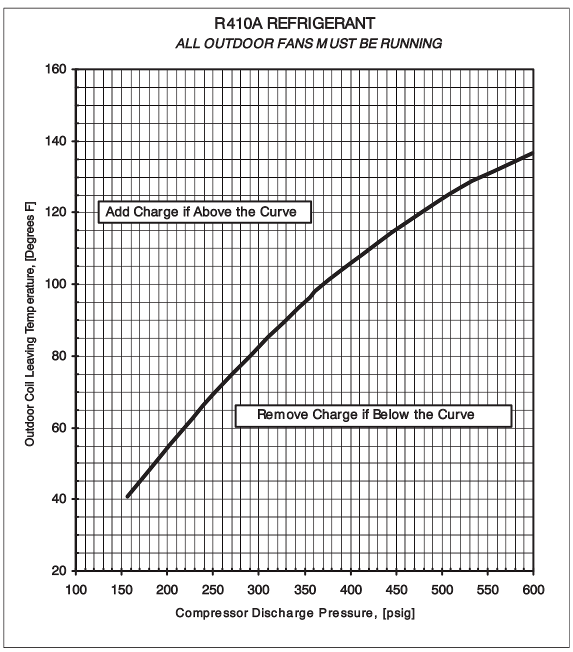
C06265

Fig. 39 — Charging Chart — 48PG08 and 09



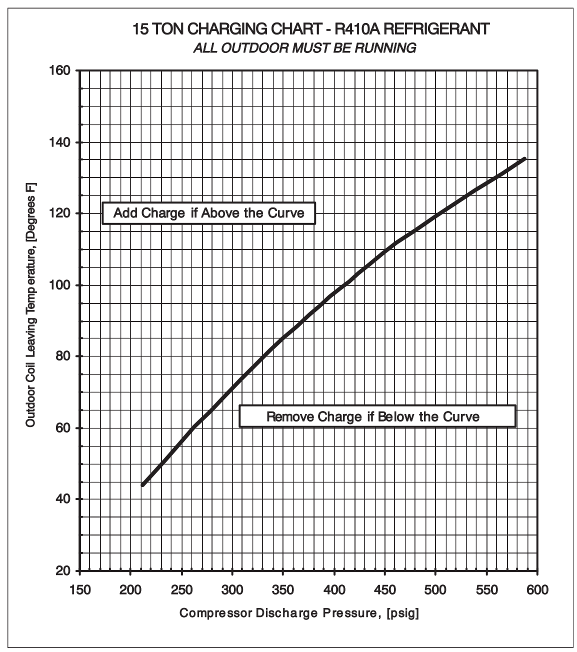
C06267

Fig. 41 — Charging Chart — 48PG14



C06266

Fig. 40 — Charging Chart — 48PG12



C06268

Fig. 42 — Charging Chart — 48PG16

48PG08−16

Puron® Refrigerant

Puron® refrigerant operates at 50 to 70% higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with Puron refrigerant. Do not mix with components that have been used with other refrigerants. Puron® refrigerant, as with other HFCs, is only compatible with POE oils.

Recovery cylinder service pressure rating must be 400 psig. Puron® refrigerant systems should be charged with liquid refrigerant. Use a commercial-type metering device in the manifold hose. Manifold sets should be 750 psig high-side and 200 psig low-side with 520 psig low-side retard. Use hoses with 750 psig service pressure rating. Leak detectors should be designed to detect HFC refrigerant.

Gas Valve Adjustment

The gas valve opens and closes in response to the thermostat or limit control.

When power is supplied to valve terminals W2 (High Fire) and C1, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body.

To adjust regulator:

1. Set unit at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove $^1/_8$-in. pipe plug from manifold pressure tap connection. Install a suitable pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat.
6. Remove screw cap covering regulator adjustment screw. (See Fig. 43.)
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure. The setting is 3.50 in. wg on sizes 08-14 and 3.00 in. wg on size 16.
8. Once desired pressure is established, set unit setting for no call for heat, turn off main gas valve, remove pressure-measuring device, and replace $^1/_8$-in. pipe plug and screw cap.

High Altitude

For high altitude applications greater than 2,000 ft the heat input rate should be reduced. The higher the altitude is above sea level, the less oxygen is in the air. See Table 41 for orifice sizing. A high altitude kit is available to convert unit for altitudes up to 7,000 ft.

LP (Liquid Propane) Gas Use

Base units are equipped with orifice sizes selected for Natural Gas use at elevations below 2000 ft. If LP fuel will be used, change the orifices according to Table 41 data. Manifold pressure is NOT changed when using LP fuel. Check per Start-Up section.

Main Burners

For all applications, main burners are factory set and should require no adjustment.

Main Burner Removal

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power to unit.
3. Open gas section access door.
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws that hold the burner assembly to vestibule plate.
9. Rotate the burner/manifold assembly to the right, away from the flue extension and lift burner/manifold assembly out of unit.

Cleaning and Adjustment

1. Remove burner rack from unit as described in Main Burner Removal section above.
2. Inspect burners, and if dirty, remove burners from rack. The two outer burners have the flame crossover closed off in order to prevent gas flow from exiting the sides of the burner assembly. To prevent ignition problems, make sure the outer burners are returned to their original position when done servicing.
3. Using a soft brush, clean burners and crossover port as required.
4. Adjust spark gap. (See Fig. 43.)
5. Reinstall burners on rack.
6. Reinstall burner rack as described above.

Filter Drier

Replace whenever refrigerant system is exposed to atmosphere. Only use factory specified liquid-line filter driers with working pressures no less than 650 psig. Do not install a suction-line filter drier in liquid line. A liquid-line filter drier designed for use with Puron refrigerant is required on every unit.

Table 41 — Altitude Compensation*

48PG08-14

ELEVATION (ft)	NATURAL GAS ORIFICE†	LP ORIFICE†
0-1,999	43	50
2,000	44	51
3,000	44	51
4,000	44	51
5,000	45	51
6,000	45	52
7,000	47	52
8,000	47	52
9,000	47	53
10,000	48	53
11,000	49	53
12,000	50	54
13,000	50	54
14,000	51	55

48PG16

ELEVATION (ft)	NATURAL GAS ORIFICE†	LP ORIFICE†
0-1,999	30	38
2,000	30	40
3,000	31	40
4,000	31	41
5,000	31	41
6,000	31	42
7,000	32	42
8,000	32	43
9,000	32	43
10,000	35	44
11,000	36	44
12,000	37	45
13,000	38	46
14,000	39	47

LEGEND

LP — Liquid Propane

* As the height above sea level increases, there is less oxygen per cubic foot of air. Therefore, heat input rate should be reduced at higher altitudes. Includes a 4% input reduction per each 1000 ft.

† Orifices available through the local Carrier dealer.

Protective Devices

Compressor Protection

High-Pressure Switch

If the high-pressure switch opens, the compressor will shut down and the compressor lockout (CLO) device will energize to block further compressor operation. The high-pressure switch will reset automatically as the refrigerant pressure drops below its reset level. The CLO will remain energized until manually reset.

Low-Pressure Switch

If the low-pressure switch opens, the compressor will shut down and the compressor lockout (CLO) device will energize to block further compressor operation. The low-pressure switch will reset automatically as the refrigerant pressure rises above its reset level. The CLO will remain energized until manually reset.

Freeze Protection Switch

This switch is installed on each evaporator coil section to provide protection against continued unit operation with a frosted evaporator surface. If the freeze protection switch opens, the compressor on this circuit will shut down and the compressor lockout (CLO) device will energize to block further compressor operation. The freeze protection switch will reset as the evaporator tube temperature rises above its reset level. The CLO will remain energized until manually reset.

Compressor Lockout (CLO) Device

The CLO prevents automatic recycling of the compressor as safety controls reset. If the high-pressure switch, low-pressure switch or freeze protection switch opens, the CLO device will energize to block further compressor operation. To reset the CLO (after all safety switches have reset), either open the thermostat to remove the cooling demand signal (and then re-close) or cycle the control power in the unit.

Overcurrent

Each compressor has internal line break motor protection.

Overtemperature —

Each compressor has an internal protector to protect it against excessively high discharge gas temperatures.

Evaporator Fan Motor Protection

Indoor-fan motors less than 5 hp are equipped with internal overcurrent and overtemperature protection. Protection devices reset automatically. Do not bypass protective devices to correct problem. Disconnect and lock out power when servicing motor.

Indoor- fan motors 5 hp and larger are equipped with a manual reset, calibrated trip, magnetic circuit breaker and overcurrent protection. Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

Condenser-Fan Motor Protection

Each condenser-fan motor is internally protected against overtemperature.

Relief Devices

All units have relief devices to protect against damage from excessive pressures (i.e., fire). These devices protect the high and low side and are located at the suction line service port. Protect joint during brazing operations near joint.

Control Circuit, 24-V

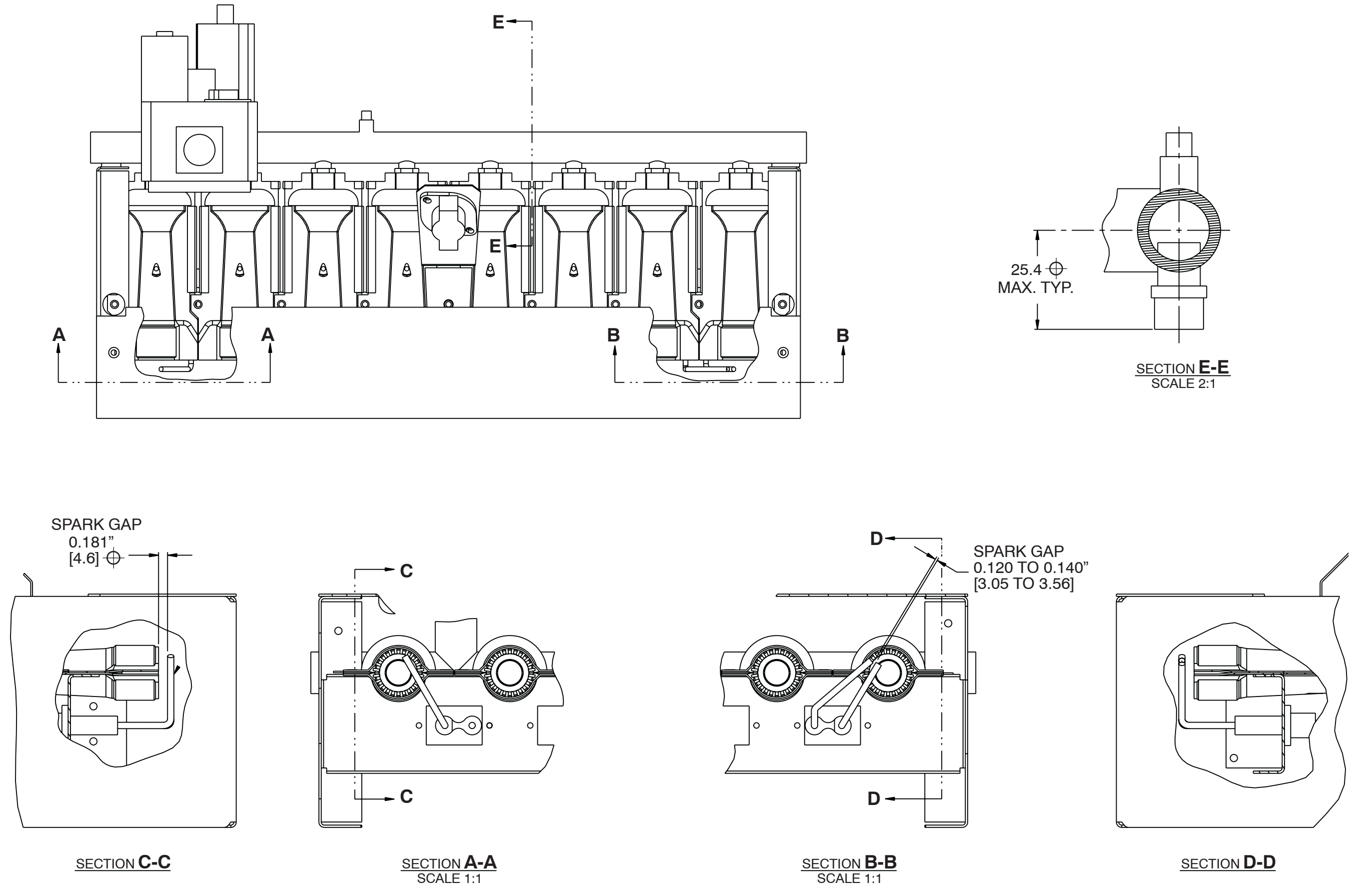
Each control circuit is protected against overcurrent by a 3.2 amp circuit breaker. Breaker can be reset. If it trips, determine cause of trouble before resetting. See Fig. 43 and 44.

Replacement Parts

A complete list of replacement parts may be obtained from any Carrier distributor upon request.

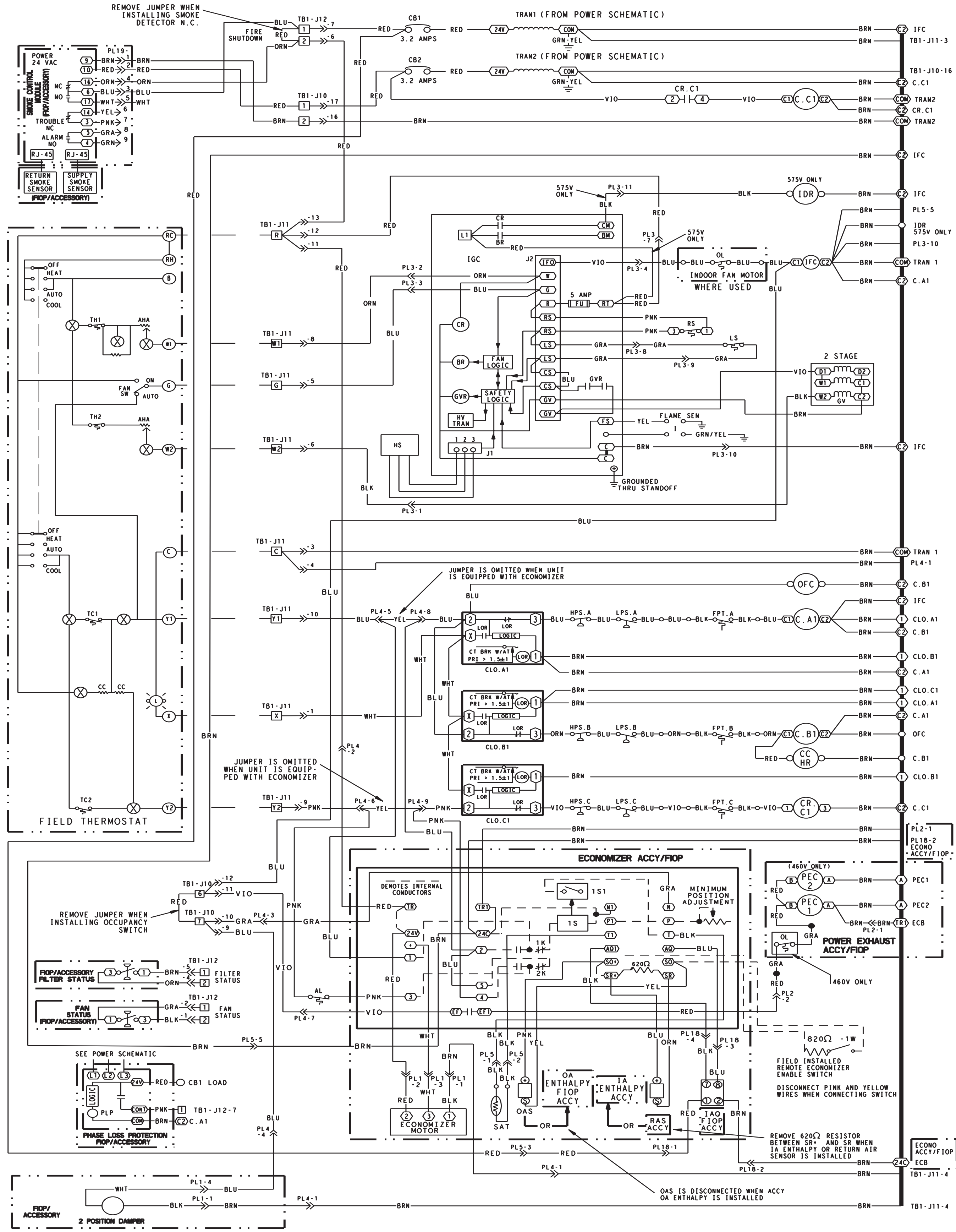
Diagnostic LEDs

The IGC control board has a LED for diagnostic purposes.



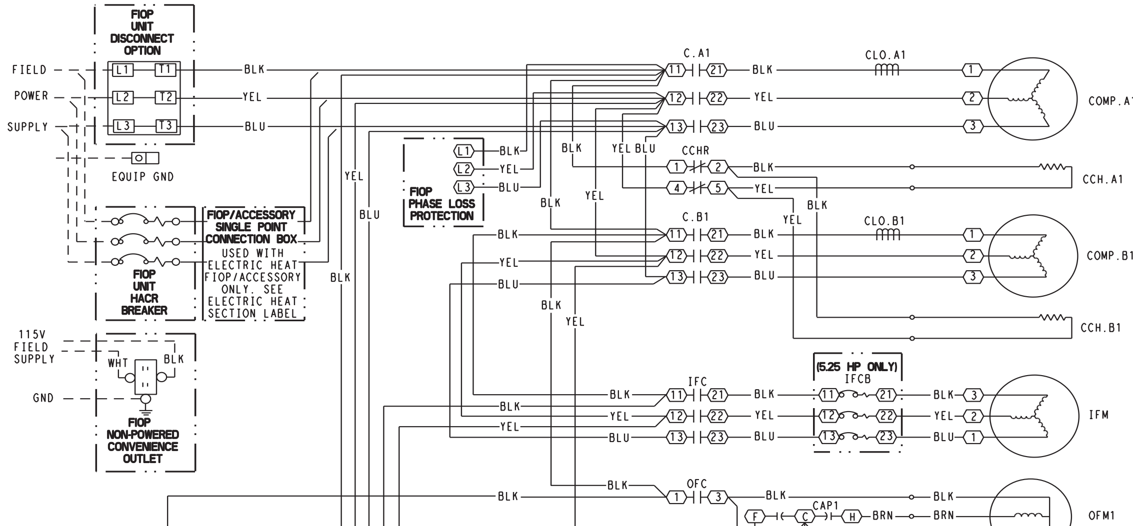
C06269

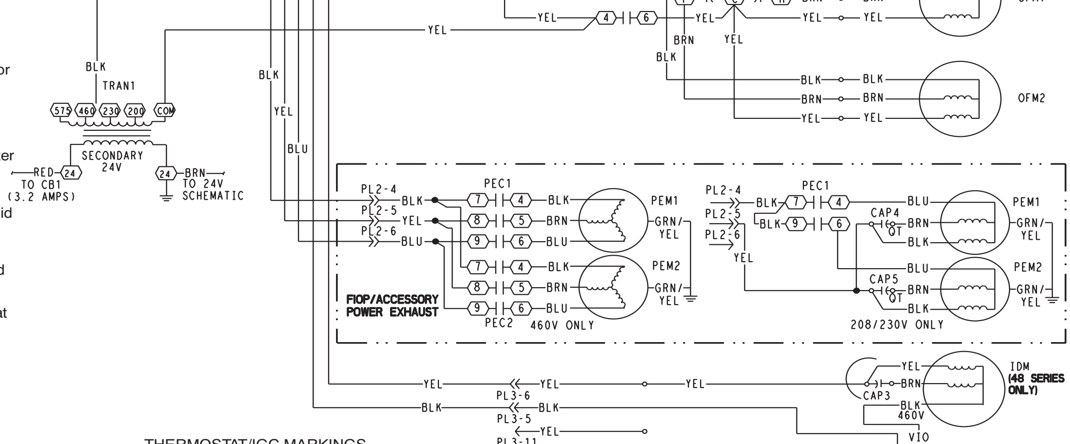
Fig. 43 – Spark Gap Adjustment

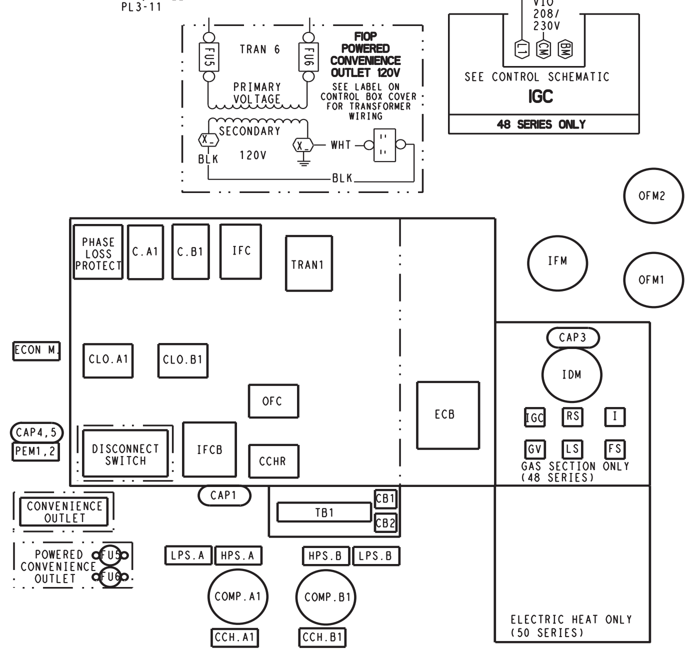


C06270

Fig. 44 – Typical Low Voltage Control Schematic







LEGEND FOR FIG. 44 AND 45

AHA	—	Adjustable Heat Anticipator
AL	—	Ambient Lockout
---A	—	Circuit A
---B	—	Circuit B
C	—	Compressor Contactor
CAP	—	Capacitor
CB	—	Compressor Circuit Breaker
CC	—	Cooling Compensator
CCH	—	Crankcase Heater
CCHR	—	Crankcase Heater Relay
CCHS	—	Crankcase Heater Solenoid
CLO	—	Compressor Lockout
COMP	—	Compressor
CT BRK	—	Circuit Breaker
ECB	—	Economizer Control Board
ECON	—	Economizer
FIOP	—	Factory-Installed Option
FPT	—	Freeze Protect Thermostat
FS	—	Flame Sensor
FU	—	Fuse
GND	—	Ground
GV	—	Gas Valve
HACR	—	Heating, Air Conditioning, and Refrigeration
HPS	—	High-Pressure Switch
HS	—	Hall Effect Sensor
I	—	Ignitor
IAE	—	Indoor Air Enthalpy
IAQ	—	Indoor Air Quality
IDM	—	Induced-Draft Motor
IFC	—	Indoor-Fan Contactor
IFCB	—	Indoor Fan Circuit Breaker
IFM	—	Indoor-Fan Motor
IGC	—	Integrated Gas Controller
LOR	—	Lockout Relay
LPS	—	Low-Pressure Switch
LS	—	Limit Switch
LSM	—	Mechanical Limit Switch
OAE	—	Outdoor-Air Enthalpy
OAS	—	Outdoor-Air Sensor
OFC	—	Outdoor-Fan Contactor
OFM	—	Outdoor-Fan Motor
OL	—	Overload Relay
PEC	—	Power Exhaust Contactor
PEM	—	Power Exhaust Motor
PL	—	Plug
QT	—	Quadruple Terminal
RAS	—	Return Air Sensor
RS	—	Rollout Switch
SAT	—	Supply-Air Temperature
TB	—	Terminal Block
TC	—	Thermostat-Cooling
TH	—	Thermostat-Heating
TRAN	—	Transformer
W/AT	—	With Auxiliary Trip

- Terminal (Marked)
- Terminal (Unmarked)
- Terminal Block
- Factory Wiring
- Field Control Wiring
- Field Power Wiring
- Accessory or Optional Wiring
- To Indicate Common Potential Only. Not to Represent Wiring.

THERMOSTAT/IGC MARKINGS

BM	—	Blower Motor
C	—	Common
CM	—	Combustion Motor
CS	—	Centrifugal Switch
G	—	Fan
IFO	—	Indoor Fan On
L1	—	Line 1
R	—	Thermostat Power
RT	—	Power Supply
SS	—	Speed Sensor
W	—	Thermostat Heat
W1	—	1st Stage of Heating
W2	—	2nd Stage of Heating
X	—	Alarm Output
Y1	—	1st Stage of Cooling
Y2	—	2nd Stage of Cooling

NOTES:

1. If any of the original wire furnished must be replaced, it must be replaced with Type 90° C or its equivalent.
2. Three-phase motors are protected under primary single-phasing conditions.
3. Use copper conductors only.
4. RED jumper wire must be added between R and W1 for space temperature mode and temporarily during Service-Test mode when the heaters need to operate.
5. TRAN1 and 2 are wired for 230-v on 208/230-v units. If unit is to be run with 208-v power supply, disconnect BLK wire from 230-v terminal and connect to 200-v terminal.

C06271

Fig. 45 — Typical Power Schematic

TROUBLESHOOTING

Unit Troubleshooting

See Table 42 for unit cooling troubleshooting. See Tables 43 and 44 for unit heating troubleshooting.

Table 42 — Cooling Service Analysis

PROBLEM	CAUSE	REMEDY
Compressor and Condenser Fan Will Not Start.	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay.	Replace component.
	Insufficient line voltage.	Determine cause and correct.
	Incorrect or faulty wiring.	Check wiring diagram and rewire correctly.
	Thermostat setting too high.	Lower thermostat setting below room temperature.
Compressor Will Not Start But Condenser Fan Runs.	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open.	Determine cause. Replace compressor.
	Defective run/start capacitor, overload, start relay.	Determine cause and replace.
	One leg of 3-phase power dead.	Replace fuse or reset circuit breaker. Determine cause.
Compressor Cycles (Other Than Normally Satisfying Thermostat).	Refrigerant overcharge or undercharge.	Recover refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor.	Replace and determine cause.
	Insufficient line voltage.	Determine cause and correct.
	Blocked condenser.	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay.	Determine cause and replace.
	Defective thermostat.	Replace thermostat.
	Faulty condenser-fan motor or capacitor.	Replace.
	Restriction in refrigerant system.	Locate restriction and remove.
Compressor Operates Continuously.	Dirty air filter.	Replace filter.
	Unit undersized for load.	Decrease load or increase unit size.
	Thermostat set too low.	Reset thermostat.
	Low refrigerant charge.	Locate leak, repair, and recharge.
	Leaking valves in compressor.	Replace compressor.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted.	Clean coil or remove restriction.
Excessive Head Pressure.	Dirty air filter.	Replace filter.
	Dirty condenser coil.	Clean coil.
	Refrigerant overcharged.	Recover excess refrigerant.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short-cycling.	Determine cause and correct.
Head Pressure Too Low.	Low refrigerant charge.	Check for leaks, repair, and recharge.
	Compressor valves leaking.	Replace compressor.
	Restriction in liquid tube.	Remove restriction.
Excessive Suction Pressure.	High heat load.	Check for source and eliminate.
	Compressor valves leaking.	Replace compressor.
	Refrigerant overcharged.	Recover excess refrigerant.
Suction Pressure Too Low.	Dirty air filter.	Replace filter.
	Low refrigerant charge.	Check for leaks, repair, and recharge.
	Metering device or low side restricted.	Remove source of restriction.
	Insufficient evaporator airflow.	Increase air quantity. Check filter and replace if necessary.
	Temperature too low in conditioned area.	Reset thermostat.
	Outdoor ambient below 25 F.	Install low-ambient kit.
Evaporator Fan Will Not Shut Off.	Time off delay not finished.	Wait for 30-second off delay.

Table 43 — Heating Service Analysis

PROBLEM	CAUSE	REMEDY
Burners Will Not Ignite.	Misaligned spark electrodes.	Check flame ignition and sensor electrode positioning. Adjust as needed.
	No gas at main burners.	Check gas line for air purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to relight unit.
		Check gas valve.
	Water in gas line.	Drain water and install drip leg to trap water.
	No power to furnace.	Check power supply, fuses, wiring, and circuit breaker.
	No 24 v power supply to control circuit.	Check transformer. Transformers with internal overcurrent protection require a cool-down period before resetting. Check 24-v circuit breaker; reset if necessary.
	Miswired or loose connections.	Check all wiring and wirenut connections.
	Burned-out heat anticipator in thermostat.	Replace thermostat.
	Broken thermostat wires.	Run continuity check. Replace wires, if necessary.
Inadequate Heating.	Dirty air filter.	Clean or replace filter as necessary.
	Gas input to unit too low.	Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure or replace with correct orifices.
	Unit undersized for application.	Replace with proper unit or add additional unit.
	Restricted airflow.	Clean filter, replace filter, or remove any restrictions.
	Blower speed too low.	Use high speed tap, increase fan speed, or install optional blower, as suitable for individual units, Adjust pulley.
	Limit switch cycles main burners.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
	Too much outdoor air.	Adjust minimum position.
		Check economizer operation.
Poor Flame Characteristics.	Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO (carbon monoxide), sooting flame, or floating flame.	Check all screws around flue outlets and burner compartment. Tighten as necessary.
		Cracked heat exchanger. Replace heat exchanger.
		Overfired unit — reduce input, change orifices, or adjust gas line or manifold pressure.
		Check vent for restriction. Clean as necessary.
		Check orifice to burner alignment.
Burners Will Not Turn Off.	Unit is locked into Heating mode for a one minute minimum.	Wait until mandatory one-minute time period has elapsed or reset power to unit.

Table 44 — IGC Board LED Alarm Codes

LED FLASH CODE	DESCRIPTION	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
On	Normal Operation	—	—	—
Off	Hardware Failure	No gas heating.	—	Loss of power to the IGC. Check 5 amp fuse on IGC, power to unit, 24V circuit breaker, transformer, and wiring to the IGC.
1 Flash	Indoor Fan On/Off Delay Modified	5 seconds subtracted from On delay. 5 seconds added to Off delay (3 min max).	Power reset.	High temperature limit switch opens during heat exchanger warm-up period before fan-on delay expires. High temperature limit switch opens within 10 minutes of heat call (W) Off. See Limit Switch Fault.
2 Flashes	Limit Switch Fault	Gas valve and igniter Off. Indoor fan and inducer On.	Limit switch closed, or heat call (W) Off.	High temperature limit switch is open. Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is within the range on the unit nameplate. Check wiring and limit switch operation.
3 Flashes	Flame Sense Fault	Indoor fan and inducer On.	Flame sense normal. Power reset for LED reset.	The IGC sensed a flame when the gas valve should be closed. Check wiring, flame sensor, and gas valve operation.
4 Flashes	Four Consecutive Limit Switch Fault	No gas heating.	Heat call (W) Off. Power reset for LED reset.	4 consecutive limit switch faults within a single call for heat. See Limit Switch Fault.
5 Flashes	Ignition Fault	No gas heating.	Heat call (W) Off. Power reset for LED reset.	Unit unsuccessfully attempted ignition for 15 minutes. Check igniter and flame sensor electrode spacing, gaps, etc. Check flame sense and igniter wiring. Check gas valve operation and gas supply.
6 Flashes	Induced Draft Motor Fault	If heat off: no gas heating. If heat on: gas valve Off and inducer On.	Inducer sense normal, or heat call (W) Off.	Inducer sense On when heat call Off, or inducer sense Off when heat call On. Check wiring, voltage, and operation of IGC motor. Check speed sensor wiring to IGC.
7 Flashes	Rollout Switch Lockout	Gas valve and igniter Off. Indoor fan and inducer On.	Power reset.	Rollout switch has opened. Check gas valve operation. Check induced-draft blower wheel is properly secured to motor shaft.
8 Flashes	Internal Control Lockout	No gas heating.	Power reset.	IGC has sensed internal hardware or software error. If fault is not cleared by resetting 24 v power, replace the IGC.
9 Flashes	Temporary Software Lockout	No gas heating.	1 hour auto reset, or power reset.	Electrical interference is disrupting the IGC software.

LEGEND

IGC — Integrated Gas Unit
LED — Light–Emitting Diode

NOTES:

1. There is a 3-second pause between alarm code displays.
2. If more than one alarm code exists, all applicable alarm codes will be displayed in numerical sequence.
3. Alarm codes on the IGC will be lost if power to the unit is interrupted.

EconoMi$er IV Troubleshooting

Economi$er IV Preparation

NOTE: This procedure requires a 9-v battery, 1.2 kilo-ohm resistor, and a 5.6 kilo-ohm resistor which are not supplied with the EconoMi$er IV.

IMPORTANT: Be sure to record the positions of all potentiometers before starting troubleshooting.

1. Disconnect power at TR and TR1. All LEDs should be off. Exhaust fan contacts should be open.
2. Disconnect device at P and P1.
3. Jumper P to P1.
4. Disconnect wires at T and T1. Place 5.6 kilo-ohm resistor across T and T1.
5. Jumper TR to 1.
6. Jumper TR to N.
7. If connected, remove sensor from terminals S_O and +. Connect 1.2 kilo-ohm 4074EJM checkout resistor across terminals S_O and +.
8. Put 620-ohm resistor across terminals S_R and +.
9. Set minimum position, DCV set point, and exhaust potentiometers fully CCW (counterclockwise).
10. Set DCV maximum position potentiometer fully CW (clockwise).
11. Set enthalpy potentiometer to D.
12. Apply power (24 vac) to terminals TR and TR1.

Differential Enthalpy

To check differential enthalpy:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Place 620-ohm resistor across S_O and +.
3. Place 1.2 kilo-ohm resistor across S_R and +. The Free Cool LED should be lit.
4. Remove 620-ohm resistor across S_O and +. The Free Cool LED should turn off.
5. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

Single Enthalpy

To check single enthalpy:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

DCV (Demand Controlled Ventilation) and Power Exhause

To check DCV and Power Exhaust:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Ensure terminals AQ and AQ1 are open. The LED for both DCV and Exhaust should be off. The actuator should be fully closed.
3. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The LED for both DCV and Exhaust should turn on. The actuator should drive to between 90 and 95% open.
4. Turn the Exhaust potentiometer CW until the Exhaust LED turns off. The LED should turn off when the potentiometer is approximately 90%. The actuator should remain in position.
5. Turn the DCV set point potentiometer CW until the DCV LED turns off. The DCV LED should turn off when the potentiometer is approximately 9 v. The actuator should drive fully closed.
6. Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contacts will close 30 to 120 seconds after the Exhaust LED turns on.
7. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

DCV Minimum and Maximum Position

To check the DCV minimum and maximum position:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Connect a 9-v battery to AQ (positive node) and AQ1 (negative node). The DCV LED should turn on. The actuator should drive to between 90 and 95% open.
3. Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
4. Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
5. Turn the Minimum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
6. Turn the Minimum Position Potentiometer fully CW. The actuator should drive fully open.
7. Remove the jumper from TR and N. The actuator should drive fully closed.
8. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

Mixed-Air Input

To check mixed-air input:

1. Make sure EconoMi$er IV preparation procedure has been performed.
2. Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
3. Remove the 5.6 kilo-ohm resistor and jumper T to T1. The actuator should drive fully open.
4. Remove the jumper across T and T1. The actuator should drive fully closed.
5. Return EconoMi$er IV settings and wiring to normal after completing troubleshooting.

Economi$er IV Troubleshooting Completion

This procedure is used to return the EconoMi$er IV to operation. No troubleshooting or testing is done by performing the following procedure.

1. Disconnect power at TR and TR1.
2. Set enthalpy potentiometer to previous setting.
3. Set DCV maximum position potentiometer to previous setting.
4. Set minimum position, DCV set point, and exhaust potentiometers to previous settings.
5. Remove 620-ohm resistor from terminals S_R and +.
6. Remove 1.2 kilo-ohm checkout resistor from terminals S_O and +. If used, reconnect sensor from terminals S_O and +.
7. Remove jumper from TR to N.
8. Remove jumper from TR to 1.
9. Remove 5.6 kilo-ohm resistor from T and T1. Reconnect wires at T and T1.
10. Remove jumper from P to P1. Reconnect device at P and P1.
11. Apply power (24 vac) to terminals TR and TR1.

Phase Loss Protection

The phase loss protection option will monitor the three-phase electrical system to provide phase reversal and phase loss protection.

Phase Reversal Protection

If the control senses an incorrect phase relationship, the relay (K1) will be de-energized (opening its contact). If the phase relationship is correct, the relay will be energized. The control has a self-bypass function after a pre-set time. If the control determines that the three phases stay in a correct relationship for 10 consecutive minutes, the relay will stay energized regardless of the phase sequence of three inputs as long as 24-vac control voltage is applied. This self-bypass function will be reset if all three phases are restored in a phase loss event.

Phase Loss Protection

If the reverse rotation board senses any one of the three phase inputs has no AC voltage, the relay will be deenergized (opening its contact). This protection is always active as long as 24-vac control voltage is applied, and is not affected by the self bypass function of the phase sequence monitoring function. However, in the event of phase loss, the relay will be re-energized only if all three phases are restored and the three phases are in the correct sequence.

A red LED is provided to indicate the function of the board. See the table below.

LED STATUS	FUNCTION
On Continuously	Relay contact closed (normal operation).
Blinking	Relay contact open (phase loss or phase reversal has occurred) – No power will be supplied to the control system.
Off	24 vac control power not present (off).

UNIT START-UP CHECKLIST

MODEL NO.:____________________ SERIAL NO.:____________________

DATE:____________________ TECHNICIAN:____________________

48PG08−16

I. PRE-START-UP:

- ☐ VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ VERIFY INSTALLATION OF OUTDOOR AIR HOOD
- ☐ VERIFY INSTALLATION OF FLUE EXHAUST AND INLET HOOD
- ☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTRUCTIONS
- ☐ VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT
- ☐ VERIFY GAS PRESSURE TO UNIT GAS VALVE IS WITHIN SPECIFIED RANGE
- ☐ CHECK GAS PIPING FOR LEAKS
- ☐ CHECK THAT INDOOR-AIR FILTERS ARE CLEAN AND IN PLACE
- ☐ CHECK THAT OUTDOOR AIR INLET SCREENS ARE IN PLACE
- ☐ VERIFY THAT UNIT IS LEVEL
- ☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE, AND VERIFY SETSCREW IS TIGHT
- ☐ VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED
- ☐ VERIFY THAT SCROLL COMPRESSORS ARE ROTATING IN THE CORRECT DIRECTION
- ☐ VERIFY INSTALLATION OF THERMOSTAT
- ☐ VERIFY THAT CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR AT LEAST 24 HOURS

II. START-UP

ELECTRICAL

SUPPLY VOLTAGE		L1-L2	________	L2-L3	________	L3-L1	________
COMPRESSOR AMPS	— COMPRESSOR A1	L1	________	L2	________	L3	________
	— COMPRESSOR B1	L1	________	L2	________	L3	________
	— COMPRESSOR C1 (16)	L1	________	L2	________	L3	________
SUPPLY FAN AMPS		L1	________	L2	________	L3	________

TEMPERATURES

OUTDOOR-AIR TEMPERATURE	________	F DB (Dry Bulb)
RETURN-AIR TEMPERATURE	________	F DB ________ F WB (Wet Bulb)
COOLING SUPPLY AIR	________	F
GAS HEAT SUPPLY AIR	________	F

PRESSURES

GAS INLET PRESSURE		________	IN. WG			
GAS MANIFOLD PRESSURE	STAGE NO. 1	________	IN. WG	STAGE NO. 2	________	IN. WG
REFRIGERANT SUCTION	CIRCUIT A	________	PSIG			
	CIRCUIT B	________	PSIG			
	CIRCUIT C (16)	________	PSIG			
REFRIGERANTDISCHARGE	CIRCUIT A	________	PSIG			
	CIRCUIT B	________	PSIG			
	CIRCUIT C (16)	________	PSIG			

- ☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS

GENERAL

- ☐ ECONOMIZER MINIMUM VENT AND CHANGEOVER SETTINGS TO JOB REQUIREMENTS

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Replaces:48PG−9SI

TRANE®

Installation and Maintenance Manual

CLCH-IM-16A

Library	**Service Literature**
Product Section	**Air Handling**
Product	**Central Station Air Handlers**
Model	**T-Series Climate Changer**
Literature Type	**Installation/Maintenance**
Sequence	**2**
Date	**March 1999**
File No.	**CLCH-IM-16A 3/99**

T-Series Climate Changer® Central Station Air Handlers

Draw-Thru and Blow-Thru Unit Sizes 3, 6, 8, 10, 12, 14, 17, 21, 25, 30, 35, 40, 50, 66, 80, and 100

Part No. X39640516-01

Notice

WORLD ENVIRONMENTAL SCIENTISTS HAVE CONCLUDED, BASED ON THE BEST CURRENTLY AVAILABLE EVIDENCE, THAT OZONE IN OUR UPPER ATMOSPHERE IS BEING REDUCED DUE TO THE RELEASE OF CFC FULLY HALOGENATED COMPOUNDS.

THE TRANE COMPANY URGES THAT ALL HVAC SERVICERS WORKING ON TRANE EQUIPMENT, OR ANY MANUFACTURER'S PRODUCTS, MAKE EVERY EFFORT TO ELIMINATE, IF POSSIBLE, OR VIGOROUSLY REDUCE THE EMISSION OF CFC, HCFC, AND HFC REFRIGERANTS TO THE ATMOSPHERE RESULTING FROM INSTALLATION, OPERATION, ROUTINE MAINTENANCE, OR MAJOR SERVICE ON THIS EQUIPMENT. ALWAYS ACT IN A RESPONSIBLE MANNER TO CONSERVE REFRIGERANTS FOR CONTINUED USE EVEN WHEN ACCEPTABLE ALTERNATIVES ARE AVAILABLE.

REFRIGERANT USED IN ANY TYPE OF AIR-CONDITIONING OR REFRIGERATING EQUIPMENT SHOULD BE RECOVERED FOR REUSE, RECOVERED AND /OR RECYCLED FOR REUSE, REPROCESSED (RECLAIMED), OR PROPERLY DESTROYED, WHENEVER IT IS REMOVED FROM EQUIPMENT. NEVER RELEASE TO THE ATMOSPHERE!

Literature Change History

CLCH-IM-16 (November 1997)
Initial Manual covering T-Series Climate Changer, sizes 3, 6, 8, 10, 12, 14, 17, 21, 25, 30, 35,40, 50, 66, 80, and 100.

CLCH-IM-16A (March 1999)
Revised manual to include new details on shipping, assembly, and installation.

Warning and Cautions

Notice that WARNING and CAUTION appear at appropriate intervals throughout this manual.

⚠ WARNING

WARNING indicates a potentially hazardous situation that could result in personal injury or death.

⚠ CAUTION

CAUTIONs are designed to alert you to conditions that could result in minor personal injury or equipment damage.

Table of Contents

General Information

Unit Description

Trane T-Series Climate Changers® are Central Station Air Handlers designed for a variety of air handling applications. The basic unit consists of a fan, heating and/or cooling coils, filters, and dampers. See the sales catalog (CLCH-DS-9) for a list of available options and components.

The fan is internally isolated. Fans available are double-width, double-inlet Centrifugal types with forward curved, backward inclined, or airfoil blade type design; single-width, single-inlet Plug Fans or Vane-Axial Q Fans®. Fans are available in low, medium, and high pressure classes with or without inlet guide vanes.

To insure fan stability, the unit ships with four (4) lock-down devices that prevent the fan from shifting during shipment and installation. These spacers must be removed prior to fan operation to assure proper vibration isolation.

The units are available with factory-mounted controls for stand-alone operation or operation with a complete building automation system. This includes factory-mounted starters, DDC controllers, and end devices.

Trane T-Series Climate Changers ship as complete assemblies or sectional subassemblies. Some assembly is required when the units ship as subassemblies.

Operating Environment

The T-Series Climate Changer (TSC) is an outdoor air handler. When considering the placement of the TSC it is important to consider the operating environment. The acceptable ambient temperature range for unit operation is -40° to +140°F (-40°C to 60°C).

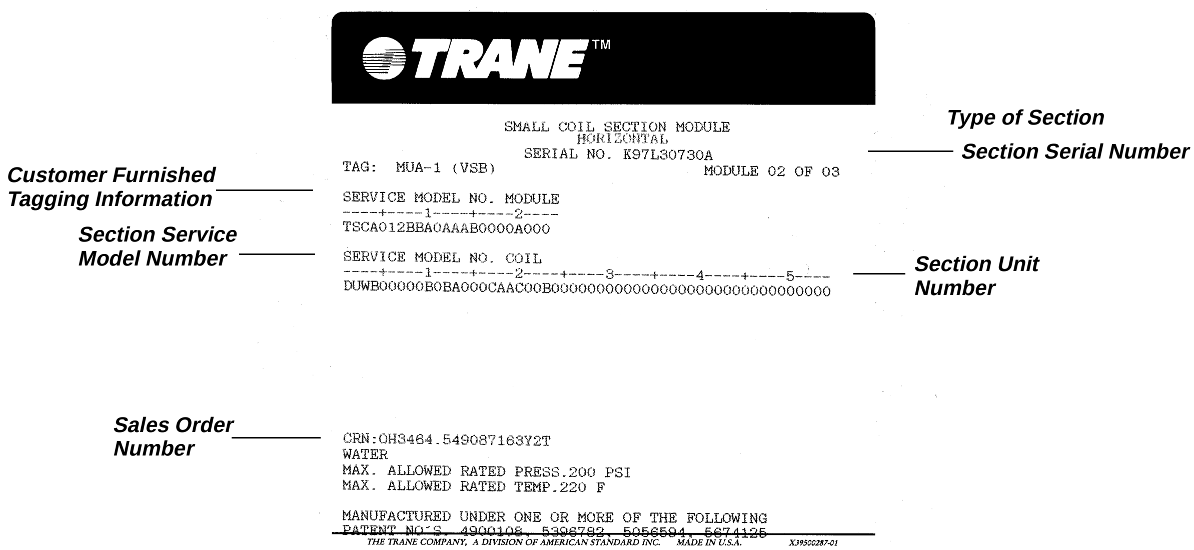
For heating applications a special motor may be required to withstand the higher temperatures. Motors with Class "B" insulation are acceptable for ambient temperatures **up to 104°F** while motors with class "F" insulation can withstand ambient temperatures **to +140° F** (60°C).

NOTE: IT IS RECOMMENDED THAT THE CUSTOMER PROVIDE ADEQUATE FREEZE PROTECTION FOR THE COILS.
UNITS WITH UL APPROVAL HAVE A MAXIMUM AMBIENT TEMPERATURE REQUIREMENT OF 104°F.

Unit Nameplates

Each unit section is provided with a section nameplate (label). See *Figure 1* . This nameplate includes type of section, section serial number, customer tagging information, section position and service model number.

Figure 1
Unit Nameplate



Each section of a T-Series Climate Changer is identified with a multi-character model number and serial number. The model number precisely identifies a particular section. Refer to model number and serial number when ordering parts or requesting service.

If the unit ships as individual sections or section subassemblies refer to the nameplate for customer tagging information and section position to insure proper placement of the sections during assembly.

Controls

Wiring Sizes and Connections

Entrances are provided for field installation of high and low voltage wiring through a pipe/nipple connection in the base of the unit. The low and high voltage connections are on opposite sides of the unit on sizes 3 - 50 and on the same side for sizes 66 - 100.

⚠ CAUTION

The high and low voltage wire raceways for the T-series units are intended for factory wiring ONLY. Do not use these raceways for field uses. Failure to follow these instructions can result in damage to the unit.

Wiring to the unit must be provided by the installer and must comply with all national and local electrical codes. The motor nameplate includes a wiring diagram. If there are any questions concerning the wiring of the motor be sure to take the motor manufacturer's name, model number, and serial number and contact your local Trane representative for assistance.

Factory Mounted Controls

NOTE: FOR MORE IN-DEPTH UNDERSTANDING OF THE PROGRAMMABLE CONTROL MODULE (PCM) REFERENCE INSTALLATION GUIDE EMTX-IN-11A, APPLICATION GUIDE EMTX-AG-1, OPERATORS GUIDE EMTX-OG-4, INSTALLATION, OPERATION AND PROGRAMMING GUIDE CLCH-IOP-1, AND INSTALLATION, OPERATION AND MAINTENANCE MISC-IOM-5.

The T-Series Climate Changer is available with a wide array of factory mounted controls. They include the Programmable Control Module (PCM), motor starters, and Variable Frequency Drives (VFD).

NOTE: THIS SECTION WILL PROVIDE A BRIEF OVERVIEW OF THE OPTIONAL FACTORY MOUNTED CONTROLS. FOR MORE IN-DEPTH UNDERSTANDING OF THE PROGRAMMABLE CONTROL MODULE (PCM), REFERENCE INSTALLATION GUIDE EMTX-IN-11A, APPLICATION GUIDE EMTX-AG-1, OPERATORS' GUIDE EMTX-OG-4, INSTALLATION OPERATION AND PROGRAMMING GUIDE CLCH-IOP-1 AND INSTALLATION OPERATION AND MAINTENANCE MISC-IOM-5.

Most control components are mounted inside the units. Depending on system configuration, these controls may include damper actuators, dirty filter switches, averaging temperature sensors, low limit switches, point temperature switches, and inlet guide vane actuators. Variable frequency drives, starters, PCMs, control transformers, static pressure transducers, DC power supplies, customer interface relays, etc. will be in enclosures mounted on the inside of the unit.

Small items that cannot be factory-mounted will ship inside the control enclosures. These controls may include space temperature sensors, outside air temperature sensors, and humidity sensors.

All control valves will ship directly to the "ship to address" from the vendor, unless another address was given on the order.

All constant volume or variable air volume control systems are provided with 120 to 24 VAC control transformers. Unless ordered with a factory-mounted/wired starter or variable frequency drive, the customer must provide 120 VAC control power, 50/60 hz, typically 3 amps for unit sizes 3 - 50, and 5 amps for unit sizes 66 -100. A dedicated 15 amp circuit is recommended.

A T-Series Climate Changer unit and/or field-installed accessories that must be stored for a period of time prior to being installed MUST be protected from the elements. The PCM and all other electrical/electronic components should be stored in conditions of -20 - 120°F and 5 - 95% relative humidity non-condensing. Electrical components ARE NOT moisture-tolerant

The warranty will not cover damage to the unit or controls due to negligence during storage. A controlled indoor environment is recommended for proper storage. For further storage considerations, refer to "Storage Considerations" in the next section.

Receiving

The T-Series Climate Changer can ship as individual sections, section subassemblies, or a complete air handler. Sizes 3 - 100 have an integral base rail.

Upon receipt of the unit(s) and prior to unloading, inspect the unit for damage and verify that the shipment is complete. **Delivery cannot be refused**.

Inspection

1. Visually inspect components for any damage that may have occurred during shipment.

NOTE: THE TRANE COMPANY IS NOT RESPONSIBLE FOR SHIPPING DAMAGE.

2. Check all access doors to confirm that the latches and hinges are not damaged.
3. Check all coil connections to confirm they are straight and undamaged.
4. Inspect the coils for damage to the fin surface or coil connections.
5. Check all devices attached to the unit exterior and confirm that they are not damaged.
6. Manually rotate the fan wheel to ensure free movement of the shaft, bearings, and drive. Inspect the fan housing for any foreign objects.
7. Inspect the interior of each section for any internal damage as soon as possible after delivery. Concealed damage must be reported within 15 days of receipt.
8. If the unit was ordered with Factory Mounted Controls, locate all sensors. These components will be shipped inside the control enclosure.
9. If the unit shipped in subassemblies, locate assembly hardware. The necessary assembly hardware will be packaged inside the fan section or the mixing section.

Resolving Shipping Damage

The T-Series Climate Changer ships FOB. If damage has occurred to the unit sections during shipment, the following instructions should be completed:

1. Make specific notation describing the damage on the freight bill.
2. Report all claims of shipping damage to the delivering carrier immediately.
3. Keep damaged material in the same location as it was received. It is the receiver's responsibility to provide reasonable evidence that the concealed damage was not incurred after delivery.
4. Notify the Trane sales representative of the damage and arrange for repair. Do not attempt to repair the unit without consulting the sales representative. *TRANE IS NOT RESPONSIBLE FOR SHIPPING DAMAGE.*

Storage Considerations

General

The Trane T-Series Climate Changer air handler is an outdoor unit and requires no special protection for storage before installation. Keep the equipment in the original shipping container for protection and ease of handling. **The warranty will not cover damages to the unit due to negligence during storage**.

For longer periods of storage, allow enough clearance around the unit to perform periodic inspection and maintenance of the equipment. In addition, loosen belt tension on drive belts.

Long Term Storage

Every two weeks, rotate the fan and motor shaft thirty revolutions by hand. Check for free rotation.

Every six months, check fan shaft bearings and grease lines. Add grease using a manual grease gun following the lubrication recommendations in the Periodic Maintenance section.

Check the motor lubrication; remove and clean grease plugs and check for the presence of moisture in the grease. If moisture is present, remove the motor and send it to an authorized repair shop for bearing inspection/replacement. If no moisture is present, refer to the motor manufacturer's lubrication recommendation for proper lubrication.

Rigging and Handling

The unit will be shipped (as specified by sales order) as 1) a complete assembly, 2) in sub-assemblies (collection of sections), or 3) as individual sections. Follow appropriate lift warnings as shown on the label affixed to the unit.

⚠ WARNING

Never bolt (assemble) sections or sub-assemblies together before rigging. Always rig subassemblies or sections as received from the factory.

⚠ CAUTION

Do NOT lift from the top of the unit. Lift only from lift lugs located at the bottom of the unit. Use all lift lugs provided. Failure to do so can damage the unit.

Determine Unit Weights

Weights in this manual are approximate. Always test-lift the unit section to check for proper balance and rigging before hoisting to the desired location.

When preparing to lift sections, estimate the equipment's approximate weight and center of gravity. Refer to the tables listed below and placed on the following pages. Due to placement of internal components, the weight of the unit may be unevenly distributed, with more weight being present in the fan and coil areas)

Table 1
T-Series Section Weights (lb) - Unit Sizes 3 - 50

Trane Unit Size	*3*	*6*	*8*	*10*	*12*	*14*	*17*	*21*	*25*	*30*	*35*	*40*	*50*
Filter / Mixing	*225*	*232*	*270*	*367*	*393*	*443*	*490*	*526*	*624*	*687*	*933*	*1025*	*1148*
Economizer	*314*	*377*	*419*	*582*	*637*	*677*	*740*	*827*	*902*	*1118*	*1291*	*1544*	*1785*
Exhaust	*88*	*105*	*115*	*134*	*145*	*154*	*167*	*187*	*201*	*219*	*265*	*283*	*399*
Air Blender	*191*	*242*	*279*	*355*	*380*	*399*	*431*	*477*	*562*	*614*	*822*	*888*	*1080*
Flat Filter	*71*	*84*	*91*	*109*	*122*	*130*	*140*	*157*	*164*	*177*	*235*	*249*	*365*
Angled Filter	*154*	*199*	*232*	*242*	*261*	*290*	*312*	*338*	*355*	*389*	*545*	*590*	*684*
Bag Filter	*189*	*248*	*281*	*285*	*323*	*372*	*426*	*511*	*579*	*632*	*698*	*752*	*852*
Cartridge Filter	*143*	*181*	*213*	*218*	*235*	*266*	*284*	*317*	*334*	*368*	*494*	*538*	*621*
Sm. Blank / Inspection	*47*	*56*	*61*	*71*	*76*	*80*	*85*	*95*	*100*	*108*	*130*	*139*	*221*
Med Blank / Access	*62*	*75*	*80*	*95*	*101*	*105*	*113*	*125*	*132*	*143*	*169*	*181*	*269*
M-L Blank / Access	*N/A*	*N/A*	*N/A*	*161*	*171*	*179*	*192*	*212*	*221*	*241*	*334*	*364*	*429*
Large Blank / Access	*105*	*137*	*164*	*218*	*232*	*243*	*261*	*289*	*361*	*393*	*541*	*584*	*662*
Small Coil													
Weight includes 2 row UW	*117*	*151*	*170*	*210*	*238*	*255*	*285*	*323*	*353*	*390*	*448*	*487*	*757*
Med. Coil													
Weight includes 8 row UW	*182*	*250*	*294*	*363*	*431*	*476*	*539*	*641*	*722*	*824*	*897*	*1017*	*1444*
M-L Coil													
Weight includes 10 row W	*N/A*	*N/A*	*N/A*	*649*	*788*	*842*	*967*	*1142*	*1298*	*1483*	*1759*	*1982*	*2550*
Large Coil													
Weight includes 10 row W	*323*	*439*	*568*	*720*	*864*	*923*	*1054*	*1234*	*1465*	*1664*	*1986*	*2222*	*2804*
Moisture Eliminator	*59*	*80*	*93*	*147*	*167*	*182*	*202*	*231*	*254*	*289*	*347*	*385*	*554*
Internal Face/Bypass	*98*	*129*	*144*	*185*	*200*	*230*	*252*	*281*	*306*	*343*	*425*	*480*	*645*
Face Damper	*98*	*129*	*144*	*185*	*200*	*230*	*252*	*281*	*306*	*343*	*425*	*480*	*645*

Table 1
T-Series Section Weights (lb) - Unit Sizes 3 - 50

Trane Unit Size	3	6	8	10	12	14	17	21	25	30	35	40	50
Front Horiz Disch Fan													
Weight includes Type A fan	300	444	500	508	599	652	762	905	1022	1277	2010	2168	2560
Bottom Vert Disch Fan													
Weight includes Type A fan	347	500	561	580	676	731	847	1000	1122	1385	2139	2307	2780
Diffuser	74	91	98	114	122	130	143	163	173	192	293	322	445
Discharge Plenum	92	118	135	195	204	209	224	252	318	337	472	511	571

Table 2
T-Series Section Weights (lb) - Unit Sizes 66 - 100

Trane Unit Size	66	80	100
Filter / Mixing	1367	1511	1817
Economizer	2147	2382	2984
Exhaust	464	506	572
Air Blender	1257	1386	1640
Flat Filter	432	477	546
Angled Filter	797	839	964
Bag Filter	1046	1163	1414
Cartridge Filter	761	798	911
Sm. Blank / Inspection	252	262	288
Med Blank / Access	307	319	350
M-L Blank / Access	472	491	538
Large Blank / Access	775	870	1056
Small Coil			
Weight includes 2 row UW	933	1040	1237

Table 2
T-Series Section Weights (lb) - Unit Sizes 66 - 100

Trane Unit Size	66	80	100
Med. Coil			
Weight includes 8 row UW	1850	2143	2608
M-L Coil			
Weight includes 10 row W	3372	3884	4738
Large Coil			
Weight includes 10 row W	N/A	N/A	N/A
Moisture Eliminator	710	786	928
Internal Face/Bypass	753	852	1002
Face Damper	753	852	1002
Front Horiz Disch Fan			
Weight includes Type A fan	3621	4391	5141
Bottom Vert Disch Fan			
Weight includes Type A fan	3621	4391	5141
Diffuser	913	1029	1257
Discharge Plenum	651	769	928

.

Table 3
Inlet Guide Vane Weights (lb)

Fan Type/ Unit Size	3	6	8	10	12	14	17	21	25	30	35	40	50	66	80	100
FC Fan	N/A	38	38	43	46	55	57	65	70	70	105	128	155	155	N/A	N/A
BI Fan	N/A	N/A	N/A	58	63	69	76	89	66	66	N/A	N/A	N/A	N/A	N/A	N/A
AF Fan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36	43	54	64	93	111
Plug Fan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	29	29	40	64	74	100	122	118

Table 4
Approximate Motor Weights (lb)

Motor Type/ Horsepower	***1/6***	***1/4***	***1/3***	***1/2***	***3/4***	***1***	***1-1/2***
General Purpose ODP	*16*	*21*	*24*	*26*	*28*	*32*	*35*
General Purpose TEFC	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*50*	*54*
Energy Efficient ODP	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*35*	*41*
Energy Efficient TEFC	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*36*	*46*
VAV-ODP	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*38*	*42*

Motor Type/ Horsepower	***2***	***3***	***5***	***7-1/2***	***10***	***15***	***20***	***25***	***30***	***40***	***50***	***60***	***75***	***100***
General Purpose ODP	*38*	*70*	*88*	*126*	*151*	*230*	*265*	*329*	*359*	*370*	*508*	*685*	*722*	*970*
General Purpose TEFC NA	*60*	*90*	*111*	*163*	*193*	*253*	*300*	*365*	*409*	*610*	*681*	*872*	*968*	*1255*
Energy Efficient ODP	*41*	*67*	*79*	*107*	*119*	*215*	*260*	*286*	*334*	*372*	*406*	*591*	*765*	*989*
Energy Efficient TEFC	*45*	*75*	*96*	*140*	*160*	*233*	*289*	*332*	*384*	*471*	*536*	*764*	*820*	*1302*
VAV-ODP	*42*	*87*	*91*	*132*	*147*	*230*	*220*	*331*	*352*	*450*	*509*	*796*	*825*	*1000*

Table 5
Approximate Dry Cooling Coil Weights Type UU, UF, and UW, Fin Series 168 (Weights in lb)

	Unit Size															
Rows	***3***	***6***	***8***	***10***	***12***	***14***	***17***	***21***	***25***	***30***	***35***	***40***	***50***	***66***	***80***	***100***
2	*41*	*58*	*69*	*88*	*110*	*122*	*138*	*175*	*197*	*222*	*247*	*274*	*358*	*458*	*548*	*666*
4	*63*	*94*	*114*	*146*	*181*	*203*	*232*	*289*	*329*	*376*	*425*	*475*	*621*	*804*	*956*	*1175*
6	*79*	*121*	*148*	*188*	*236*	*266*	*306*	*381*	*437*	*503*	*573*	*645*	*831*	*1083*	*1292*	*1604*
8	*94*	*147*	*182*	*231*	*290*	*329*	*380*	*473*	*545*	*631*	*721*	*814*	*1042*	*1362*	*1628*	*2032*

Table 6
Unit Size 3, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***TT***	***NS***
1	*44*								*44*	*39*		*57*
2	*65*	*77*	*41*	*44*					*66*		*38*	

Table 6
Unit Size 3, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
4	90	127	66	68	83	107	99					
6	116	176	95	102		148	157)	123				
8	141)	231		122	131	189	183	148				
10	166	274				231	241	173				
12	191	324				272	266	198				

Table 7
Unit Size 6, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	53								53	48		73
2	81	93	56	59					81		54	
4	119	155	95	96	111	135	127					
6	157	217	136	142		189	198	164				
8	194)	285		175	185	243	236	201				
10	232	341				297	307	238				
12	270	403				351	345	275				

Table 8
Unit Size 8, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	71								71	66		97
2	108	124	75	77					109		72	
4	164	210	130	131	146	183	175					
6	217	296	187	194		259	273	227				
8	271	382		244	253	334	327	280				
10	326	469				409	425	334				
12	380	555				484	480	387				

Table 9
Unit Size 10, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	80								80	75		114
2	127	144	94	97					128		91	
4	197	245	164	166	181	218	209					
6	266	346	237	244		308	322	275				
8	336	447		308	318	398	392	344				
10	405	548				489	505	412				
12	475	650				579	575	481				

Table 10
Unit Size 12, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	103								103	103		142
2	165	185	119	122					166		116	
4	257	316	211	213	228	284	274					
6	349	448	306	313		402	421	361				
8	441	579		400	410	521	513	452				
10	533	710				638	661	542				
12	625	842				756	75	633				

Table 11 Unit Size 14, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	107								107	107		149
2	173	192	126	129					173		123	
4	271	330	225	226	241	297	287					
6	369	467	326	333		42	441	381				
8	467	605		426	435	547	539	477				
10	565	742				671	693	574				
12	663	880				796						

Table 12
Unit Size 17, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	123								123	122		172
2	199	221	N/A	N/A					199		145	
4	316	381	N/A	N/A	N/A	345	333					
6	434	542	N/A	N/A		491	513	445				
8	551	703		N/A	N/A	637	630	561				
10	667	864				782	810	677				
12	786	1025				928	928	792				

Table 13
Unit Size 21, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	148								149	139		214
2	241	264	191	197					241		184	
4	379	451	330	333	364	411	396					
6	517	637	475	489		581	600	528				
8	655	835		617	636	752	738	664				
10	793	1009				922	943	800				
12	931	1195				1092	1081	936				

Table 14
Unit Size 25, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	**W**	**K**	**P2**	**P4**	**P8**	**D**	**DD**	**WD**	**WA**	**WC**	**TT**	**NS**
1	170								171	161		247
2	277	305	219	225					278		213	
4	440	524	384	386	417	478	461					
6	604	743	553	567		678	701	617				
8	767	969		721	739	878	864	778				
10	930	1181				1078	1105	939				

Table 14
Unit Size 25, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	W	K	P2	P4	P8	D	DD	WD	WA	WC	TT	NS
12	1093	1401				1278	1268	1100				

Table 15
Unit Size 30, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	W	K	P2	P4	P8	D	DD	WD	WA	WC	TT	NS
1	190								191	180		278
2	312	340	254	260					313		249	
4	505	588	448	450	481	542	526					
6	697	837	647	661		771	794	709				
8	889	1091		842	862	1001	897	899				
10	1082	1333				1230	1257	1088				
12	1275	1582				1459	1450	1278				

Table 16
Unit Size 35, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type											
Rows	W	K	P2	P4	P8	D	DD	WD	WA	WC	TT	NS
1	275		N/A	N/A	N/A				212	224		333
2	379	413							340		298	
4	616	717				660	642					
6	853	1022				943	974	879				
8	1091	1333				1224	1211	1116				
10	1328	1631				1505	1544	1353				
12	1565	1936				1788	1781	1590				

Table 17
Unit Size 40, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

	Coil Type										
Rows	W	K	P2	P4	P8	D	DD	WD	WA	WC	NS
1	306		N/A	N/A	N/A				231	247	368
2	425	458							381		

Table 17
Unit Size 40, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type					
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***NS***
4	*699*	*800*				*743*	*724*				
6	*973*	*1142*				*1062*	*1093*	*998*			
8	*1247*	*1489*				*1381*	*1368*	*1273*			
10	*1521*	*1825*				*1700*	*1738*	*1546*			
12	*1795*	*2166*				*2018*	*2011*	*1820*			

Table 18
Unit Size 50, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type					
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***NS***
1	*386*		*N/A*	*N/A*	*N/A*				*294*	*322*	*477*
2	*551*	*592*							*491*		
4	*920*	*1044*				*975*	*953*				
6	*1289*	*1496*				*1399*	*1440*	*1323*			
8	*1658*	*1949*				*1823*	*1810*	*1692*			
10	*2028*	*2400*				*2248*	*2297*	*2061*			
12	*2397*	*2853*				*2672*	*2666*	*2431*			

Table 19
Unit Size 66, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type						
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***N***	***NS***
1	*521*		*N/A*	*N/A*	*N/A*				*387*	*441*	*660*	*648*
2	*738*	*789*										
4	*1242*	*1383*				*1302*	*1275*		*660*			
6	*1740*	*1980*				*1866*	*1908*	*1776*				
8	*2241*	*2577*				*2430*	*2409*	*2277*				
10	*2742*	*3171*				*2994*	*3042*	*2778*				
12	*3243*	*3768*				*3555*	*3543*	*3279*				

Table 20
Unit Size 80, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type					
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***NS***
1	*611*		*N/A*	*N/A*	*N/A*				*453*	*494*	*753*

Table 20
Unit Size 80, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type					
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***NS***
2	*873*	*932*							*778*		
4	*1471*	*1643*				*1547*	*1516*				
6	*2068*	*2355*				*2219*	*2275*	*2114*			
8	*2664*	*3066*				*2893*	*2872*	*2710*			
10	*3262*	*3777*				*3565*	*3632*	*3307*			
12	*3859*	*4490*				*4268*	*4228*	*3904*			

Table 21
Unit Size 100, Approximate Dry Coil Weights, Fin Series 168 (Weights in lb)

						Coil Type					
Rows	***W***	***K***	***P2***	***P4***	***P8***	***D***	***DD***	***WD***	***WA***	***WC***	***NS***
1	*729*		*N/A*	*N/A*	*N/A*				*546*	*603*	*909*
2	*1065*	*1131*							*945*		
4	*1815*	*2010*				*1900*	*1866*				
6	*2565*	*2889*				*2733*	*2802*	*2613*			
8	*3315*	*3771*				*3570*	*3552*	*3363*			
10	*4062*	*4653*				*4404*	*4488*	*4113*			
12	*4812*	*5529*				*5238*	*5238*	*4863*			

Lifting Instructions

The Trane Company recommends that the contractor use spreader bars and slings to rig units and subassemblies (sections) as shown.

- ❑ Always assemble the unit at the installation site.
- ❑ Always rig subassemblies or sections as they ship from the factory.
- ❑ Make the loop of the sling parallel to the direction of airflow, whenever possible.

The following instructions cover lifting the unit as well as inlet and exhaust hoods and external pipe chases. Follow specific instructions.

⚠ WARNING

Follow good lifting practices before lifting the unit to include following instructions in this manual, estimating center of gravity, and test lifting the unit to check balance and stability.

Do NOT use fork lifts for handling units.

Never lift units in windy conditions or raise units above personnel.

Failure to follow all instructions may result in personal injury or equipment damage.

1 Before lifting the unit, estimate the approximate center of gravity and test lift the unit to determine balance and stability.

NOTE: PREPARATION OF THE ROOF CURB OR PIER MOUNT AND ROOF OPENINGS SHOULD BE COMPLETED BEFORE LIFTING UNIT TO THE ROOF. SEE THE ASSEMBLY SECTION OF THIS MANUAL.

USE ALL OF THE LIFT LUGS PROVIDED.

NEVER STACK THE PIPE CABINET AND INLET HOODS ON THE UNIT AS THE UNIT IS BEING LIFTED.

2 Lift all sections individually using all lifting lugs provided and shown in *Figure 4* . See specific instructions for handling the inlet and exhaust hoods and pipe chase in paragraphs following.

3 Remove all wooden blocks before installing the unit to the roof curb (see *Figure 5*).

4 After the sections are in place, assemble them (see Unit Assembly).

Lifting Inlet and Exhaust Hoods

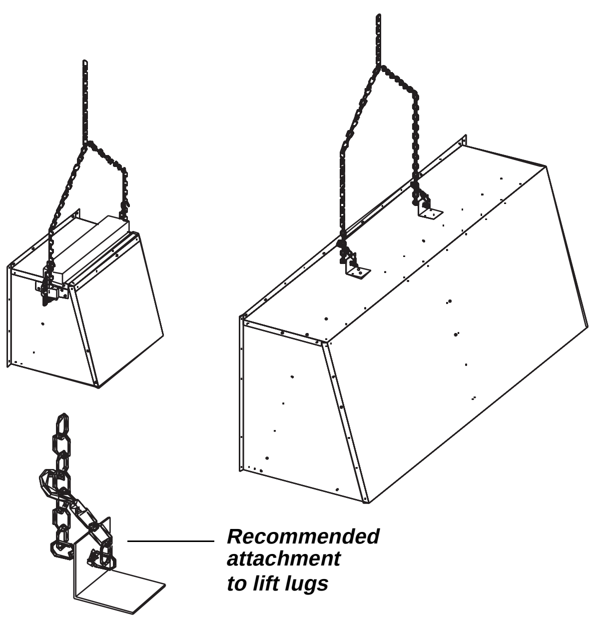
⚠ CAUTION
Do not attach the hood to the unit prior to lifting the unit. Doing so could damage the equipment.

Follow all warnings lifting instructions in the general Lifting section of this manual to include test lifting.

Lift the hood sections individually as shown in *Figure 2* . Attach the cables, chains or straps to lifting lugs as shown.

Attach the hood to the unit only after all sections are in place.

Figure 2
Inlet and Exhaust Hood Lifting



Lifting the External Pipe Cabinet (Chase)

⚠ CAUTION
Do not attach the pipe chase to the unit prior to lifting the unit. Doing so could damage the equipment.

Follow all warnings lifting instructions in the general Lifting section of this manual to include test lifting.

Lift the pipe chase section individually as shown in *Figure 3* . Attach the cables, chains or straps to lifting lugs as shown.

Attach the pipe chase to the unit only after all sections are in place.

Figure 3
Pipe Cabinet Lifting

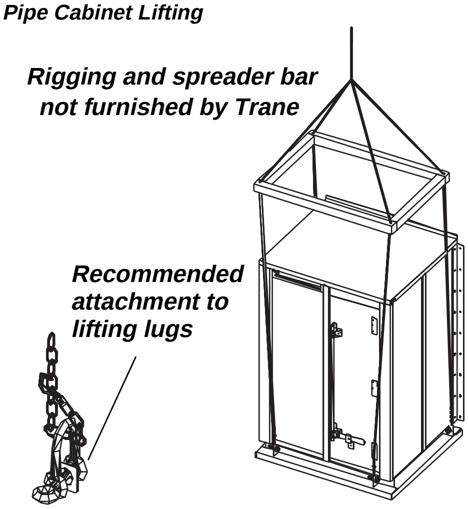


Figure 4
Field Unit Lifting

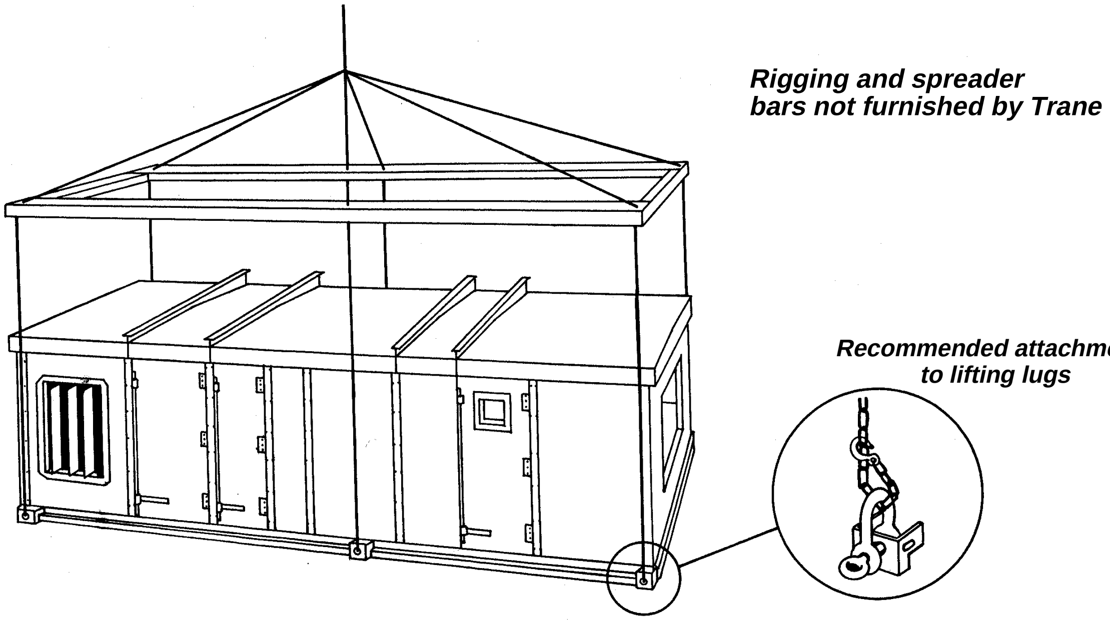
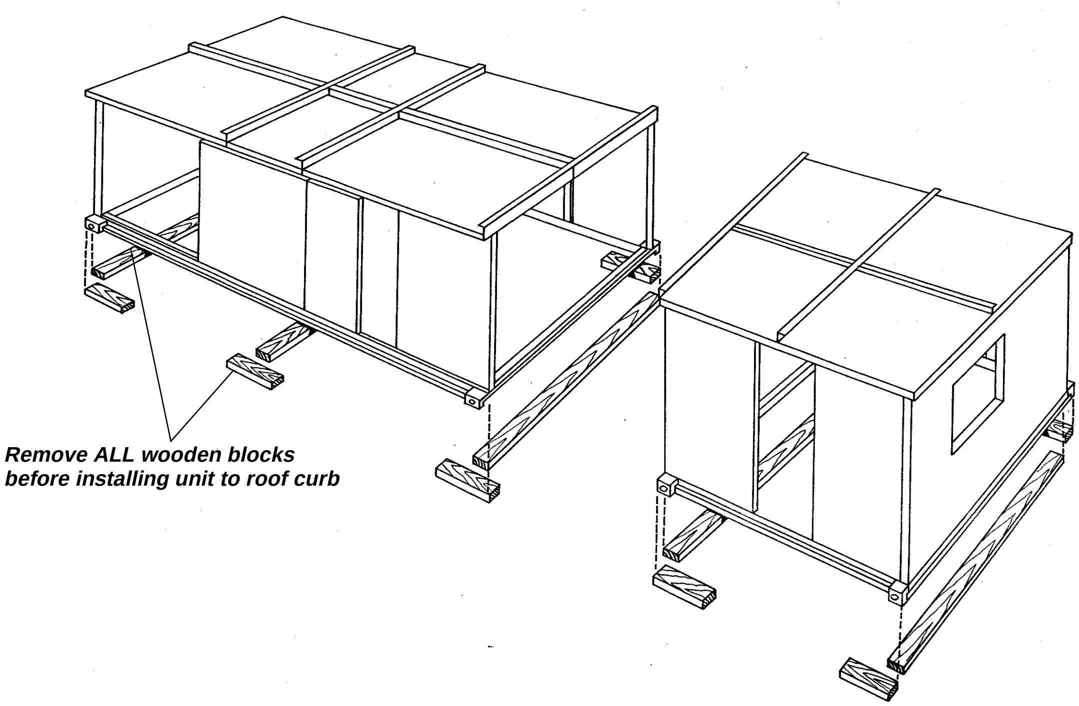


Figure 5
Shipping Block Removal



Installation

When preparing the unit site, consider the following:

1 Ensure that the site can support the total weight of the unit. *Table 1* and *Table 2* list approximate section weights.

2 Allow sufficient space for the recommended service access. Refer to *Figure 6* for FC, BI and AF fan wheels and for plug fans.

3 Confirm that the foundation of the mounting platform is large enough to include the unit dimensions. Refer to unit submittals for specific dimensions.

Figure 6
Service Clearances

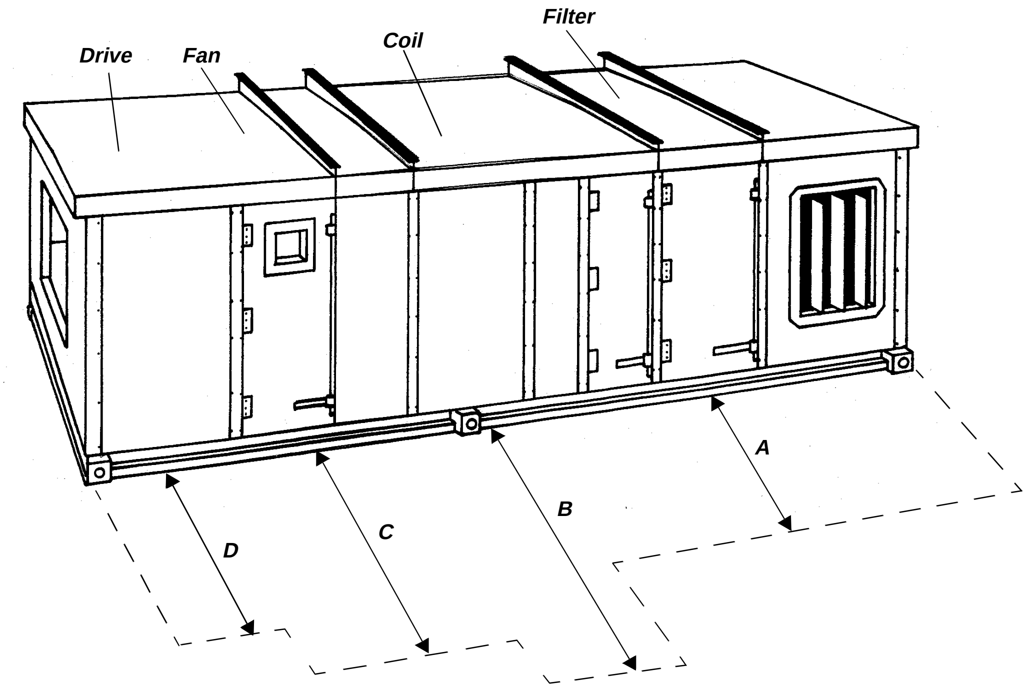


Table 22
Service Clearances (in inches)

Unit Size	Filter A	Coil Removal B	Fan C	Starter D
3	48	48	48	60
6	48	60	48	60
8	48	64	48	60
10	48	75	51	60
12	48	79	54	60
14	48	83	58	60
17	48	89	61	60
21	48	91	60	60
25	48	93	66	60
30	48	106	66	60
35	48	110	65	60
40	48	123	70	60
50	48	134	77	60

Table 22
Service Clearances (in inches)

Unit Size	Filter A	Coil Removal B	Fan C	Starter D
66	52	150	93	60
80	56	150	91	60
100	58	165	101	60

The floor or foundation must be level for proper coil drainage and condensate flow.

4 Allow the proper height for condensate drain requirements. Insufficient height may inhibit condensate drainage and result in flooding the unit.

5 Provide adequate lighting for maintenance personnel to perform maintenance duties.

6 Provide permanent power outlets in close proximity of the unit for installation and maintenance.

Unit Assembly

The T-Series Climate Changer is extremely versatile and can be assembled in many configurations. **Prior to unit assembly, refer to the correct submittals and unit tagging for correct placement of accessory sections**. Failure to review the submittal could result in performance or assembly problems. If there are any discrepancies, contact your local Trane representative before proceeding.

IMPORTANT: All shipping support screws on the face of the sections and sectional subassemblies must be removed and discarded to permit proper fit-up and sealing of the surfaces.

General

⚠ WARNING

To avoid personal injury or death keep open flame away from unit exterior or interior. Do not weld or use cutting torch on the exterior or interior of the unit. The unit contains polyurethane insulation. Failure to keep open flame away from unit exterior or interior may result in the production of toxic gas that could result in death or serious injury.

⚠ CAUTION

The internal sections of this unit containing electrical components must not exceed 104° F temperature. Internal sections of the unit not containing electrical components must not exceed 180° F temperature. Failure to comply with temperature requirements may cause equipment damage.

Units may be mounted on the roof with a roof curb or pier mount. <u>Refer to submittals for dimensions and roof openings.</u> Provide clearance around the unit to allow adequate free air and necessary service access. Also, allow room for supply and return piping, ductwork, electrical connections, and coil removal.

The building roof must be able to support the entire weight of the unit, roof curb and accessories. See *Table 1* thru *Table 4* for unit and accessory weights.

- ❑ Prepare the roof curb or pier mount and roof openings **before** hoisting the unit to the roof.
- ❑ Check that the gasketing is intact and provides an airtight seal with the unit base. Refer to the applicable roof curb installation manual.
- ❑ Complete all ductwork, piping and electrical connections only after mounting the unit. Refer to unit submittals.

All T-Series Climate Changer units are identified by a multiple-character model number that identifies each section. It is located on the panel on the inside of the supply fan section access door. Be sure to refer to the information on the nameplate when ordering replacement parts or requesting service

Assembly Hardware

T-Series Climate Changers ship with all necessary assembly hardware and gasket material. This hardware is packaged in either a clear plastic envelope or cardboard box and can be found inside the Fan section, Access section, or Mixing section. The number of sections to be assembled often makes it necessary to use more than one section to ship the material. Please check ***all*** sections thoroughly before contacting your Trane Company Representative to report missing hardware.

Unit Assembly - All Sizes

Mounting

If a unit arrives in **sections,** then each section **must** be individually hoisted, set on a roof curb or pier mount and assembled.

The pipe cabinet **must** also be mounted as an individual section. Refer to the pipe cabinet assembly section following for specific instructions.

When mounting the unit on its roof curb or pier mount make sure that the gasketing between the roof curb or pier mount and unit base provides an airtight seal. See *Figure 7* and *Figure 8* for suggested pier/rail mounting.

Figure 7
Pier Locations (Typical)

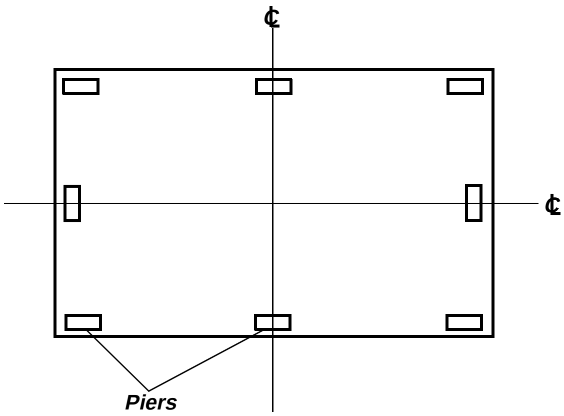
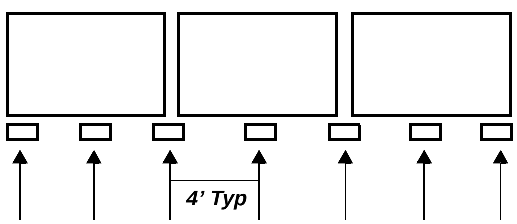


Figure 8
Side View of Unit with Two Shipping Splits



Unit Supports for Pier Mounts

NOTE: PIERS BENEATH SHIPPING SPLITS MUST BE STRUCTURALLY SOUND TO SUPPORT THE WEIGHT OF THE UNIT

Locate one pier at each corner, **as a minimum**, directly underneath any shipping split (ensure full support under each side), and then every four feet at equally spaced intervals around the perimeter of the unit. Both the unit and the pipe cabinet should be supported by their base channel around the entire perimeter.

CHECK THAT THE UNIT IS LEVEL TO ENSURE PROPER OPERATION.

<u>IMPORTANT</u>: FOR PROPER OPERATION, THE UNIT MUST BE INSTALLED LEVEL (ZERO TOLERANCE) IN BOTH HORIZONTAL AXES. FAILURE TO LEVEL THE UNIT PROPERLY CAN RESULT IN CONDENSATE MANAGEMENT PROBLEMS SUCH AS STANDING WATER INSIDE THE UNIT. STANDING WATER AND WET SURFACES INSIDE AIR HANDLING UNITS CAN RESULT IN MICROBIAL GROWTH (MOLD) IN THE DRAIN PAN THAT MAY CAUSE UNPLEASANT ODORS AND SERIOUS HEALTH-RELATED INDOOR AIR QUALITY PROBLEMS.

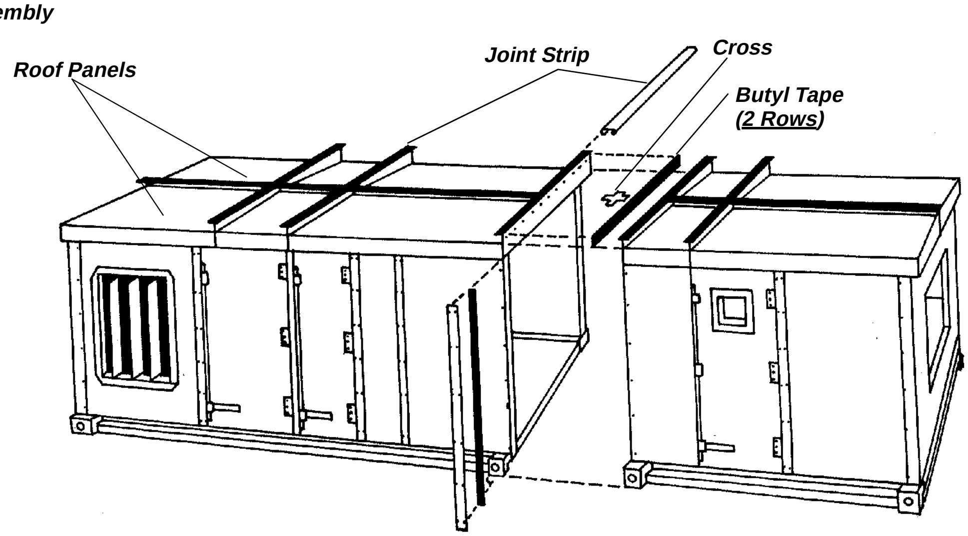
For vertical discharge units, allow space under the unit for supply air ductwork connections.

Assembling the Unit

Before sections are joined for final assembly, a butyl tape seal must be made at the roof connection and then hardware and sealing metal strips are installed at the base assembly, the roof joint or joints and both side panel seams.

Roof Assembly (for Unit Sizes 50-100 only)

Figure 9
Roof Assembly



NOTE: THE BUTYL TAPE APPLIED THE ROOF PANELS WILL COVER THE DRILLED HOLES.

1 Apply butyl tape along four roof panel seams where they come together.

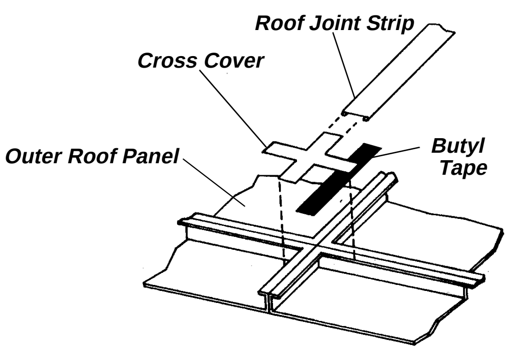
2 Join the panels together at the seams and secure them in place with 5/16 X 3/4” screws and nuts.

3 Apply a strip of butyl tape along the center of the joint and place the cross cover directly over it as shown in *Figure 10* .

4 Slide the three roof joint strips (one long and two short) along the flat flange formed by the joined roof panels in the three directions shown, allowing 4” overhang at the ends.

5 Crimp down the three overhanging ends and secure with #10-16 x 3/4” self-drilling screws.

Figure 10
Roof Assembly Joints



Unit Sizes 50-100

Control Wiring Assembly at Section Splits (All Unit Sizes) (Reference Figure 11)

1 Sections Must be together

2 Remove outer and inner raceway access covers on both sections adjacent to shipping split.

3 Remove top foam blocks in raceway.

4 Route wire harness(es) under inner roof through raceway and make connection to corresponding wire harness.

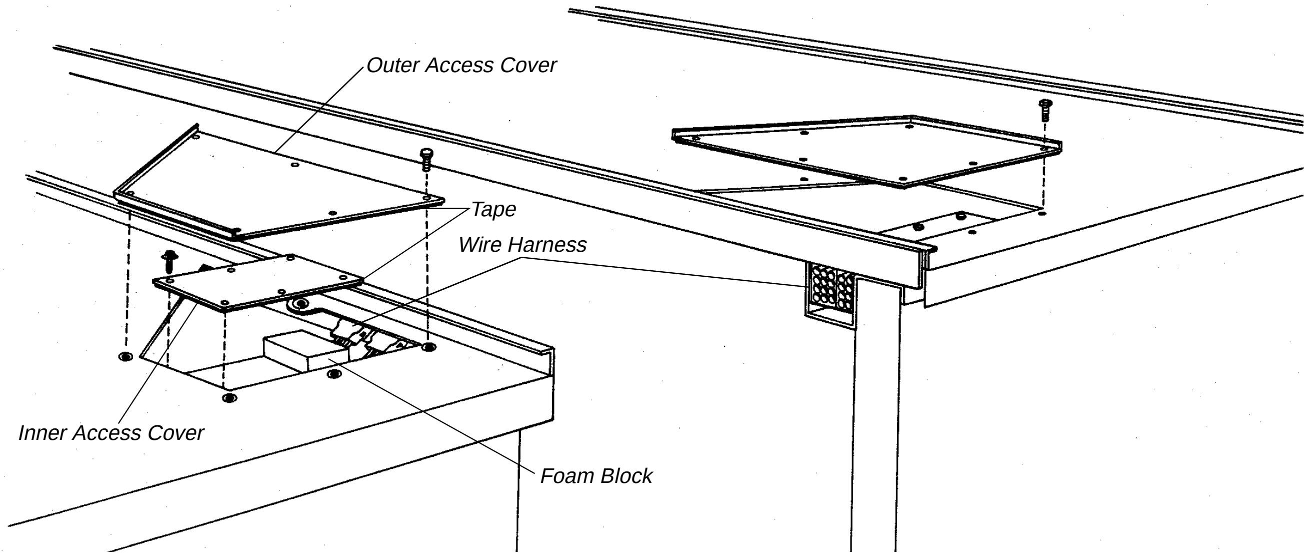
5 Replace foam blocks.

IMPORTANT:* *FOR PROPER UNIT OPERATION, THE FOAM BLOCKS MUST BE INSTALLED IN THE RACEWAY. FAILURE TO INSTALL THE FOAM BLOCKS CAN RESULT IN CONDENSATE MANAGEMENT PROBLEMS.

6 Remove backing from inner access cover tape and replace inner access cover.

7 Remove backing from outer access cover tape and replace outer access cover.

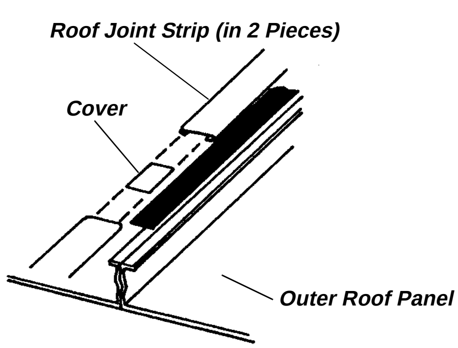
Figure 11
Control Wiring Assembly



Roof Assembly at Section Splits (All Unit Sizes)

1. Apply two rows of butyl tape at the roof seams, covering the hole pattern.
2. Align the roof panels together at the seams and bring the two sections together. Secure the roof panels in place with 5/16 X 3/4" screws and 5/16" nuts.
3. Slide the roof joint strip along the flat flange formed by the joined roof panels, allowing 4"hang on the ends.
4. *(For Unit Sizes 3 - 40 when the roof joint strip is in two pieces):* Apply a piece of butyl tape where the strips come together and place a cover directly over the tape. Then slide the two strips on the roof panels as shown in *Figure 12* .
5. Crimp down the two overhanging ends and secure with #10-16 x 3/4" sheet metal screws.

Figure 12
Roof Assembly at Section Splits

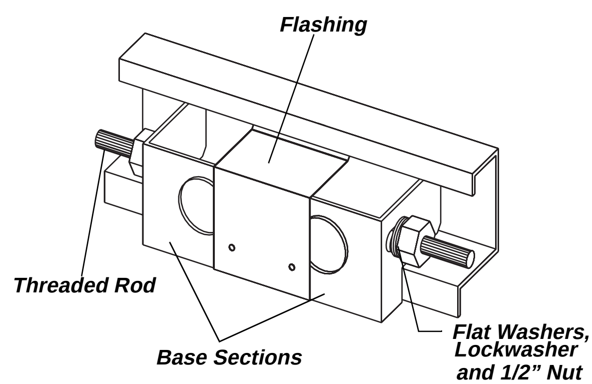


Unit Sizes 3-40

Base Assembly

1. Slide the 1/2" threaded rod through the hole in each of the two joined base sections as shown.
2. Install two flat washers, lockwasher, and 1/2" nut at each rod end. Tighten both nuts.
3. Install the flashing piece on the base assembly. Secure in place with two #10-16 x 3/4" sheet metal screws.
4. Repeat steps 1 - 3 for the base assembly on the other side of the unit.

Figure 13
Joining Base Assembly



Panel Assembly

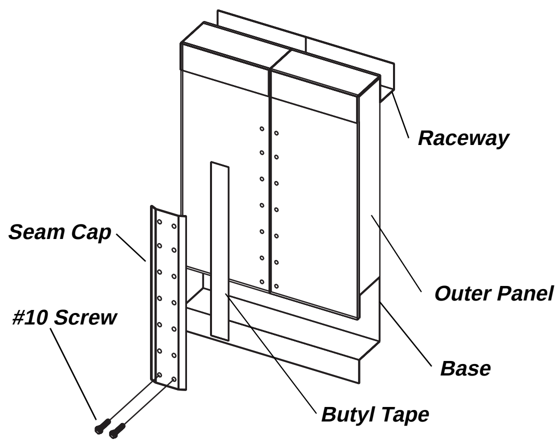
1. Leaving the paper backing on the tape, apply butyl tape (tape side down) along the length of the panel seam.

NOTE: THE SEAM CAP SHOULD BE CUT TO SIZE TO COVER THE SEAM AND TAPE.

2 Install the seam cap directly over the seam and tape. Attach using #10-16 x 3/4” screws through all predrilled holes in the cap.

3 Caulk the gap between the top of the seam cap and the bottom of the raceway.

Figure 14
Panel Assembly



Hood (Back and Side) Installation

Inlet hoods should be installed after the unit has been set in place. They should not be stacked on the unit as it is being hoisted. Mounting hardware and caulking tape for the inlet hoods are located inside the unit. For installation complete the following:

NOTE: THE HOOD ASSEMBLY SHOULD BE SUPPORTED BY CHAINS, SPREADER BAR, OR OTHER MEANS (SEE LIFTING INSTRUCTIONS SECTION) WHEN INSTALLED TO THE UNIT. MOUNTING TAPE AND HARDWARE ARE LOCATED INSIDE THE UNIT.

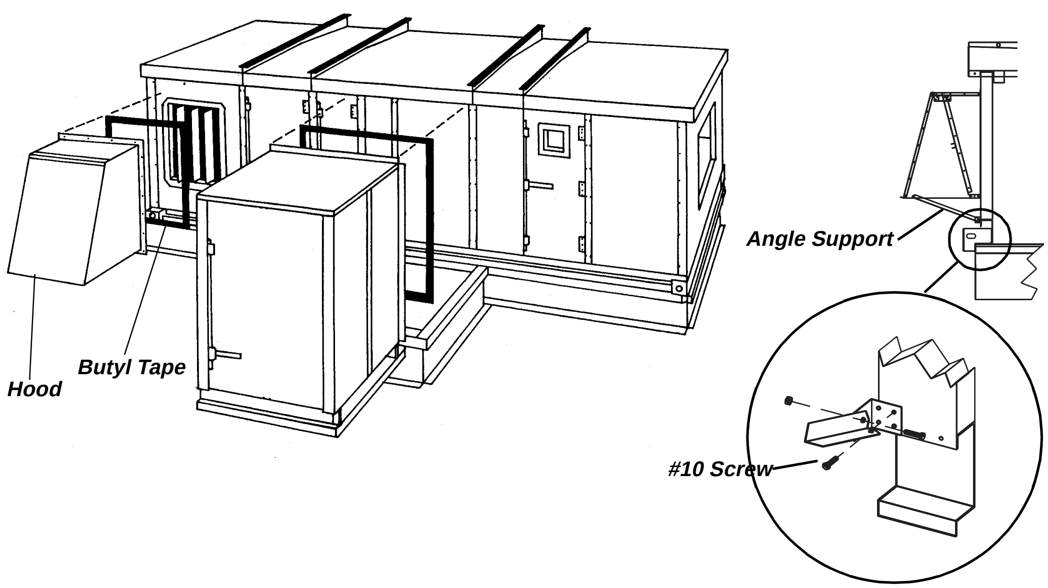
1 Apply the 1” butyl tape in a strip around the perimeter of the hood.

2 Using the lifting lugs, hoist the hood and center it over the panel opening as shown in.

3 Attach the hood to the unit with the 1/4-20 self-drilling screws provided. Use ALL holes drilled in the attachment flanges.

4 Attach the two hood angle supports (when provided) to the hood at one end and the bracket on the unit as shown. Secure with 5/16” lock bolts and lock nuts and #10-3/4 self-drilling screws.

Figure 15
Hood and Pipe Cabinet Installation



Pipe Cabinet (Chase) Installation

Installation of the cabinet will be different depending on the extent of the piping installation. Follow the appropriate instructions below.

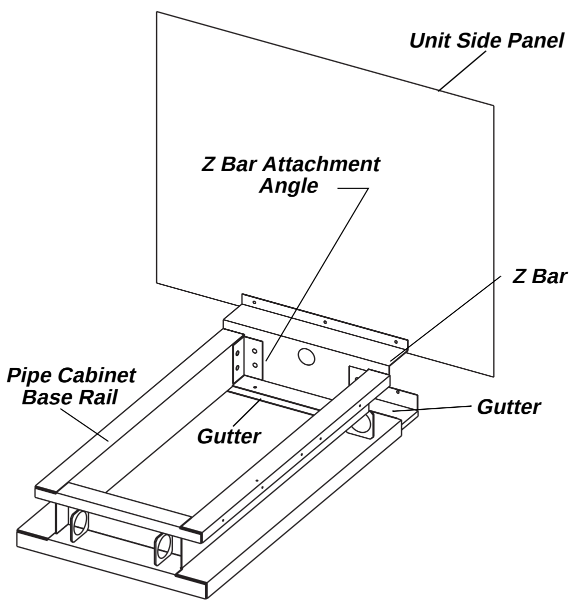
INSTALLATION OF THE PIPE CHASE CABINET REQUIRES ASSEMBLY OF THE CURB AND INSTALLING THE CABINET TO BOTH THE CURB AND THE UNIT AS DESCRIBED BELOW.

THE PIPE CABINET SHOULD BE SUPPORTED BY CHAINS, SPREADER BAR, OR OTHER MEANS (SEE LIFTING INSTRUCTIONS SECTION) WHEN INSTALLING.
MOUNTING TAPE AND HARDWARE ARE LOCATED INSIDE THE UNIT.

1 Assemble the pipe cabinet curb and attach to the roof or mounting surface.

2 *If piping is not already run through the roof, follow steps 2 through 5 only.* First remove the paper backing from the butyl tape on the Z bar and pipe chase side panels. (A gasket should already be in place from the curb installation.) Set the cabinet on top of the curb.

Figure 16
Pipe Cabinet Installation



3 Attach the Z bar to the unit side panel with #10 self-drilling screws *(Figure 16)* .

4 Attach the Z bar to the gutter with #10 screws.

NOTE: USE ALL HOLES DRILLED IN THE ATTACHMENT FLANGES.

5 Attach the pipe cabinet side (attachment) flanges to the unit panel with #10 screws.

6 *If piping is already run through the roof, follow steps 6 through 13*. First remove the Z bar from the pipe cabinet.

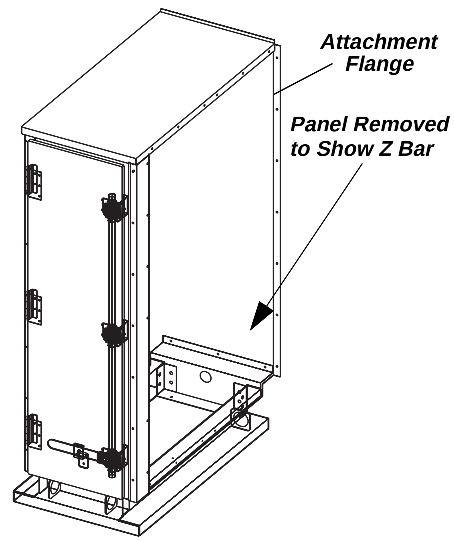
7 Remove the paper backing from the butyl tape on the Z bar and set the Z bar on top of the gutter

8 Attach the Z bar to the unit side panel with #10 screws.

9 Attach the Z bar to the gutter with #10 screws.

10 Remove the paper backing from the butyl tape on the pipe chase side panels. Set the cabinet on top of the curb *(Figure 17)* .

Figure 17
Pipe Cabinet Attachment



NOTE: USE ALL HOLES DRILLED IN THE ATTACHMENT FLANGES.

11 Attach the pipe cabinet side flanges to the unit panel with #10 screws.

12 Attach the pipe cabinet base rail to the Z bar with bolts provided.

13 Apply caulk between the Z bar, the cabinet side flanges, the base and around the drain connection hole.

Component Installation Requirements

The T-Series Climate Changer is extremely versatile and the assembled unit is a complete air handling system. Each section may have installation requirements that will affect the performance of the unit.

High Efficiency Bag and Cartridge Filter Section

The Bag and Cartridge Filter sections can be used as either a pre-filter section, a Final Filter section or both. This is determined by placement in relation to the fan.

Filter Installation

NOTE: CARTRIDGE AND BAG FILTERS PROVIDED BY TRANE ARE FITTED WITH A 7/8" HEADER THAT FITS IN THE FILTER TRACK. IF USING FILTERS SUPPLIED BY ANOTHER MANUFACTURER, FILTERS SHOULD BE PURCHASED WITH A 7/8" HEADER. IN SOME CASES IT MAY BE NECESSARY TO GASKET THE LOCALLY PURCHASED FILTERS TO INSURE A GOOD AIR SEAL.

FILTERS SHOULD BE INSTALLED WHEN THE UNIT IS SET. THIS WILL PROTECT INTERNAL COMPONENTS SUCH AS THE UNIT'S HEATING AND COOLING COILS.

Trane recommends the use of disposable pre-filters with high efficiency filters. Disposable pre-filters slide into the mounting tracks just ahead of the bag/ cartridge filters.

⚠ WARNING

Pressurized Cabinet!
Disconnect all electric power before opening door. Failure to disconnect power before servicing can cause severe personal injury.

1. Disconnect the power to the unit.
2. Open the filter section access door.
3. Remove the adjustable block-off from the filter track.
4. Slide the filters into the tracks. Note that bag filters must be installed with the pleats in the vertical plane.
5. Slide the adjustable block-offs into the filter track. The block-off is intended to make a seal when the access door is closed. It is adjustable and may require a few changes to insure a proper seal.
6. Close the access door and confirm that there is a good seal of the filter track block-off against the access door.

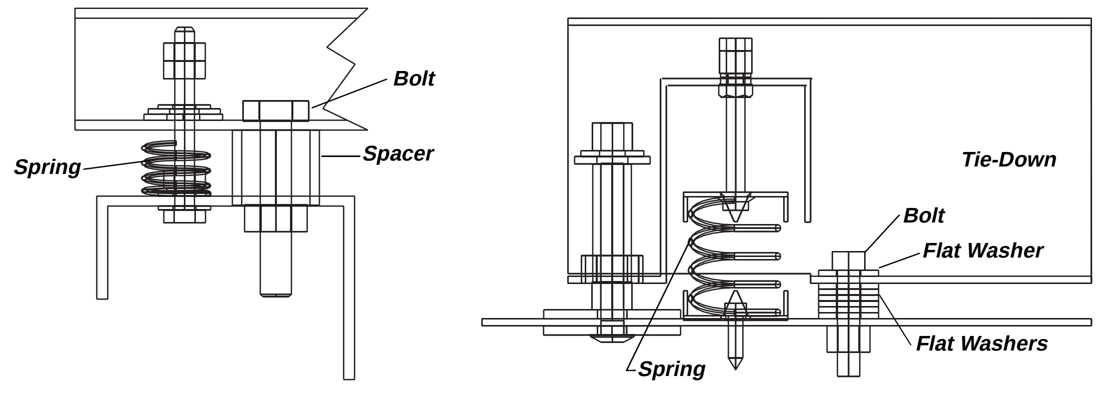
Fan Section

The Fan section can be configured as either draw-thru or blow-thru. Review the submittals and unit tagging prior to assembly.

The fan and motor assembly are internally isolated. The fan and motor bases are bolted to four spring isolators (see *Figure 19*). The isolators are secured to the fan section support base. Four (4) shipping tie-downs are bolted adjacent to the isolators between the fan isolation base and the support frame.

The shipping tie-downs secure the isolation base to the support assembly to prevent any damage to the fan section during shipment of the air handler. The shipping spacers must be removed prior to unit operation unless the unit is to be externally isolated.

Figure 18
Shipping Spacer



Tie-Down Removal, Sizes 3-8 ***Tie-Down Removal, Sizes 10-50***

Unit Isolation

Review the mechanical specifications and determine the type of isolation to be used prior to removing the shipping tie-downs. Remove the tie-downs only if the factory provided isolation is to be used. If external isolation is intended, review the portion of this manual titled “External Isolation.”

Internal Isolation

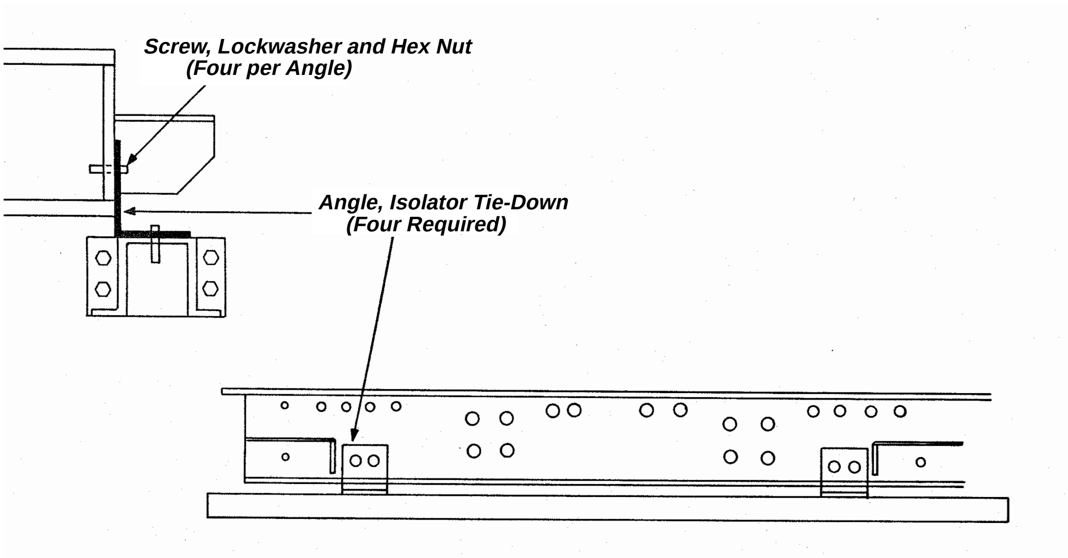
The T-Series Climate Changer Fan section is internally isolated. The unit ships with the internal isolation base secured to prevent damage to the fan and motor assembly during shipment. To activate the isolation, remove the shipping tie-downs.

Shipping Tie-down Removal

There are four types of shipping tie-downs used to secure the isolation base:

- ❑ Sizes 3 - 8 use a 3/8”x1” pipe. (See *Figure 18* .)
- ❑ Sizes 10 - 30, except plug fans, use washers with a bolt. (See *Figure 18* .)
- ❑ Sizes 35 - 50, except plug fans, use a tie-down bolt and shim. (See *Figure 18* .)
- ❑ Size 66 -100 and plug fans use a tie-down angle and bolt. (See *Figure 19* .)

Figure 19
Shipping Angle and Isolator Tie-down Removal for Unit Sizes 66, 80 and 100 (Includes Plug Fans)



Remove the shipping tie-downs per the following instructions:

1. Shipping tie-downs are located at each corner of the isolation base. Access for removal of shipping spacer is available through the fan module access doors.
2. Remove the bolt. This will release the isolator and make it possible to remove the pipe or spacer.

Isolator Adjustment

Once the shipping tie-downs are removed and the internal isolation is released, it may be necessary to adjust the isolators to achieve the proper operation height of the fan and motor isolation base.

The isolators are bolted between the fan and motor isolation base. There are five designs based on unit size and fan type. Specific isolator clearances are listed in *Table 23* . The measurement is taken between the top of the floor panel (or support channel on sizes 66-100) and the bottom of the isolation base channel for all sizes.

Table 23
Isolator Minimum Clearance Adjustments (in)

Unit Size	Fan Type	Isolator Type	Req'd Clearance
3-8	FC	Rubber	1.0
3-8	FC	Spring	1.0
10-30	FC	Rubber	0.5
10-30	FC and BI	Spring	0.5
21-50	Plug	Spring	0.5
35-50	FC & AF	Spring	0.5
66-100	FC, AF & Plug	Spring	1.0

Set-Up

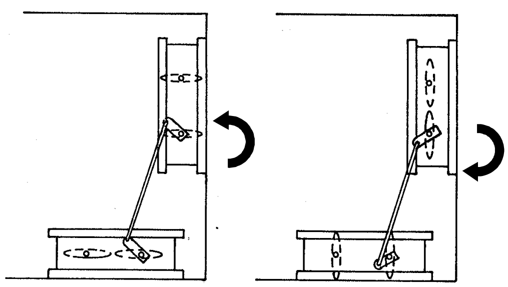
Once the T-Series Climate Changer is assembled and installed, attention must be directed to individual components for proper operation.

Dampers

(Including filter mixing sections, mixing sections, face and bypass dampers and Traq dampers)

Before installing the Mixing sections fitted with filter racks, be sure adequate clearance is provided to open the access doors and install the filters. Filter installation is explained in the section titled “Filter Installation.”

Figure 20
Typical Mixing Box Configuration (sizes 3-100)s



actuators. The actuators should be sized according to the torques given in *Table 24* .

NOTE: MIXING SECTIONS, AND FACE AND BYPASS DAMPERS ARE DESIGNED, FOR THE DAMPER ACTUATORS TO BE DIRECT COUPLED AND INSTALLED IN THE AIR STREAM. IF OTHER PROVISIONS ARE REQUIRED, MODIFICATIONS TO THE SECTION WILL BE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR.

Rods, Operators and Settings

The T-Series Climate Changer is available with factory mounted controls or end devices. If the unit is not ordered with controls or end devices, it is the responsibility of the installer to provide and install the Dampers are factory installed and adjusted. There are three damper blade configurations available: parallel blade, opposed blade, and Traq dampers.

Opposed and Parallel Dampers

Opposed and parallel dampers in units size 3 through 100 have an internal jack-shaft. See *Figure 21* . A 90° jack shaft rotation gives a 95° blade travel.

Figure 21
Typical Internal Face and Bypass Configuration

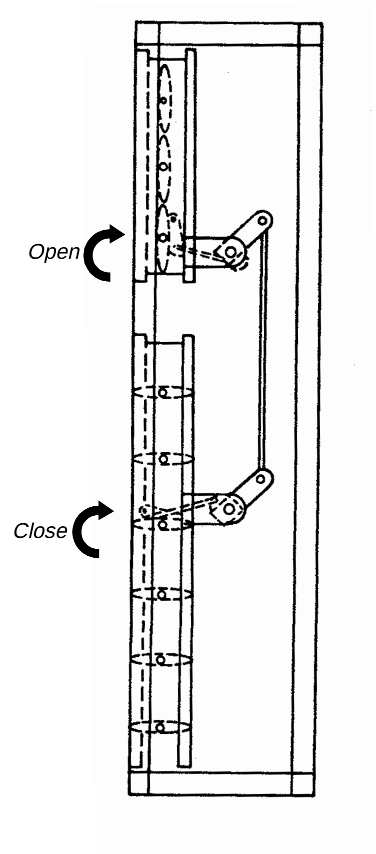


Table 24
Damper Torque at 1 in wg, Air Pressure Drop in lb-in

Unit Size	Mixing Box (Back and Bottom)	Internal Face and Bypass	Face Damper	Economizer Exhaust Side Mixing Box
3	8	10	9	6
6	14	15	14	9
8	16	24	19	12
10	38	41	25	16
12	43	44	33	19
14	44	59	35	23
17	65	64	45	26
21	66	79	53	30
25	85	95	62	36
30	101	112	65	44
35	138	90	95	52
40	148	100	106	60
50	162	136	144	76
66	218	201	181	103
80	245	230	224	122
100	307	291	284	151

Table 25
Torque and Force Required to Operate Inlet Vanes (FC, BI, and AF Fans) in lb-in

Table 25
Torque and Force Required to Operate Inlet Vanes (FC, BI, and AF Fans) in lb-in

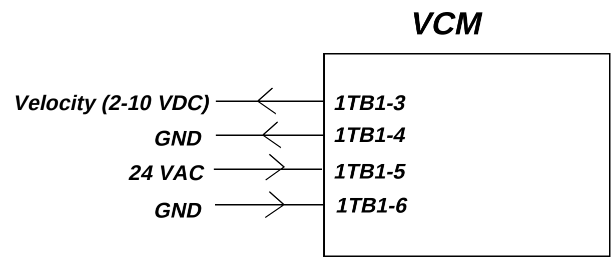
		Fan Outlet Velocity			
		2000 FPM		3000 FPM	
Unit Size	Fan Size	Open (Torque)	Close (Torque)	Open (Torque)	Close (Torque)
3	9 FC	N/A	N/A	N/A	N/A
6	12 FC	10.0	3.5	22.5	7.8
	10 FC	5.7	2.9	19.6	6.5
8	13 FC	10.9	3.9	24.5	8.7
	12 FC	10.0	3.5	22.5	7.8
	13 FC	10.9	3.9	24.5	8.7
10	15 FC	14.1	5.0	31.9	11.4
	13BI	38.0	N/A	40.0	N/A
	15 FC	14.1	5.0	31.9	11.4
12	16 FC	18.0	6.4	40.5	14.4
	15 BI	38.0	N/A	40.0	N/A
	16 FC	18.0	6.4	40.5	14.4
14	18 FC	23.1	8.3	52.2	18.6
	16 BI	44.0	N/A	50.0	N/A
	18 FC	23.1	8.3	52.2	18.6
17	20 FC	24.0	9.0	54.0	19.5
	18 BI	54.0	N/A	60.0	N/A
	20 FC	24.0	9.5	54.0	19.5
21	22 FC	25.0	9.5	56.0	21.0
	20 BI	66.0	N/A	74.0	N/A
	22 FC	25.0	9.5	56.0	21.0
25, 30	25 FC	26.5	10.0	59.7	22.5
	22 BI	90.0	N/A	100.0	N/A
	27 fc	115	46	200	104
35	25 FC	26	1	59	22
	24 FC	31	7	70	17
	30 FC	150	65	220	120
40	27 FC	115	46	200	104
	27 AF	46	11	103	25
	33 FC	215	100	310	180
50	30 FC	150	65	220	120
	30 AF	62	15	142	35
	33 FC	215	100	310	180
66	36 AF	113	27	256	63
	33 AF	84	20	189	46
	40 AF	100	62	216	140
80	36 AF	113	27	256	63
	33 AF	84	20	189	46
	44 AF	124	80	278	181
100	40 AF	100	62	216	140
	36 AF	113	27	256	63

Traq Dampers

Traq dampers are fitted in mixing sections in several possible configurations. These low leak dampers modulate and measure air flow.

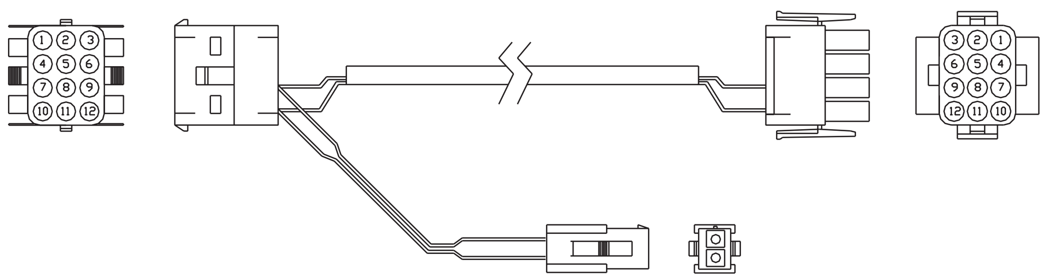
Each Traq damper section is supplied with a factory-mounted ventilation control module (VCM) on the interior of the mixing box. The VCM has an input terminal for power and an output terminal for air velocity. (See *Figure 22* .)

Figure 22
Traq Damper Terminal Connections.



The actuators, factory-mounted or field-supplied, are separately wired and controlled by a PCM or other building logic. *Figure 23* illustrates the typical quick connect scheme.

Figure 23
Typical Quick Connects with Wiring Identification



VCM (Transducer) Calibration

The VCM has an auto-zero function that recalibrates the transducer once every minute.

Input Power Signal

The only input signal the VCM needs is the 24 VAC power connected to terminals TB5 and TB6.

Output Velocity Signal

The 2 - 10 VDC linear output signal from the VCM represents air velocity. This voltage can be converted to represent cfm or L/s using the formula and *Table 26* following. For example, if the VCM on a Size 21 T-Series Climate Changer has a 10-volt signal, it would represent 16650 cfm (7859 L/s) through the Traq damper. If this voltage is 6 volts, air flow through the Traq damper would be 8325 cfm (3930 L/s).

Using the formulas

cfm = k (cfm @ 10V) [volts-2/8]

L/s = k (L/s @ 10V) [volts-2/8], and tables following

TSC Size	*cfm @ 10V*	*L/s @ 10V*
3	2304	1087
6	4609	2175
8	4609	2175
10	6913	3263
12	10900	5145
14	10900	5145
17	10900	5145
21	16650	7859
25	10900	5145
30	24970	11786
35	24970	11786
40	24970	11786
50	34630	16345
66	46200	21806
80	57820	27291
100	69270	32695

For Traq Dampers, use the following table.

Table 26
VCM Voltage Versus Airflow - Traq Dampers (at Sea Level)

	Side Installation		Back Installation	
TSC Size	cfm @ 10V	L/s @ 10V	cfm @ 10V	L/s @ 10V
3	4609	2175	2304	1088
6	4609	2175	4609	2175
8	4609	2175	4609	2175
10	7400	3493	6913	3263
12	7400	3493	11100	5239
14	7400	3493	11100	5239
17	9218	4351	11100	5239
21	9218	4351	11563	5458
25	14800	6986	16965	8007
30	14800	6986	17344	8186
35	23126	10915	24970	11786
40	23091	10899	25447	12011
50	23126	10915	34636	16348
66	33929	16014	46181	21797
80	46181	21797	57727	27247
100	50894	24022	69272	32696

Altitude can be adjusted for using the following factors:

Elevation (ft)	"k"	Elevation (ft)	"k"
Sea Level	1.000	6000	0.897
1000	0.982	7000	0.876
2000	0.964	8000	0.860
3000	0.949	9000	0.846
4000	0.930	10000	0.825
5000	0.914		

Inlet Guide Vanes

Inlet guide vanes can be provided with factory mounted actuator motors when ordered with factory mounted controls or end devices. If actuators are not ordered factory mounted, it is the responsibility of the contractor to provided the actuator and all mounting hardware.

The Inlet guide vanes are designed for the actuators to be internally mounted in the fan section. Size the actuators based on operating torque requirements.

NOTE: TO PROVIDE EVEN TORQUE DISTRIBUTION AND RELIABLE VANE TRACKING, IT IS RECOMMENDED THAT TWO EQUALLY SIZED ACTUATORS BE MOUNTED ON EACH SIDE OF THE FAN HOUSING FOR UNIT SIZES 35, 50, 66, 80, AND 100.

BEFORE OPERATION, INSPECT THE VANE ASSEMBLY FOR FREEDOM OF MOVEMENT. IF RESISTANCE IS ABOVE THE TORQUES GIVEN IN TABLE 25 CHECK THE ASSEMBLY FOR ANY BINDING OR MISALIGNMENT. <u>DO NOT FORCE THE VANES</u>.

Duct Connections

All duct connections to the T-Series Climate Changer should be installed in accordance with the standards of the National Fire Protection Association(NFPA) for installing of air conditioning and ventilating systems other than residence type (NFPA 90A), and residence type warm air heating and air conditioning systems (NFPA 90B).

See unit submittal documentation for additional duct mounting information.

To ensure the highest fan efficiency, duct turns and transitions must be made carefully minimizing air friction losses and turbulence. Proper duct work installation, as outlined by such organizations as SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) should be adhered to.

Fan Discharge Connections

When using lined duct, the insulation should not obstruct the discharge opening. (See *Figure 24* .)

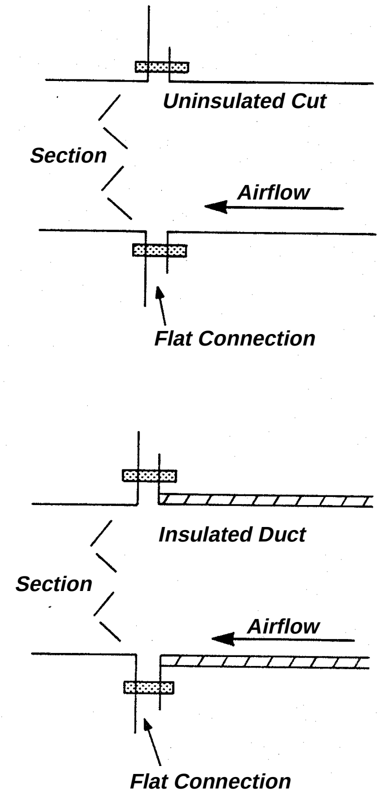
Connections made directly to the discharge opening of the fan should have a minimum of 3 fan diameters of straight duct before any turns or transitions. The first turn of the connection should be in the same direction as the fan rotation. The air that the fan discharges into the duct is extremely turbulent and requires some length of duct to stabilize. Abrupt changes in duct work directly off the fan discharge will affect fan performance.

Damper Sections

Standard damper sections include mixing sections, filter mixing sections, face damper sections, internal face and bypass sections, and economizer sections.

Duct work attached to the standard damper sections should be sized to fit the opening of the damper. This information is provided in the submittals. When using lined duct, ensure that the insulation does not obstruct the damper opening. (See *Figure 24* .)

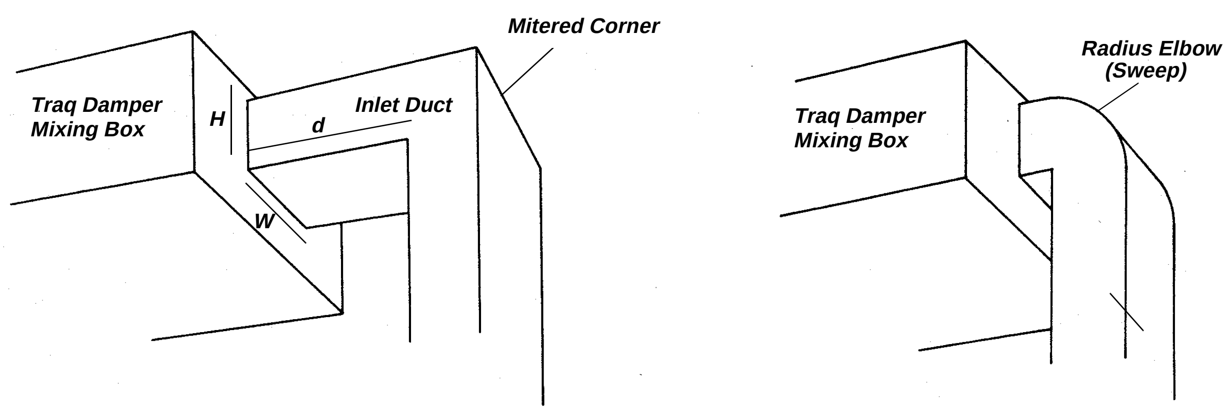
Figure 24
Typical Section with Duct Flat/Flange Connections



Traq Dampers

Traq dampers are installed in mixing sections. Size the duct connection to attach to the specified portion on the face of the section. (See *Figure 25* .)

Figure 25
Traq Damper Duct Connections



$$d = 1 \text{ hydraulic duct diameter} = \frac{2 \times W \times H}{W + H}$$

Discharge Plenum

Discharge plenum sections are available with or without openings. Sections with openings have a framed opening that can be used to secure the duct to the frames. If the duct is lined, it is important that the insulation does not obstruct the opening of the section.

Miscellaneous Sections

Miscellaneous sections include access sections, coil sections, fan sections and intake sections.

If the duct is lined, it is important that the insulation does not obstruct the opening of the section.

Internal Face and Bypass

Duct connections for internal face and bypass damper sections are similar to the miscellaneous sections. Duct work can be attached directly to this frame.

Drain Pan

Piping

Condensate Drain Pan Connections

⚠ CAUTION

Failure to provide adequate condensate piping may result in water damage to the equipment and or building.

Threaded condensate drain connections are provided on only one side of the coil section. Pitch the connection lines horizontal or downward toward an open drain. Trane recommends installing a plug to facilitate cleaning of the trap.

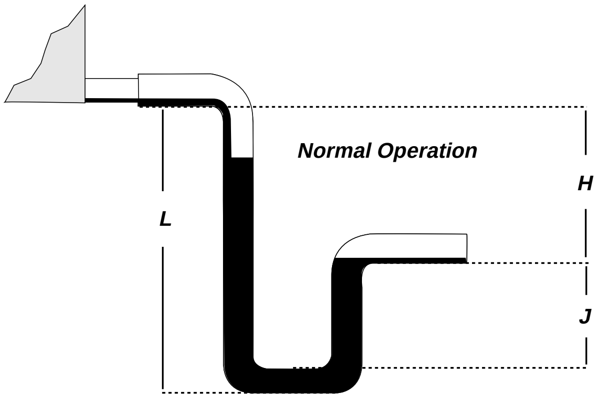
***IMPORTANT*: PROPER TRAPPING OF THE COOLING COIL CONDENSATE DRAIN LINES IS NECESSARY FOR PROPER CONDENSATE MANAGEMENT. IMPROPER TRAPPING CAN RESULT IN STANDING WATER INSIDE THE UNIT OR WET INTERIOR SURFACES THAT CAN CAUSE UNPLEASANT ODORS AND SERIOUS HEALTH-RELATED INDOOR AIR QUALITY PROBLEMS.**

It is essential that the drain pan condensate trap be deep enough and of the correct design to ensure a water seal in the trap while allowing the condensate pan to drain. Insufficient depth or incorrect design can cause the drain pan to overflow.

NOTES: THE DRAIN CONNECTION SIZE IS 1" NPT EXTERNAL FOR UNIT SIZES 3 THROUGH 30; 1-1/2 NPT EXTERNAL FOR UNIT SIZES 35, 40, 50; 1-1/4" INTERNAL THREADS ON SIZES 66, 80, 100.

DRAIN PANS MUST BE PRIMED AT START-UP TO OPERATE PROPERLY.

Figure 26
Drain Pan Trapping for Section under Negative Pressure

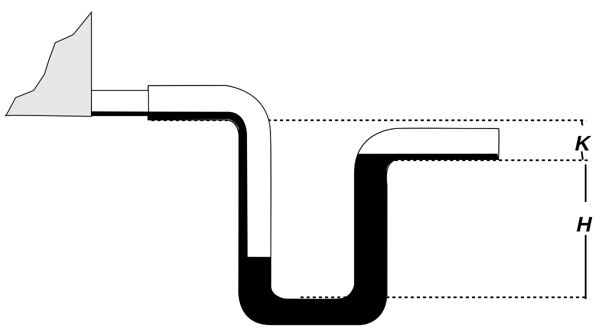


H = (1" for each 1" of maximum negative pressure) + 1"

J = 1/2 H

L = H + J + Pipe Diameter + Insulation

Figure 27
Drain Pan Trapping for Section under Positive Pressure



K = min. 1/2"

H = 1/2" plus maximum total static pressure

Negative Pressure Section

Trap the drain pan as illustrated in *Figure 26* , which also illustrates the proper piping as well as the operation of the trap. Use the formula given in *Figure 26* to determine the correct minimum depth for the condensate trap.

Positive Pressure Section

The positive pressure section requires a different design than the negative pressure trap. Refer to *Figure 27* and the formula provided to determine the minimum trap depth.

Units With More Than One Drain Pan

With the T-Series Climate Changer, each section can be ordered with or without a drain pan. When more than one section has a drain pan, you must trap each section individually. Connecting all drains to a common line with only one trap will result in condensate retention, and possible water damage to the air handler or adjoining space.

If a section has a drain pan for cleaning purposes only, it does not need a trap; however a cap or shut off valve should be installed on the drain connection. Only sections handling condensate, such as a cooling coil section or eliminator section, require a trap. *Figure 28* through *Figure 37* are examples of typical installations.

Coil Piping And Connections

See *Table 27* through *Table 29* for connection sizes. For supply, vent and drain connections, refer to *Figure 28* through *Figure 37* .

NOTE: DRAIN AND VENT CONNECTIONS ARE PROVIDED AS STANDARD ON UW, UU, DD, AND D COILS ONLY. ALL OTHERS, IF REQUIRED, MUST BE FIELD INSTALLED.

NOTE: DRAIN AND VENT CONNECTIONS ON THE UU AND UW COILS ARE RECESSED. IF EXTENDED DRAINS AND VENTS ARE REQUIRED, THEY MUST BE FIELD PROVIDED.

General Coil Piping Recommendations

Proper installation, piping and trapping is necessary to ensure satisfactory coil operation and to prevent operational damage.

- ❑ Support all piping independently of the coils.
- ❑ Provide swing joints or flexible fittings on all connections that are adjacent to heating coils in order to absorb thermal expansion and contraction strains.
- ❑ If ordered with factory mounted controls, install the control valves. The valves ship separately in the unit. The contractor should supply the pipe nipples, couplings, etc.for installation.

NOTE: WHEN USING ELECTRONIC VALVE ACTUATORS ON CHILLED WATER VALVES, THE VALVE SHOULD BE MOUNTED ABOVE THE HORIZONTAL POSITION TO PREVENT COLLECTION OF CONDENSATE IN THE ACTUATOR ELECTRONIC CIRCUITS AND SUBSEQUENT ACTUATOR FAILURE.

WHEN USING ELECTRONIC VALVE ACTUATORS ON HOT WATER OR STEAM COILS, THE ACTUATOR SHOULD BE INSTALLED APPROXIMATELY 45 DEGREES FROM VERTICAL. VERTICAL INSTALLATION OF A VALVE ACTUATOR ON A HOT WATER OR STEAM COIL WILL EXPOSE THE ACTUATOR TO HIGH TEMPERATURES, RESULTING IN ACTUATOR FAILURE.

THE EXTERNAL CABINET IS ONLY SUFFICIENTLY SIZED FOR HOUSING COIL PIPING. ALL VALVES AND VALVE ACTUATORS MUST BE LOCATED ELSEWHERE.

For best results, The Trane Company recommends that a short pipe nipple be used on the coil headers prior to making any welded flange or welded elbow type connections.

IMPORTANT: TEFLON TAPE OR PIPING COMPOUND SHOULD NOT BE USED FOR ANY FIELD CONNECTIONS BECAUSE ITS HIGH LUBRICITY MAY ALLOW CONNECTIONS TO BE OVER-TIGHTENED, RESULTING IN DAMAGE TO THE COIL HEADER.

NOTE: USE A BACK-UP WRENCH WHEN ATTACHING PIPING TO COILS WITH TUBE HEADER CONSTRUCTION TO PREVENT DAMAGE TO THE COIL HEADER. DO NOT USE BRASS CONNECTORS. BRASS DISTORTS EASILY AND COULD CAUSE CONNECTION LEAKS.

When attaching the piping to the coil header, make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 pound-feet.

Use pipe sealer on all thread connections.

After completing the piping connections, use mastic to seal between the pipe and casing before insulating the pipe.

Table 27
Shipping Coil Water and Steam Connection Sizes

Coil Type	Header Height	Supply	Return	Drain/Vent
W, WA	18, 24, 30, 33	2-1/2	2-1/2	1/2
W	42, 48, 54	2-1/2	2-1/2	1/2
D, DD, WD, K	18, 24, 30, 33	2-1/2	2-1/2	1/2
P2	18, 24, 30	3/4	3/4	1/2

Table 27
Shipping Coil Water and Steam Connection Sizes

Coil Type	Header Height	Supply	Return	Drain/Vent
P4	18, 24, 30	1	1	1/2
P8	18, 24, 30	1-1/4	1-1/4	1/2
WC	18	1	1	1/2
WC	24	1-1/4	1-1/4	1/2
WC	30, 33	2-1/2	1-1/2	1/2
NS	18	2	1	1
NS	24	2-1/2	1-1/4	1-1/4
NS	30, 33	3	1-1/4	1-1/4

Table 28
UF Refrigerant Coil Connections (Inches)

Unit Size	Header Height	Rows	Dist. Tube	No. Circuits	Circuiting	1 Distributor		2 Distributors		4 Distributors	
						Liquid	Suction	Liquid	Suction	Liquid	Suction
3	21	4, 6, 8	1/4	16	Full			1-1/8	1-5/8		
			3/16	16				1-1/8	1-5/8		
		4, 6	1/4	8	Half	1-1/8	1-5/8	7/8	1-3/8		
			3/16	8		1-1/8	1-5/8	5/8	1-3/8		
		4	1/4	4	Qtr.	7/8	1-3/8	7/8	1-3/8		
			3/16	4		5/8	1-3/8	5/8	1-3/8		
6	23	4, 6, 8	1/4	18	Full			1-1/8	1-5/8		
			3/16	18				1-1/8	1-5/8		
		4, 6	1/4	9	Half	1-1/8	1-5/8	7/8	1-3/8		
			3/16	9		1-1/8	1-5/8	Note 1	1-3/8		
		4	1/4	4	Qtr.	7/8	1-3/8	7/8	1-3/8		
			3/16	4		5/8	1-3/8	5/8	1-3/8		
8,10	27	4, 6, 8	1/4	21	Full			Note 2	1-5/8		
			3/16	21				1 1/8	1-5/8		
		4, 6	1/4	10	Half	1-1/8	1-5/8	7/8	1-3/8		
			3/16	10		1-1/8	1-5/8	7/8	1-3/8		
		4	1/4	5	Qtr.	7/8	1-3/8	7/8	1-3/8		
			3/16	5		7/8	1-3/8	5/8	1-3/8		
12	32	4, 6, 8	1/4	25	Full			1-3/8	1-5/8		
			3/16	25				1-1/8	1-5/8		
		4, 6	1/4	12	Half	1-3/8	1-5/8	1-1/8	1-3/8		
			3/16	12		1-1/8	1-5/8	7/8	1-3/8		
		4	1/4	6	Qtr.	1-1/8	1-5/8	7/8	1-3/8		
			3/16	6		7/8	1-3/8	5/8	1-3/8		
14	35	4, 6, 8	1/4	27	Full			1-3/8	1-5/8		
			3/16	27				1 1/8	1-5/8		
		4, 6	1/4	13	Half	1-3/8	1-5/8	1 1/8	1-3/8		
			3/16	13		1-1/8	1-5/8	7/8	1-3/8		
17	37	4, 6, 8	1/4	29	Full					1-1/8	Note 3
			3/16	29						Note 4	Note 3
		4, 6	1/4	14	Half			1-1/8	1-3/8		
			3/16	14				7/8	1-3/8		

Table 28
UF Refrigerant Coil Connections (Inches)

Unit Size	Header Height	Rows	Dist. Tube	No. Circuits	Circuiting	1 Distributor		2 Distributors		4 Distributors	
						Liquid	Suction	Liquid	Suction	Liquid	Suction
21	45	4, 6, 8	1/4	35	Full					1-1/8	1-5/8
			3/16	35						1-1/8	1-5/8
		4, 6	1/4	17	Half			1-1/8	1-5/8	7/8	1-3/8
			3/16	17				1-1/8	1-5/8	Note 5	1-3/8
25,30	51	4, 6, 8	1/4	40	Full					1-1/8	1-5/8
			3/16	40						1 1/8	1-5/8
		4, 6	1/4	20	Half			1-1/8	1-5/8	7/8	1-3/8
			3/16	20				1-1/8	1-5/8	7/8	1-3/8

Notes:

Number of connections - Size (Inches)

1. 1- 5/8, 1- 7/8

2. 1-1 1/8 and 1-1 3/8

3. 3-1 3/8 and 1-1 5/8

4. 3-7/8 and 1-1 1/8

5. 3-5/8 and 1-7/8

Table 29
UF Refrigerant Coil Connections (Inches)

Unit Size	Header Height	Rows	Dist. Tube	No. Circuits	Circuiting	2 Distributors		4 Distributors		8 Distributors	
						Liquid	Suction	Liquid	Suction	Liquid	Suction
35,40	57	4, 6, 8	1/4	45	Full			1-3/8	1-5/8		
			3/16	45				1-1/8	1-5/8		
		4, 6	1/4	22	Half	1-3/8	1-5/8	Note 1	1-3/8		
			3/16	22		1-1/8	1-5/8	7/8	1-3/8		
50	2-32	4, 6, 8	1/4	50	Full			1-3/8	1-5/8		
			3/16	50				1-1/8	1-5/8		
		4, 6	1/4	24	Half	1-3/8	1-5/8	1-1/8	1-3/8		
			3/16	24		1-1/8	1-5/8	7/8	1-3/8		
		4	1/4	12	Qtr.	1-1/8	1-3/8	7/8	1-3/8		
			3/16	12		1-1/8	1-3/8	5/8	1-3/8		
66	2-37	4, 6, 8	1/4	58	Full					1-1/8	Note 2
			3/16	58						Note 3	Note 2
		4	1/4	29	Half			1-1/8	1-3/8		
			3/16	29				7/8	1-3/8		
80	2-45	4, 6, 8	1/4	70	Full					1-1/8	1-5/8
			3/16	70						1-1/8	1-5/8
		4	1/4	35	Half			1-1/8	1-5/8	7/8	1-3/8
			3/16	35				1-1/8	1-5/8	Note 4	1-3/8
100	2-51	4, 6, 8	1/4	80	Full					1-1/8	1-5/8
			3/16	80						1-1/8	1-5/8
		4, 6	1/4	40	Half			1-1/8	1-5/8	7/8	1-3/8
			3/16	40				1-1/8	1-5/8	7/8	1-3/8

Notes:

Number of connections - Size (Inches):

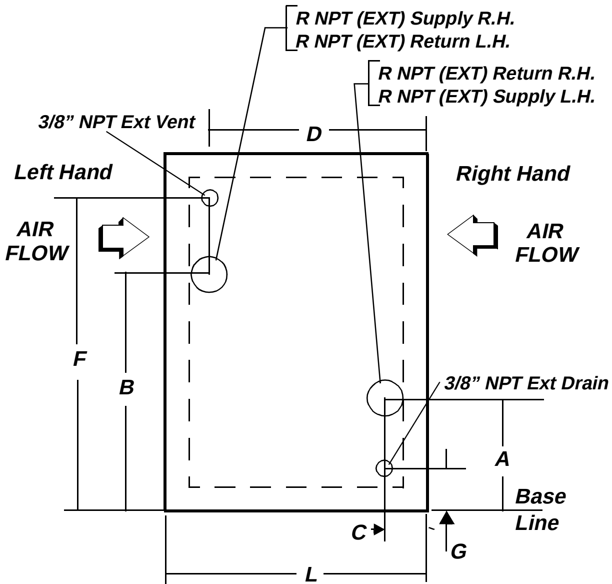
1. 2-7/8, 2-1-1/8

2. 6-1 3/8 and 2-1-5/8

3. 6-7/8 and 2-1-1/8

4. 6-5/8 and 2-7/8

Figure 28
Coil Type UW 2-Row RH and LH Small Coil Section Connections with Drain and Vent Locations



Note: External connections fit through casing side

.

Table 30
2-Row UW Coil Dimensions

Unit Size	L	A	B	C	D	F	G	R
3	11	10-9/16	13-11/16	4-1/2	6-1/2	21-5/8	2-5/8	1-1/2
6	11	12-1/16	14-3/16	4-1/2	6-1/2	24-5/8	2-5/8	1-1/2
8	11	13-15/16	17-1/16	4-1/2	6-1/2	26-3/8	2-5/8	1-1/2
10	11	13-15/16	17-1/16	4-1/2	6-1/2	26-3/8	2-5/8	1-1/2
12	11	16-7/16	19-9/16	4-1/4	6-3/4	33-3/8	2-5/8	2
14	11	13-15/16	20-13/16	4-1/4	6-3/4	25-7/8	2-5/8	2
17	11	18-15/16	22-1/16	4-1/4	6-3/4	38-3/8	2-5/8	2
21	11	20-5/8	25-3/4	3-3/4	7	42-1/8	2-5/8	2-1/2
25	11	25-3/4	26-7/8	3-3/4	7	45-1/4	2-5/8	2-1/2
30	11	25-3/4	26-7/8	3-3/4	7	45-1/4	2-5/8	2-1/2
35	11-1/2	29-7/16	30-9/16	4-3/8	7-1/8	58-3/4	3-5/32	2-1/2
40	11-1/2	29-7/16	30-9/16	4-3/8	7-1/8	58-3/4	3-5/32	2-1/2

Figure 29
Coil Type UW 2-Row RH and LH Medium Coil Section Connections with Drain and Vent Location

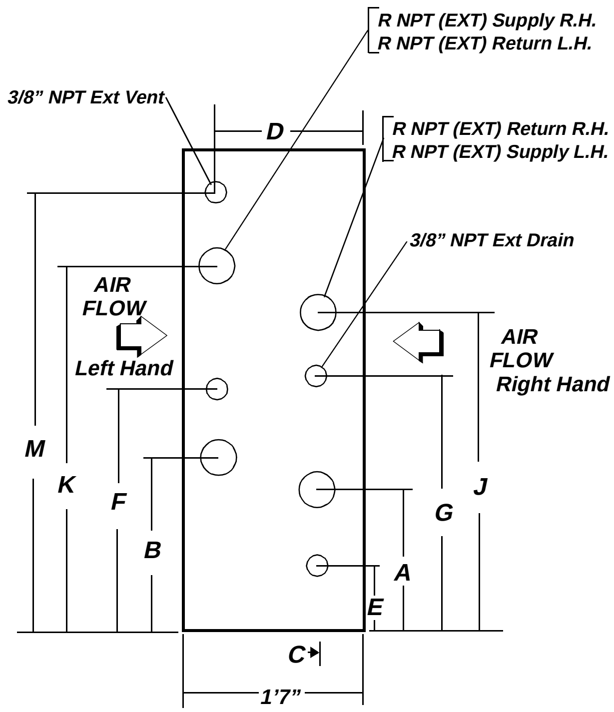


Table 31
2-Row UW Coil Dimensions

Unit Size	A	B	C	D	E	F	G	J	K	M	R
50	*18-7/*	*19-3*	*5-1/2*	*7-25/32*	*5-1/8*	*35-1/2*	*39-1/8*	*52-7/8*	*55-3/4*	*69-1/2*	*2*
66	*27-3/4*	*30-7/8*	*5-1/2*	*7-25/32*	*11-1/2*	*47-1/8*	*50-1/2*	*66-3/4*	*69-7/8*	*96-1/8*	*2*
80	*31-1/2*	*34-5/8*	*5-1/2*	*8-1/16*	*11-1/2*	*54-5/8*	*58*	*78*	*81-1/8*	*101-1/8*	*2-1/2*
100	*34-5/8*	*37-3/4*	*5-1/2*	*8-1/16*	*11-1/2*	*60-7/8*	*64-1/4*	*87-3/8*	*90-1/2*	*113-5/8*	*2-1/2*

Figure 30
Coil Type UU 4 and 8-Row and UW 4, 6, and 8-Row, RH and LH Medium Coil Connections with Drain and Vent Locations (Unit Sizes 3 - 40).

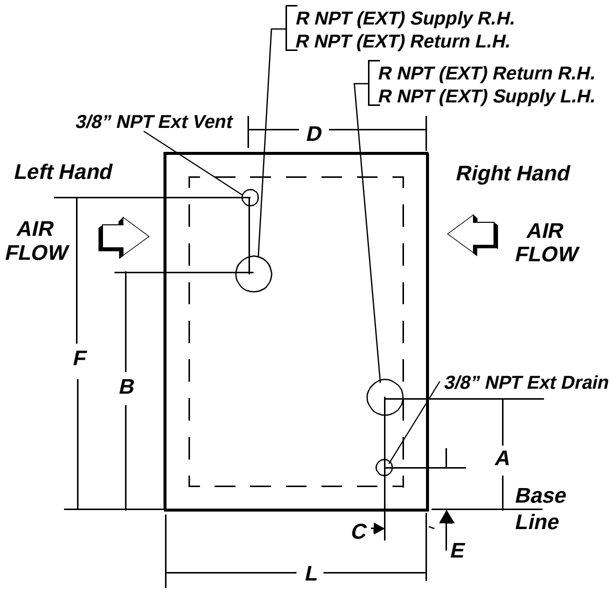


Table 32
2-Row UW Coil Dimensions

Unit Size	L	A	B	C	D	F	G	R
3	11	10-9/16	13-11/16	4-1/2	6-1/2	21-5/8	2-5/8	1-1/2
6	11	12-1/16	14-3/16	4-1/2	6-1/2	24-5/8	2-5/8	1-1/2
8	11	13-15/16	17-1/16	4-1/2	6-1/2	26-3/8	2-5/8	1-1/2
10	11	13-15/16	17-1/16	4-1/2	6-1/2	26-3/8	2-5/8	1-1/2
12	11	16-7/16	19-9/16	4-1/4	6-3/4	33-3/8	2-5/8	2
14	11	13-15/16	20-13/16	4-1/4	6-3/4	25-7/8	2-5/8	2
17	11	18-15/16	22-1/16	4-1/4	6-3/4	38-3/8	2-5/8	2
21	11	20-5/8	25-3/4	3-3/4	7	42-1/8	2-5/8	2-1/2
25	11	25-3/4	26-7/8	3-3/4	7	45-1/4	2-5/8	2-1/2
30	11	25-3/4	26-7/8	3-3/4	7	45-1/4	2-5/8	2-1/2
35	11-1/2	29-7/16	30-9/16	4-3/8	7-1/8	58-3/4	3-5/32	2-1/2
40	11-1/2	29-7/16	30-9/16	4-3/8	7-1/8	58-3/4	3-5/32	2-1/2

Table 33
UW 4, 6, and 8-Row, RH and LH Medium Coil Dimensions in inches

UW Coil Section								
				D				
Unit Size	L	A	B	C	4 ROW	6 ROW	8 ROW	R
3	15-1/2	10-9/16	13-11/16	3-15/16	7-3/16	9-5/16	11-9/16	1-1/2
6	15-1/2	12-1/6	15-3/16	3-15/16	7-3/16	9-5/16	11-9/16	1-1/2
8	15-1/2	13-15/16	17-1/16	3-15/16	7-3/16	9-5/16	11-9/16	1-1/2
10	15-1/2	13-15/16	17-1/16	3-15/16	7-3/16	9-5/16	11-9/16	1-1/2
12	15-1/2	16-7/16	19-9/16	3-15/16	7-3/16	9-5/16	11-9/16	2
14	15-1/2	17-11/16	20-13/16	3-15/16	7-3/16	9-5/16	11-9/16	2
17	15-1/2	18-15/16	22-1/6	3-15/16	7-3/16	9-5/16	11-9/16	2
21	15-1/2	22-5/8	25-3/4	3-15/16	7-3/16	9-5/16	11-9/16	2-1/2
25	15-1/2	25-3/4	28-7/8	3-15/16	7-3/16	9-5/16	11-9/16	2-1/2
30	15-1/2	25-3/4	28-7/8	3-15/16	7-3/16	9-5/16	11-9/16	2-1/2
35	16	32-9/16	29-7/16	4-3/16	7-7/16	9-5/8	11-13/16	2-1/2
40	16	32-9/16	29-7/16	4-3/16	7-7/16	9-5/8	11-13/16	2-1/2

Table 34
UU 4 and 8-Row RH and LH Medium Coil Connection Dimensions in inches

UU Coil Section						
		D				
Unit Size	C	4 ROW	8 ROW	R	E	F
3	N/A	N/A	N/A	N/A	2-5/8	21-5/8
6	N/A	N/A	N/A	N/A	2-5/8	24-5/8
8	N/A	N/A	N/A	N/A	2-5/8	28-3/8
10	N/A	N/A	N/A	N/A	2-5/8	28-3/8
12	4-1/2	6-5/8	11	2-1/2	2-5/8	31-3/8
14	4-1/2	6-5/8	11	2-1/2	2-5/8	35-7/8
17	4-1/2	6-5/8	11	2-1/2	2-5/8	38-3/8
21	4-1/2	6-5/8	11	2-1/2	2-5/8	42-1/4
25	4-1/2	6-5/8	11	2-1/2	2-5/8	45-1/4
30	4-1/2	6-5/8	11	2-1/2	2-5/8	45-1/4
35	4-3/4	6-15/16	11-1/4	2-1/2	3-3/16	58-13/16
40	4-3/4	6-15/16	11-1/4	2-1/2	3-3/16	58-13/16

Figure 31
Coil Type UU 4 and 8-Row & UW 4, 6, and 8-Row RH and LH Medium Coil Section Connections (Unit Sizes 50 - 100) with Drain and Vent Location

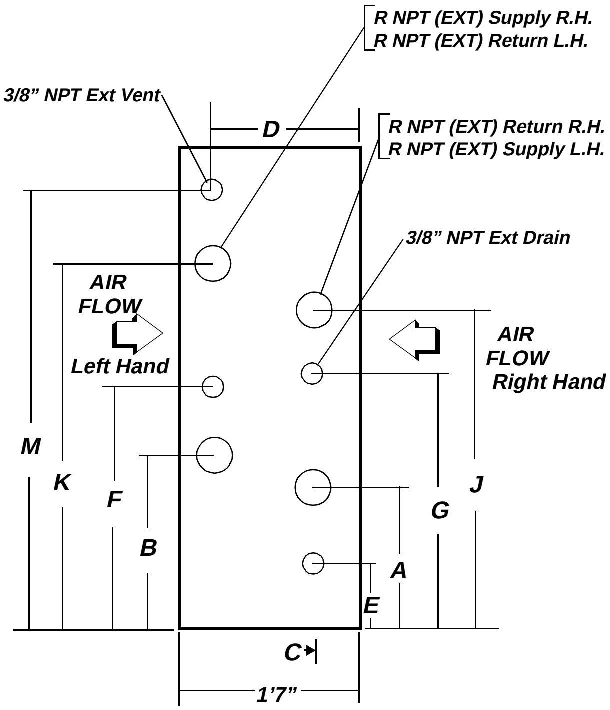


Table 35
Coil Type UU 4 and 8-Row & UW 4, 6, and 8-Row RH and LH Medium Coil Section Connections Dimensions in inches

Unit Size	A	B	E	F	G	J	K	M	R
50	18-3/4	21-7/8	60	35-5/8	39	52-3/4	55-7/8	69-5/8	2
66	27-3/4	30-7/8	11-1/2	47-1/8	50-1/2	66-3/4	69-7/8	74-1/8	2
80	31-1/2	34-5/8	11-1/2	54-5/8	58	42	81-1/8	101-1/8	2-1/2
100	34-11/16	37-3/4	11-1/2	60-11/16	64-1/4	87-3/8	90-7/16	113-5/8	2-1/2

Table 36
Coil Type UU 4 and 8-Row & UW 4, 6, and 8-Row RH and LH Medium Coil Drain and Vent Location Dimensions in inches

UW COIL SECTION					UU COIL SECTION		
		D				D	
Unit Size	C	4 ROW	6 ROW	8 ROW	C	4 ROW	8 ROW
50	5-1/8	8-3/8	10-1/2	12-11/16	5-5/8	7-13/16	12-1/8
66	5-1/8	8-3/8	10-1/2	12-11/16	5-5/8	7-13/16	12-1/8
80	5-1/ (130.2)	8-3/8	10-1/2	12-11/16	5-5/8	7-13/16	12-1/8
100	5-1/8	8-3/8	10-1/2	12-11/16	5-5/8	7-13/16	12-1/8

Figure 32
Coil Type WC-24” Headers with Drain and Vent Locations

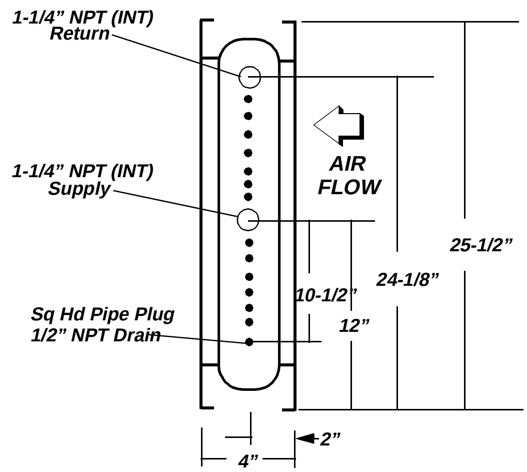


Figure 33
Coil Type P2, 18, 24” Headers with Drain and Vent Locations

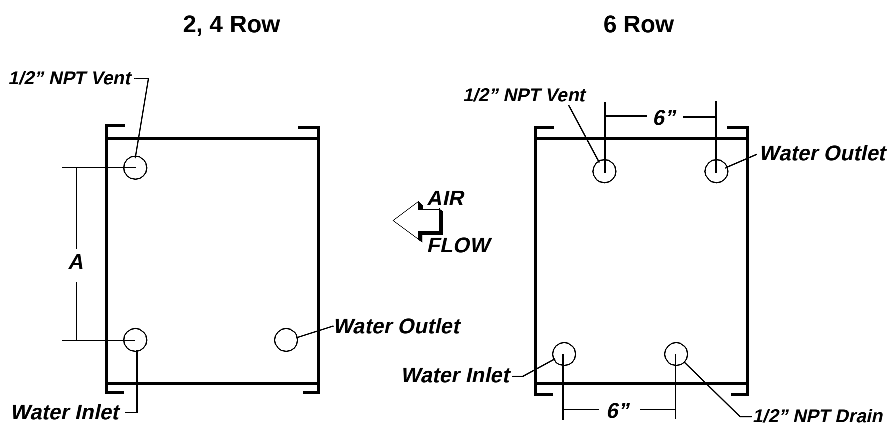


Table 37
Coil Type P2, 18, 24” Headers Dimensions (in)

Header	A
18	16.5
24	22.5

Figure 34
Coil Type P4, 18, 24" Headers with Drain and Vent Location

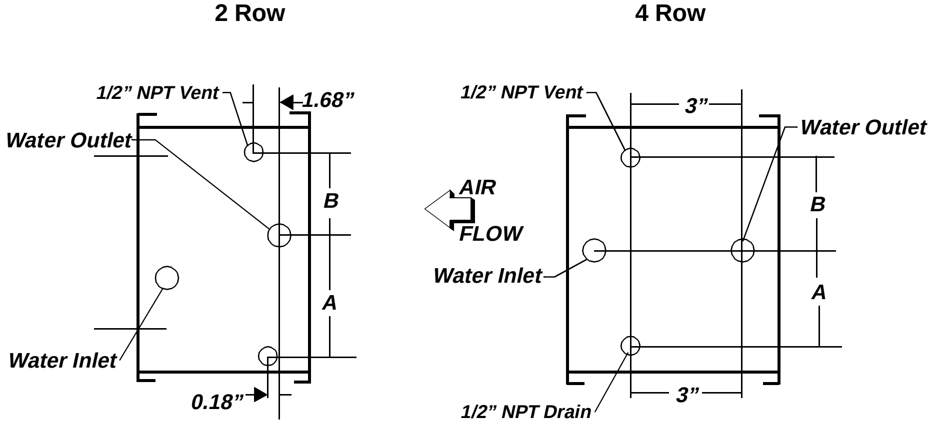


Table 38
Coil Type P4, 18, 24" Headers Dimensions (2-Row) in inches

Header	A	B
18	10.5	6
24	13.5	9

Table 39
Coil Type P4, 18, 24" Headers Dimensions (4-Row) in inches

Header	A	B
18	7.5	9
24	10.5	12

Figure 35
Coil Type P4, 18, 24" Headers with Drain and Vent Location (6 and 8 Row)

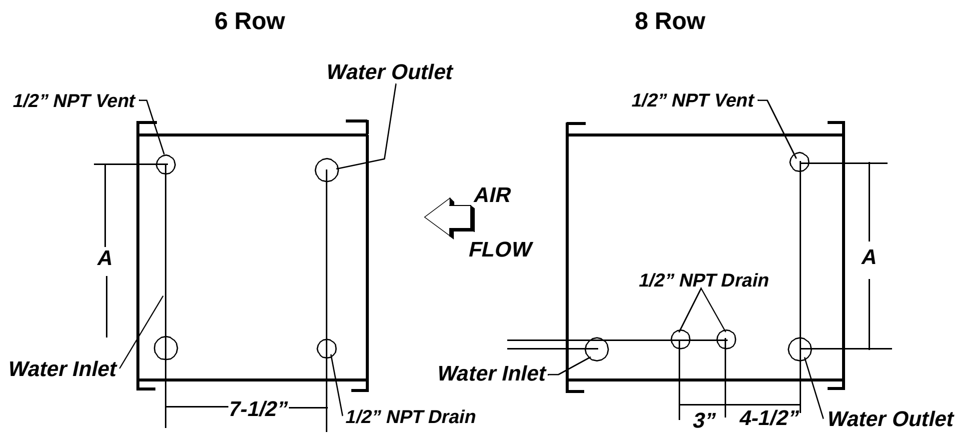


Table 40
Coil Type P4, 18, 24" Headers with Drain and Vent Location (8 Row) Dimensions in inches

Header	A
18	16.5
24	22.5

Figure 36
Coil Type P8, 18, 24" Headers with Drain and Vent Locations

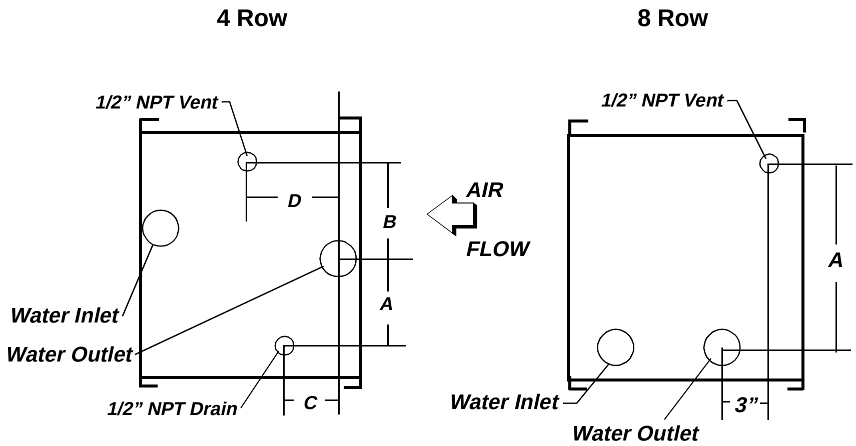


Table 41
Coil Type P8, 18, 24" Headers (4-Row) Dimensions in inches

Header	A	B	C	D
18	7.5	9	1.2	1.2
24	10.5	12	0	4.5
30	13.5	15	1.2	1.2

Table 42
Coil Type P8, 18, 24" Headers (8-Row) Dimensions in inches

Header	A
18	16.5
24	22.5
30	28.5

Figure 37
Coil Type W with 18, 24, 30 and 33" Headers and with Drain and Vent Locations

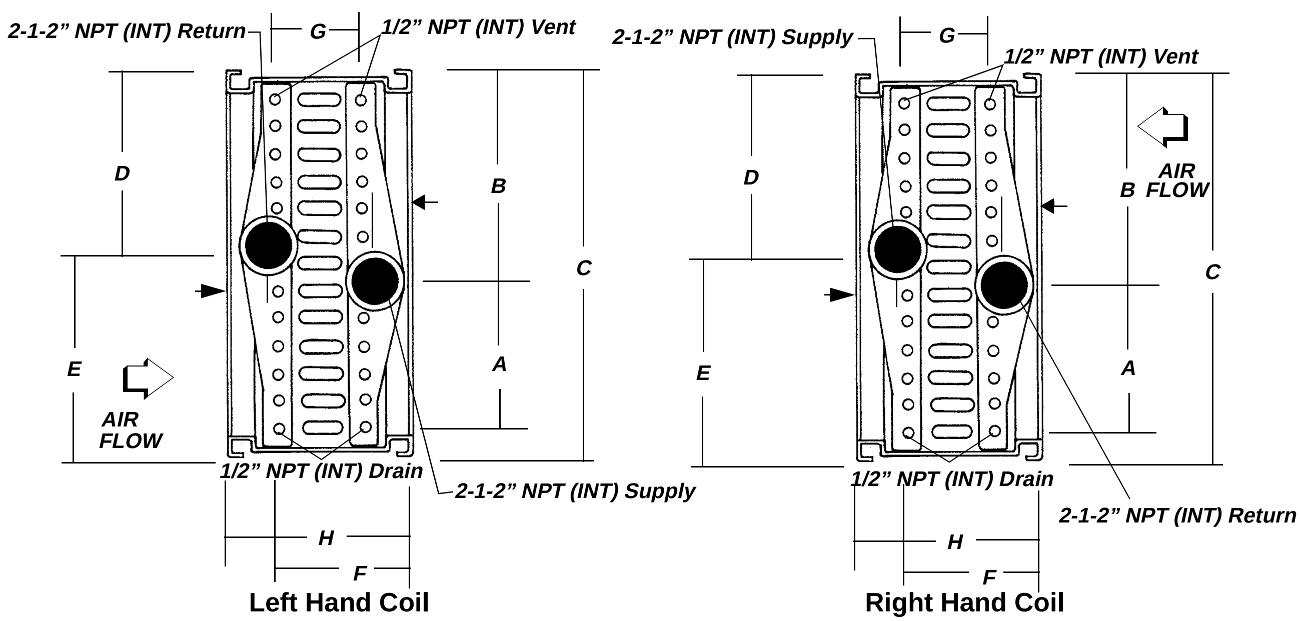


Table 43
Coil Type W with 18, 24, 30 and 33" Headers and with Drain and Vent Locations Dimensions in inches

					2-Row		4-Row		6-Row		8-Row	
Coil Size	**A**	**B**	**C**	**D**	**E**	**H**	**F**	**H**	**F**	**H**	**F**	**H**	**F**
18	6-3/4	9-3/4	19-1/2	8-1/4	11-1/4	6-1/2	4	9-1/2	7	12-1/2	10	15-1/2	13
24	9-3/4	12-3/4	25-1/2	11-1/4	14-1/4	6-1/2	4	9-1/2	7	12-1/2	10	15-1/2	13
30	12-3/4	15-3/4	31-1/2	14-1/4	17-1/4	6-1/2	4	9-1/2	7	12-1/2	10	15-1/2	13
33	14-1/4	17-1/4	34-1/2	15-3/4	18-3/4	6-1/2	4	9-1/2	7	12-1/2	10	15-1/2	13

Note: Coil Connections available right or left hand (determined by facing into air flow)

Table 44
Coil Type W Coil Connections (Left and Right Hand) in inches

Header	G
3	3
4	4.5
6	7.5
8	10.5

NOTE: THE PIPING PENETRATION INTO THE UNIT CASING MUST BE SEALED BEFORE INSULATING. FAILURE TO SEAL THE PENETRATION WILL PERMIT INFILTRATION OF UNCONDITIONED AIR INTO THE SECTION.

When subjected to freezing temperatures, provisions must be made to protect coils that are not in use. See section titled "Coil Winterization."

NOTE: IF GLYCOL IS USED IN THE CHILLED WATER OR HOT WATER SYSTEMS, BE SURE TO USE A GLYCOL APPROVED FOR USE WITH COMMERCIAL COOLING SYSTEMS AND COPPER TUBE COILS. FOLLOW THE MANUFACTURER'S RECOMMENDATIONS FOR WATER TREATMENT AND MIX. FAILURE TO DO SO COULD AFFECT COIL PERFORMANCE OR DAMAGE THE TUBES OR BRAZE JOINTS.

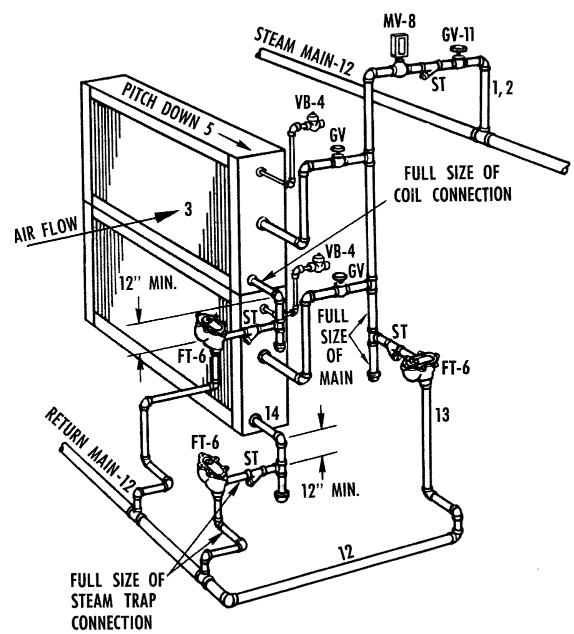
Coils should be installed with field fitted drains and vents to permit winterization of coils not in use, and to assist in evacuating air from the chilled water system during start-up.

⚠ CAUTION

Failure to properly protect coils not in use during freezing temperatures may result in coil freeze-up damage. Refer to the section titled "Coil Winterization" for specific instructions.

Steam Coil Piping

Figure 38
Typical Piping for Type NS Steam Coils and Horizontal Tubes for Horizontal Airflow



Code of System Components (Piping Diagrams	
FT	Float and thermostatic steam trap
BT	Bucket steam trap
GV	Gate valve
OV	Automatic two-position (on-off) control valve
TV	Automatic three-way control valve
VB	Vacuum breaker
CV	Check valve
ST	Strainer
AV	Automatic or manual air vent

T-Series Climate Changers fitted with steam coils have labeled holes for piping penetrations. Check that the coil is installed correctly and that the unit installation agrees with the submittals.

Refer to *Figure 38* for typical steam coil piping.

⚠ CAUTION

Condensate must flow freely from the coil to prevent coil damage from water hammer, unequal thermal stresses, freeze-up damage and corrosion. Complete the following recommendations to prevent damage:

1 Install a 1/2” 15 swing-check vacuum breaker in the unused condensate return connection at the top of the coil. This vacuum breaker should be installed as close to the coil as possible.

2 Vent the vacuum breaker to the atmosphere or pipe it to the return main at the discharge side of the steam trap.

NOTE: VACUUM BREAKER RELIEF IS MANDATORY WHEN THE COIL IS CONTROLLED BY A MODULATING STEAM SUPPLY OR TWO-POSITION (ON-OFF) AUTOMATIC STEAM SUPPLY VALVE. VACUUM BREAKER RELIEF IS ALSO RECOMMENDED WHEN FACE AND BYPASS CONTROL IS USED.

⚠ CAUTION

The 1/2” 15 swing-check vacuum breaker is recommended because of the low cracking pressure of 3- to 5-inches of water. Some other vacuum breakers, such as spring loaded ball-check vacuum breakers, have cracking pressures as high as 17-inches of water. Substitution of the 1/2” 15 swing-check vacuum breaker could result in damage to the coil by preventing proper evacuation of condensate from the coil.

The coil condensate return line must be piped full size of the condensate trap connection, except for a short nipple screwed directly into the coil headers condensate return tapping. Do not bush or reduce the coil return tapping size.

Proper steam trap selection and installation is necessary for satisfactory coil performance and service life. For installation, use the following steps:

1 Install the steam trap discharge 12 inches below the condensate return connection. 12 inches provides sufficient hydrostatic head pressure to overcome trap losses and ensures complete condensate removal.

   * Use float and thermostatic traps with atmospheric pressure gravity condensate return, with automatic controls or where the possibility of low pressure supply steam exists. Float and thermostatic traps are recommended because of gravity drain and continuous discharge operation.

   * Use bucket traps ONLY when the supply steam is not modulated and 25 psig or higher.

2 Trap each coil separately to prevent holding up condensate in one or more of the coils.

3 Install strainers as close as possible to the inlet side of the trap.

4 If installing coils in series airflow, control each coil bank independently with a automatic steam control valve. Size the traps for each coil using the capacity of the first coil in direction of airflow.

5 Use a V-Port modulating valve to obtain gradual modulation of the coil steam supply.

6 Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity into a receiver, vented to atmosphere and returned to the condensate pump.

7 Slowly turn the steam on full for at least 10 minutes before opening the fresh air intake on units with fresh air dampers.

8 Pitch all supply and return steam piping down 1-inch per 10 feet in the direction of the steam or condensate flow.

9 Do not drain the steam mains or take-offs through the coils. Drain the mains ahead of the coils through a steam trap to the return line.

10 Assure continuous condensate removal. Overhead returns require 1 psig of pressure at the steam trap discharge for each 2-foot elevation.

Hot Water Coil Piping

Figure 39
Typical Piping for Type WC Water Coil

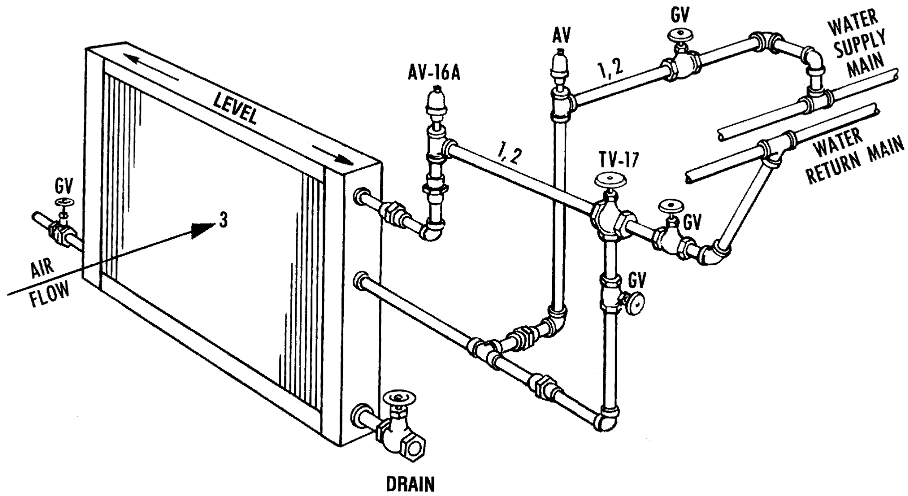
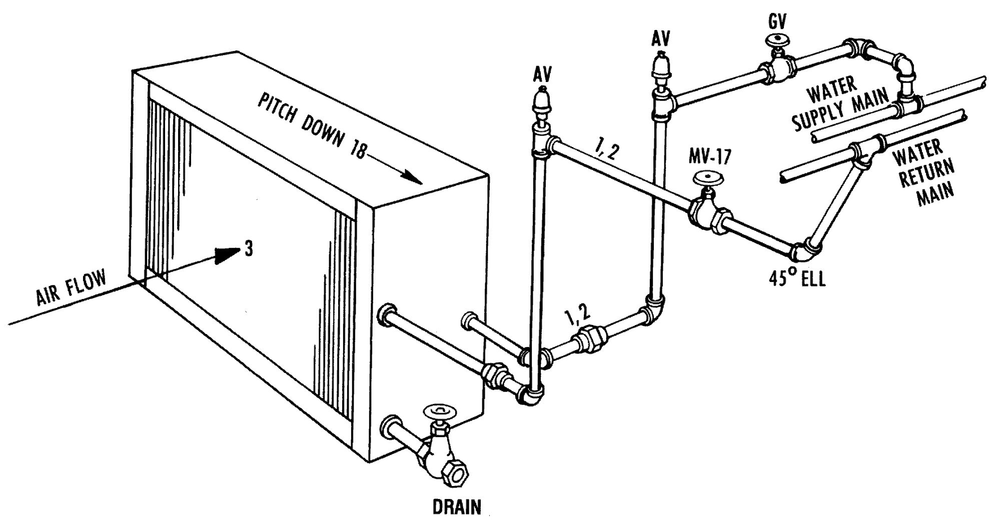


Figure 40
Typical Piping for Type W Two-Row Water Coil



Code of System Components (Piping Diagrams	
FT	*Float and thermostatic steam trap*
BT	*Bucket steam trap*
GV	*Gate valve*
OV	*Automatic two-position (on-off) control valve*
TV	*Automatic three-way control valve*
VB	*Vacuum breaker*
CV	*Check valve*
ST	*Strainer*
AV	*Automatic or manual air vent*

Refer to *Figure 39* through *Figure 42* for typical hot water coil piping.

- ❑ Check the coil for fin damage and straighten if necessary.
- ❑ Check that the coil is installed correctly with the air flow in the same direction as indicated on the nameplate or coil casing.

Figure 41
Typical Piping for Type DD Water Coil

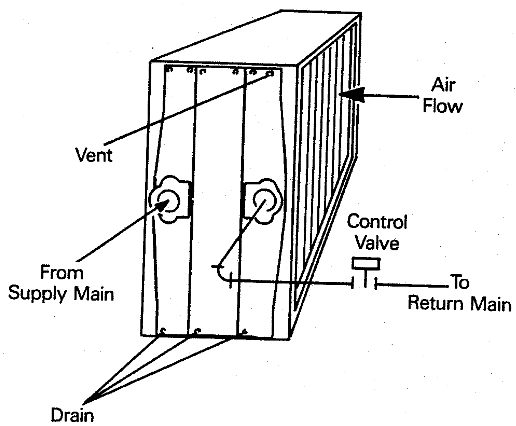
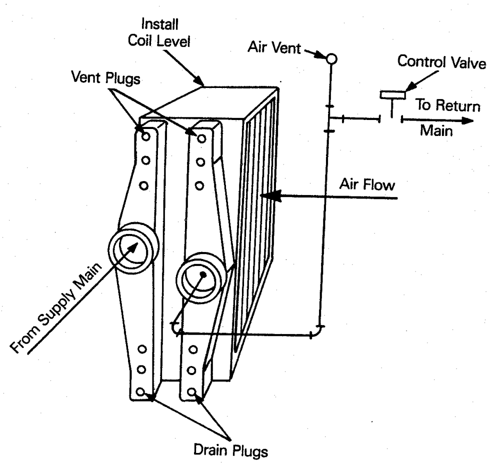


Figure 42
Typical Piping for Type W Water Coil



Type W, WC, UA, UW, and UU hot water coils are self-venting only if the water velocity exceeds 1.5 feet per second (fps). If it is below 1.5 fps, vent by one of the following methods:

1 Install an air vent in the top pipe plug tapping of the return header.

2 Vent from the top return header horizontally to the return piping when the return line rises and is above the top of the coil. (See *Figure 41* through *Figure 42* .)

⚠ CAUTION

Do not throttle or modulate the water flow for coils that are exposed to freezing temperatures. Coil damage may result from coil freeze-up.

3 Install a drain line and shutoff valve in the supply line near the coil.

Type W, D, K, UW and UU water coils are self-venting only if the water velocity exceeds 1.2 fps. Type DD coils are self venting only if the water velocity exceeds 2.5 fps. If water velocity is below these minimums vent by following one of the followings methods:

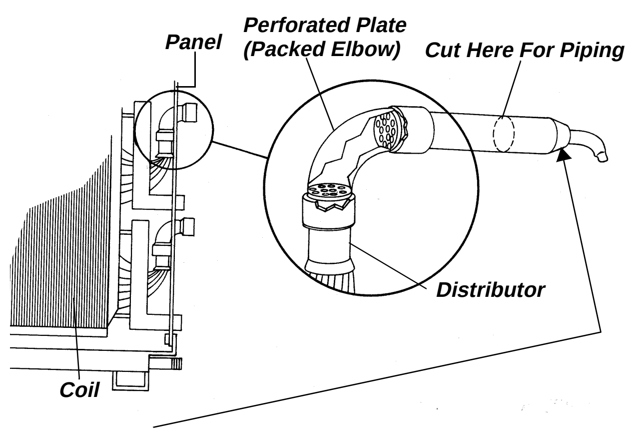
- ❑ Install an air vent in the top pipe plug tapping of the return header
- ❑ Vent from the top return header horizontally to the return piping when the return line rises and is above the top of the coil.

Refrigerant Coil Piping

Units that are UL listed shall not have refrigerant temperatures and pressures exceeding that listed on the coil nameplate.

For unit-installed refrigerant coils, packed elbows are provided. Pipe connections can be made as shown in *Figure 43* .

Figure 43
Type F Refrigerant Coil with Packed Elbow



NOTE: TYPE UF COILS ARE FITTED WITH 5/8" TUBE AND CAP ASSEMBLY TO SEAL VACUUM AND NITROGEN CHARGE. <u>DO NOT</u> USE CAP AND TUBE TO MAKE REFRIGERATION CONNECTIONS.

NOTE: TYPE F AND UF COILS HAVE BEEN DEHYDRATED AND CHARGED WITH A HOLDING CHARGE OF DRY NITROGEN. TO PREVENT LEAKS AND SYSTEM CONTAMINATION, DO NOT BREAK THE SEALS UNTIL THE COIL IS INSTALLED.

1 Check that the coil is installed correctly with airflow in the same direction as indicated on the

coil nameplate or casing. The suction connection must be at the bottom of the suction header.

2 Follow accepted refrigeration piping practices and safely precautions for typical refrigerant coil piping and components. See *Figure 43* . Specific recommendations are provided with the highside components, including instructions for pressure-testing, evacuation, and system charging. General recommendations for component selection and line sizing follow.

3 Leak-test the entire refrigeration system after all piping is complete.

4 Charge the unit according to approximate weight requirements, operating pressures and superheat/subcooling measurements.

5 Adjust the thermal expansion valve setting if necessary.

General Refrigerant Piping Recommendations

***IMPORTANT**: REFER TO THE NOTE ON THE INSIDE FRONT COVER OF THIS MANUAL REGARDING HANDLING OF REFRIGERANTS*

Liquid Line Components

Trane recommends the use of a properly sized liquid line filter-drier installed upstream from the expansion valve and as close to the evaporator coil as possible. Base filter-drier selection on a maximum pressure drop of 2 psi at the design condition.

1 Install moisture indicator/sight glass between the expansion valve and filter-drier. The moisture indicator/sight glass must be sized to match the size of the liquid line at the thermal expansion valve.

2 Size liquid line shutoff valve with an access port using the selected liquid line OD, and install it close to the condenser.

3 Minimize use of other valves, tube bends and reducers since these items tend to increase pressure drop and to reduce subcooling at the expansion valve. Liquid line receivers, other than those factory-installed, are not recommended.

4 The Thermal Expansion Valve (TEV) must be selected for proper size and capacity. The size of the TEV should cover the full range of loadings. Check that the valve will successfully operate at the lightest load condition. Also consider the use of a hot gas bypass valve when sizing the TEV. Select expansion valves with external equalizer connections, and those designed to operate against a back pressure of 20 pounds per square inch higher than actual evaporator pressure.

5 Install the TEV directly on the coil liquid connection (distributor) provided. The liquid distributor must be in a true vertical position.

⚠ CAUTION

Disassemble the thermal expansion valve before completing the brazing connections. If necessary, wrap the valve in a cool, wet cloth while brazing. Failure to protect the valve from high temperatures may result in damage to the internal components.

Suction Line Components

Install suction line pressure tap on the leaving side of the evaporator coil near the TEV sensing bulb location. Accurate superheat measurement and thermal expansion valve adjustment demands that suction pressure be measured near the evaporator coil.

Usually, suction line filter-driers are only necessary on systems that have experienced a severe compressor motor burnout or other failure which results in extremely high refrigerant temperature. Do not leave this filter-drier in the suction line permanently.

Liquid Line Sizing

All compressors have a Refrigerant Charge Limit (RCL) that must not be exceeded. Since the RCL and pressure drop are in direct conflict with each other, Trane recommends that the liquid line be sized as small as possible, while maintaining a low enough pressure drop to ensure 5°F of subcooling at the expansion valve.

Suction Line Sizing

Suction line tubes must be sized to maintain refrigerant vapor velocities that are high enough to ensure oil entertainment under all operating conditions.

It is not necessary to pitch horizontal suction lines toward the compressor when the refrigerant coil is used with Trane condensing units that are designed with a gas trap in the suction line just prior to the compressor.

Wiring

⚠ WARNING

Disconnect electrical power source before servicing the unit or connecting electrical wires.

Failure to do so may result in personal injury or death from electrical shock or entanglement in moving parts. If the unit includes a factory-mounted starter, use of the lockout/ tagout on the disconnect is required while servicing the unit.

If the unit does not include a factory-mounted starter, wiring to the unit fan motor must be provided by the installer and must comply with all national and local electrical codes. The installer must also furnish a fused disconnect switch in compliance with national and local electrical codes. Fan motors require overload protective devices rated or selected in compliance with the National Electric Code or Canadian Electric Code. Specific unit and motor connection diagrams are attached to the unit.

⚠ CAUTION

Use copper conductors only for terminal connections. Use of aluminum or other type of wiring may result in galvanic corrosion or overheating and resultant equipment damage.

Fan motors require motor overload protective devices that are rated or selected in compliance with the National Electric Code or Canadian Electric Code. Specific unit and motor connection diagrams are provided on the unit. If wiring directly to the motor, a flexible connection at the motor to permit fan belt adjustment should be provided. Fractional horsepower motors may be factory connected to a terminal box on the unit. If this construction is provided, the installer should complete field wiring to this connection box.

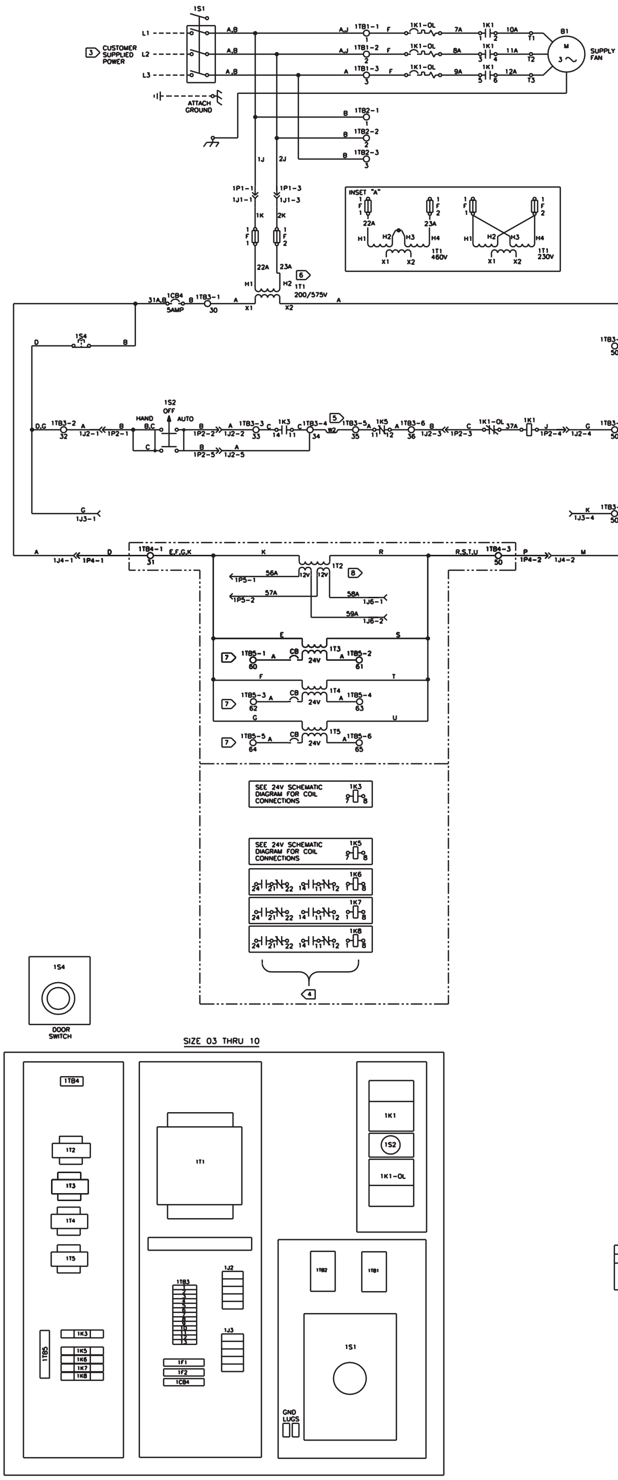
For a typical high voltage wiring schematic, see *Figure 44* following.

Connection of junction sections to unit end devices is accomplished using the connections shown in *Figure 23* . See unit control drawings for specific connection information.

For typical field wiring to units with DDC:

- ❑ Provide 120 VAC power for control. A dedicated circuit is recommended. Units with a factory-mounted starter or VFD do not require this circuit as they are powered by the oversized control transformer in the starter or VFD.
- ❑ If unit ships in multiple sections, fasten quick connects (*Figure 23*) before sections bolt together.
- ❑ Field mount and wire outside air sensor and space sensor, if ordered.

Figure 44
Typical High Voltage Wiring Schematic



⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.

⚠ CAUTION

USE COPPER CONDUCTORS ONLY!

UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.

FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

LEGEND	
DEVICE DESIGNATION	DESCRIPTION
1K1	SUPPLY FAN STARTER
1K3	SUPPLY FAN STARTER RELAY
1K5	LLT RELAY
1F1,2	PRIMARY FUSES
1J2	SUPPLY FAN CONTROL CIRCUIT JACK
1J3	RETURN FAN CONTROL CIRCUIT JACK
1CB4	SECONDARY CIRCUIT BREAKER
1S1	PRIMARY DISCONNECT SWITCH
1S2	SUPPLY FAN CONTROL SW
1S4	FAN STOP SW
1T1	PRIMARY TRANSFORMER
1T2	12V UPCM TRANSFORMER
1T3, 1T4, 1T5	24V TRANSFORMERS
1TB1	SUPPLY FAN TERM BLOCK OR PLUGGABLE
1TB2	RETURN FAN TERM BLOCK PLUGGABLE ONLY
1TB3	TERMINAL STRIP CONTROL CKT
1TB4	12 & 24V TRANSFORMER TERM BLOCK
1TB5	12 & 24V TRANSFORMER STRIP
B1	SUPPLY FAN MOTOR

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	HIGH VOLTAGE PANEL
2	LOW VOLTAGE PANEL
5	CUSTOMER PROVIDED

NOTES:

1. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. PHANTOM LINES INDICATECONTROL OPTION. REF. CONTROL PANEL SCHEMATIC FOR SPECIFIC DETAIL.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE AND LOCAL REQUIREMENTS. OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY. FIELD CONDUCTORS SHALL HAVE INSULATION RATING NOT LESS THAN 600V.

3 COPPER WIRE, SIZED PER NEC, BASED ON UNIT NAMEPLATE.

4 RELAY(S)--CONTACTS: SILVER-CADMIUM OXIDE: 1/6 HP 5AMP @ 120V AC, 1/3 HP 5AMP @ 240V AC.

5 REMOVE JUMPER AND INSTALL FIELD SAFTY INTERLOCK.

6 200/575V SHOWN SEE INSET "A" FOR OTHER VOLTAGES.

7 SEE 24V SCHEMATIC DIAGRAM FOR ACTUAL QUANTY OF TRANSFORMERS.

8 1T2 AND ASSOCIATED PLUG SETS USED WITH UPCM OPTION ONLY.

PRIMARY TRANSFORMER FUSES - CLASS CC					
LINE VOLTAGE	200	230	460	575	TRANS. VA
1F1 & 1F2	5.00	4.00	2.25	1.80	350
	4.00	3.50	3.20	2.50	500
	15.00	12.0	7.00	5.60	2000

Installation Checklist

The following is an abbreviated list of the detailed installation information given in this manual and should be used as an aid to ensure proper installation. For complete instructions, refer to the appropriate sections of the manual.

⚠ WARNING
Disconnect electrical power source when servicing the unit. Failure to do so may result in injury or death from electrical shock.
Secure drive sheaves before servicing the unit to ensure that rotor cannot free-wheel. Failure to secure drive sheaves can cause severe personal injury.

1 Examine the unit and components for material shortage or shipping damage.
2 Check unit location for unit dimensions, weights and clearances.
3 Rig each section properly and hoist it to its final position.
4 For split ship units with factory mounted controls, connect color coded and numbered quick connect plugs (reference *Figure 44*).
5 Check that unit is installed level.
6 Remove fan isolator tie-down bolt, if unit is not externally isolated. See *Figure 18* and *Figure 19* .
7 Inspect Inlet Guide Vanes and adjust if necessary.
8 Install damper operator motors and connecting linkage. Check damper operation and linkage alignment.
9 Install filters, if supplied.
10 Connect supply and return air ductwork.
11 Complete coil and condensate drain piping connections.
12 Reference CLCH-IOP-1 for more details on the installation of units with factory mounted controls.
13 Complete electrical connections to the unit and PCM.
14 Leave the unit installation and maintenance manual with the unit.

Prestart-Up Checks

Before operating the unit, complete the following checks for safe and efficient operation.

⚠ WARNING
Disconnect electrical power source when connecting or disconnecting electrical wires for test procedures. Do not open service access doors while the unit is operating. Failure to exercise caution when completing test procedures or while inspecting unit operation may result in injury or death from electrical shock, air movement or rotating parts.

- ❑ Rotate all fan wheels manually. Fans should turn freely in the proper direction.
- ❑ Check fan drive belt tension.

NOTE: IF T-SERIES CLIMATE CHANGER FAN IS GOING TO OPERATE AT OTHER THAN DESIGN RPM OR WITH A VARIABLE SPEED DRIVE NOT SUPPLIED BY TRANE, THE UNIT VIBRATION LEVELS SHOULD BE CHECKED AT THE NEW RPM AND THROUGHOUT THE SPEED RANGE. RE-BALANCE OR CORRECT VIBRATIONS AS NECESSARY.

- ❑ Check fan hub set screws, sheave set screws and bearing set screws for proper torque (*Table 45*). Fan sheaves should be tight and aligned. Bearing set screws should be aligned. See section titled “Periodic Maintenance” for alignment instructions.

Table 45
Fan Bearing Setscrew Torque Settings (lb-ft)

Screw Size	Hex Size	Torque
1/4	1/8	5.5-7.5
5/16	5/32	10.5-13.7
3/8	3/16	19-25
7/16	7/32	29-37.5
1/2	1/4	42-54.2

- ❑ Inspect fan motor and bearings for proper lubrication. Refer to *Table 49* for fan grease recommendations. Contact the motor representative for motor lubrication recommendations.

- ❑ Inspect electrical connections. They should be clean and secure. Compare actual wiring with specific diagrams on the unit.
- ❑ Check piping and valve for leaks. Open or close the valves to check operation. Drain lines should be open.
- ❑ If unit has a refrigerant coil, it must be charged, leak-tested, and ready for operation according to instructions provided with the condenser equipment. Adjust superheat setting.
- ❑ Check that air filters are in place and positioned properly.
- ❑ Remove all foreign material from the drain pan and check pan opening and condensate line for obstructions.
- ❑ Check unit for debris.
- ❑ Close and secure all unit access doors.

Start-Up

⚠ CAUTION

Inadequate lubrication of fan motor or bearings may result in premature bearing or motor failure.

1 Inspect electrical connections. They should be clean and secure. Compare actual wiring with specific diagrams provided on the unit.

2 Check piping and valves for leaks. Open or close the valves to check for proper operation. Drain lines should be open.

⚠ CAUTION

The use of untreated or improperly treated water in unit coils may cause scaling, erosion, corrosion, algae, slime or other equipment damage. Consult a qualified water treatment specialist to determine if water treatment is required. The Trane Company assumes no responsibility for equipment damage caused by untreated or improperly treated water.

3 If equipped with a refrigerant coil, charge and leak-test the unit to and ready it for operation according to instructions provided with the condenser equipment. Adjust superheat setting.

4 Check that all air filters are in place and positioned properly. Under Periodic Maintenance, see section titled “Air Filters.”

NOTE: UL-LISTED UNITS REQUIRE A “TOOL-ONLY” REMOVABLE LATCH ON ACCESS DOORS. THE HANDLE TIE-DOWN SCREW SHIPPED WITH THE UNIT MEETS THIS REQUIREMENT, AND SHOULD REMAIN IN PLACE WHEN THE ACCESS DOOR IS CLOSED.

5 Close and secure all unit access doors. Check that the latch set screws are tight.

6 Remove all foreign material from the drain pan and check drain pan opening and condensate line for obstructions.

7 Check unit for debris.

8 Reference CLCH-IOP-1 for more details on the start-up of units with factory mounted controls.

Start-Up Procedures

After completing all prestart-up checks and procedures, the unit may be started. The following checks and adjustments should be made during initial start-up:

⚠ WARNING

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to “windmilling.” The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

Disconnect electrical power source when connecting or disconnecting electrical wires for test procedures. Do not open service access doors while the unit is operating. Failure to exercise caution when completing test procedures or while inspecting unit operation may result in injury or death from electrical shock, air movement or rotating parts.

If the unit was stored for an extended period of time, the following items should be checked before starting the unit.

1 Inspect motor bearings for moisture and rust. Replace bearings if necessary and repack with new grease.

2 Check motor winding. An acceptable winding resistance reading is from 6 meg-ohms to infinity. If reading is less than 5 meg-ohms, winding should be dried out in an oven or by a blower.

3 Inspect the entire motor for rust and corrosion.

4 Lubricate the motor as instructed in the section titled “Periodic Maintenance,” or as indicated by the maintenance tag on the motor.

5 Bump-start unit and observe the fan wheel for proper rotation, as indicated by rotation arrow located on fan housing.

6 Measure the motor voltage and amperage on all phases to ensure proper operation. The readings should fall within the range given on the motor nameplate.

Maximum allowable voltage imbalance is two percent. Voltage imbalance is defined as 100 times the sum of the deviation of the three voltages from the average, divided by twice the average voltage. For example, if the three measured voltages are 221, 230 and 227, the average voltage would be 226 volts.

The percent of voltage imbalance is then calculated:

$$\frac{100 \times \{[226-221] + [230-226] + [227-226]\}}{2 \times 226}$$

= 2.2% (Unacceptable)

In this example, 2.2 percent imbalance is not acceptable and the power company should be notified to correct it.

- ❑ Check unit vibration if the fan speed is changed more than 5% from the original designed rpm, or if parts such as shafts, fan wheels, bearings, or other drive components are replaced. Do not exceed max. fan rpm.
- ❑ Pay particular attention to any vibration, noise or overheating of the motor and fan bearings. (Bearings may run warm during break in.)

Excessive Vibration

EXCESSIVE VIBRATION MUST BE CORRECTED TO PREVENT BEARING AND SHAFT DAMAGE. SEE THE SECTION TITLED "TROUBLESHOOTING" FOR DETAILS ON THE COMMON CAUSES FOR VIBRATION.

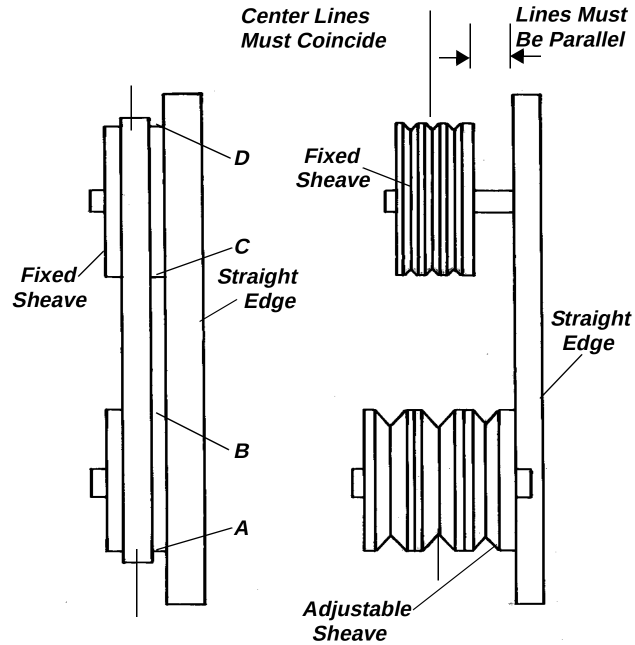
Determine Fan RPM

Fan rpm can be determined by using a strobe-type tachometer, or revolution counter.

Sheave Alignment

Align the fan and motor sheaves by using a straightedge. The straightedge must be long enough to span the distance between the outside edges of the sheaves. When the sheaves are aligned, the straightedge will touch both sheaves at points A through D to confirm that the shaft is parallel. For uneven width sheaves, place a string in the center groove of both sheaves and pull tight. Adjust sheaves and tighten the sheave set screws to the proper torque given in *Table 47* .

Figure 45
Proper Drive Alignment



⚠ WARNING

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to "wind-milling." The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

Fan Belt Alignment

Tighten the belts slightly and rotate the drive several times.

On multiple belt drives, determine that the force of deflection is approximately the same on each belt by pushing each belt in an equal distance at a point halfway from each sheave. If this force is not the same for each belt, the motor and fan shaft are not parallel. Realign as required.

After realignment, tighten the belts again to the standard belt tensioning specifications. See the following section.

Over-tensioning of belts can cause damage to bearings, shafts, and drive components. Belts should not squeal at start-up. Belt tension should be rechecked after 8 hours, 24 hours, and 100 hours of operation and monthly thereafter. When the belt is in operation, the tight side of the belt should form a straight line from sheave with only a slight bow on the slack side.

Fan Belt Tension

NOTE: FAN BELT TENSION SHOULD BE CHECKED AT LEAST THREE TIMES DURING THE FIRST DAYS OF OPERATION, SINCE THERE IS A RAPID DECREASE IN TENSION UNTIL BELTS SETTLE IN. REFER TO THE DRIVE STICKER FOR PROPER TENSION.

Figure 46
Typical Drive Belt Label

```
Browning V-BELT DRIVE KIT            1627373
                 MODULE 0400
PURCHASE ORD. NUMBER B24597-061 H5D073B A
CUSTOMER'S KIT # H5D073B A-012-0400
MTR HP.=   10.0
FAN RPM=1458 CD=  9.4 AT 3.00 TRN OPN
  TENSION INFO -   3.86 LB.,  0.14 IN.
 DRIVE'S BELTS -  B40
  MOTOR SHEAVE -  2VP75X 1 3/8
 MOTOR BUSHING -  NONE REQUIRED
    FAN SHEAVE -  2B5V80
   FAN BUSHING -  B 1 7/16
```

⚠ WARNING

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

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to “windmilling.” The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

Figure 47
Fan Sheave Pitch Diameter

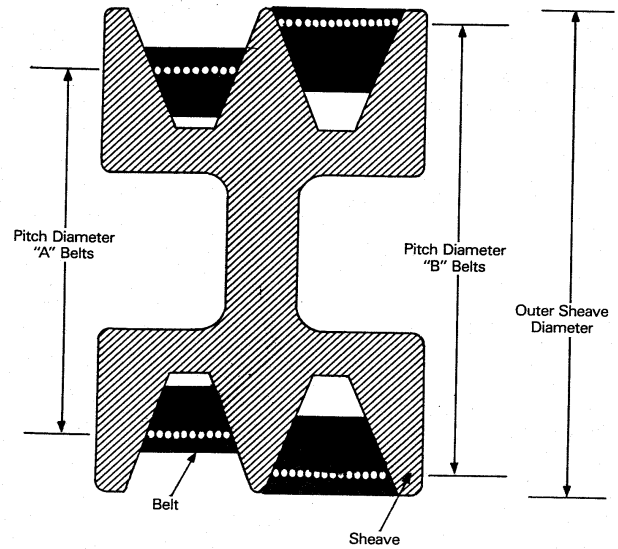


Table 46
Values for K-Factor (Belt Cross Section Types)

Belt Type	A	B	C	D	E	3L	4L	
K Factor	8	13	40	80	95	6	6	
Belt Type	5L	3V	5V	8V	AX	BX	CX	DX
K Factor	6	6	12	25	11	18	54	101

Figure 48
Belt Tension Measurement

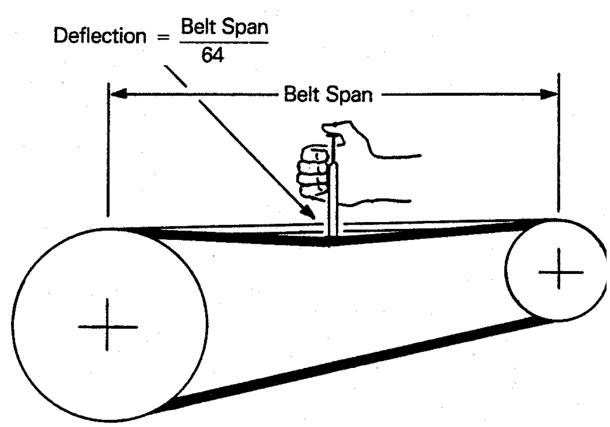
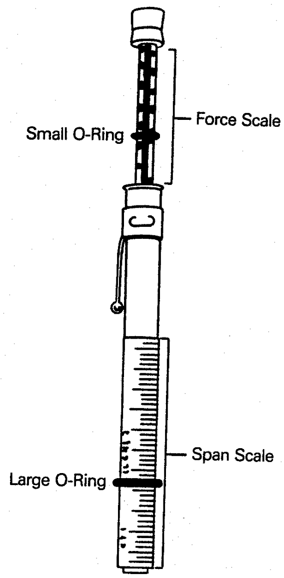


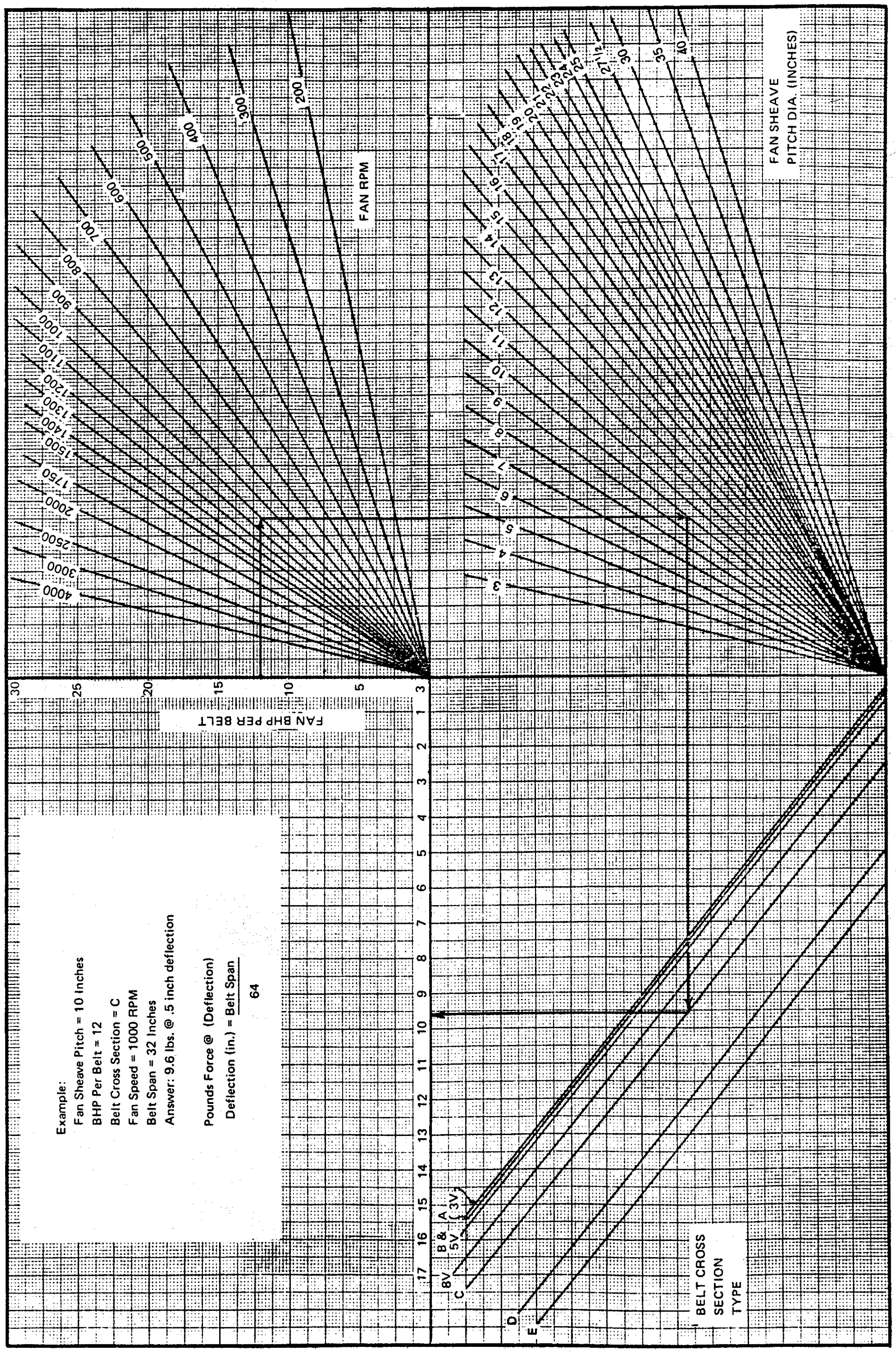
Figure 49
Belt Tensioner



Proper belt tension is required to ensure maximum bearing and drive component life and is based on fan brake horsepower requirement. Use *Table 47* to find the proper belt tension and refer to the inset for an example. To use the table, you must know:

- ❑ Fan design brake horsepower (bhp) per belt (not motor hp)
- ❑ Fan rpm
- ❑ Fan sheave pitch diameter, found by measuring where the middle of the belt rides in the sheave (See *Figure 47*)
- ❑ Type of belt cross-section (stamped on the belt)

Table 47
Belt Tension



As shown in the example of *Table 47* , the correct tension (pounds force) is 9.6 pounds, at 1/2-inch deflection. Deflection is determined by dividing the belt span distance by 64, as shown in *Figure 48* .

To measure belt tension, use a belt tensiometer as shown in *Figure 49* . Determine actual deflection by depressing one belt with the belt tensiometer and measuring the deflection relative to the other belts or to belt line. Adjust the belt tension to the correct pounds force and tighten all set screws to the proper torque. (See *Table 47* .)

For belt cross-section types not given in *Table 47* , use the following equations to calculate correct belt tension.

F = (T + K)/16

where

F = force measured in pounds at specific deflection.

K = constant determined by belt cross-section type.

T =24,750 (fan hp per belt)/ belt speed

Belt speed = ((fan pitch diameter)/12) X 3.1416 X fan rpm

For example, given the following:

Motor sheave pitch diameter: 5.7 inches, eight groove

Fan sheave pitch diameter: 10.0 inches, eight groove

Fan horsepower: 2.4 bhp

Fan rpm: 1000 rpm

Belt type: C

Sheave span: 32 inches

Belt speed = (10/12) X 3.14 X 1000 = 2618

T = (24,750 X (24 bhp/2 belts)/2618 = 113.4 lb

F = (13.4 + 40)/16 = 9.6 lb.

Also, D =(Belt span (inches))/64 = 32/64 =.50 in.

Therefore, the belt tensiometer should read 11.5 pounds force at 15/16-inch deflection. This will yield 159.4 pounds force belt tension.

Belt tensions determined by using *Table 46* are minimum values. The correct operating tension for a V-belt drive is the lowest tension at which the belts will not slip under the peak load conditions. It may be necessary, however, to increase the tension of some drives to reduce excessive belt flopping or to reduce excessive start-up squealing.

NOTE: THERE IS A LABEL LOCATED ON THE BEARING SUPPORT ON THE DRIVE SIDE OF THE UNIT THAT LISTS ALL DRIVE PARTS AND THE PROPER BELT TENSION FOR THE SPECIFIC DRIVE.

⚠ CAUTION

Do not over-tension the belts. Excessive tension will reduce fan and motor bearing life, accelerate belt wear and possibly cause shaft failure.

Periodic Maintenance

The following checklist is provided as an abbreviated guide to periodic maintenance. Detailed procedural information is given after this checklist.

⚠ WARNING

Disconnect electrical power and allow rotating parts to stop before servicing the unit. Exercise caution if unit must be on for test or maintenance procedures. Failure to do so may result in injury or death from electrical shock or moving parts.

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to "windmilling." The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

After 48 Hours Operation

Belts have acquired their permanent stretch. Readjust but do not over-tighten. See section titled "Fan Belt Tension" for instructions.

Weekly

Observe unit weekly for any change in running condition and unusual noise.

Every Month

- ❑ Check air filters. Clean or replace if clogged or dirty. Coat permanent filters with oil after cleaning. Change bag filters when pressure drop is 1-inch W.G.
- ❑ Relubricate fan bearings if operating conditions include high speeds, moist or dirty air, or high temperatures.
- ❑ Relubricate motor bearings in accordance with motor manufacturer's recommendations if operating conditions include high speeds, moist or dirty air, or high temperatures.
- ❑ Check and adjust fan belt tension.

Every Three to Six Months

- ❑ Check fan bearing grease line connections. Lines should be tight to the bearings.
- ❑ Relubricate fan bearings.
- ❑ Check motor lubrication. Recommendations are provided on the motor tag or on a unit sticker.
- ❑ Check bearing and motor bracket bolt torque.
- ❑ Align fan and motor sheaves. Tighten sheave set screws to the proper torque.
- ❑ Check and adjust fan belt tension.
- ❑ Tighten electrical connections.
- ❑ Inspect coils for dirt build-up or coil freeze-up.

Every Year

- ❑ Inspection the unit casing for corrosion. If damage is found, clean and repaint the surface with a rust-resistant primer and vinyl chlorinated lacquer.
- ❑ Clean the fan wheels and fan shaft. Remove rust with an emery cloth and apply a coat of LPS #3 or an equivalent.
- ❑ Inspect the condensate drain pan and drain line, remove sludge or foreign materials that might obstruct proper drainage. Remove obstacles.

Table 48
Minimum Hex Head Bolt Torque in lb-ft

Grade 5 Bolts		
Size (inches*)	Thread Designation	Min. Torque
1/4, 20	UNC	6
1/4, 28	UNF	7
5/16, 18	UNC	14
5/16, 24	UNF	16
3/8, 16	UNC	24
3/8, 24	UNF	28
7/16, 14	UNC	42
7/16, 20	UNF	45
1/2, 13	UNC	69
1/2, 20	UNF	83
9/16, 12	UNC	99

Table 48
Minimum Hex Head Bolt Torque in lb-ft

Grade 5 Bolts		
Size (inches*)	Thread Designation	Min. Torque
9/16, 18	UNF	118
5/8, 11	UNC	150
5/8, 18	UNF	176
3/4, 10	UNC	254
3/4, 16	UNF	301
7/8, 9	UNC	358
7/8, 14	UNF	422
1, 8	UNC	500
1, 14	UNF	602

**NOTE: Soft metric conversions not acceptable for screw and hex sizes*

- ❑ Check damper linkages, set screws and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings.
- ❑ Clean damper operators.
- ❑ Inspect the control and power box wiring for secure connections and insulation.
- ❑ Rotate the fan wheel and check for obstructions in the fan housing. The wheel should not rub on the fan housing. Adjust the center if necessary and tighten wheel set screws to the proper torque.
- ❑ Check condition of gasketing and insulation around unit, door and dampers.
- ❑ Examine flex connections for cracks or leaks. Repair or replace damaged material.

Drain Pans

Inspecting and Cleaning Drain Pans

For units with sloped drain pans, if evidence of standing water or condensate overflow exists, identify and remedy the cause immediately. (Refer to the troubleshooting section for possible causes and solutions.) If microbial growth (mold) in the drain pan is observed, clean the pan immediately using the following procedure:

7 Disconnect all electrical power to the unit.

8 Don the appropriate personal protective equipment (PPE).

9 Remove all standing water.

10 Use a scraper or other tools to remove any solid matter. Remove solid matter with a vacuum device that uses high efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97% at 0.3 micron particle size.

11 Thoroughly clean the contaminated area with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use. Carefully follow the sanitizer manufacturer's instructions regarding the use of the product.

12 Immediately rinse the drain pan thoroughly with fresh water to prevent potential corrosion from the cleaning solution of the drain pan and drain line components.

13 Allow the unit to dry thoroughly before putting the system back into service.

14 Determine and correct the cause of the microbial contamination.

15 Be careful that the contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

<u>IMPORTANT</u>: STANDING WATER IN DRAIN PANS CAN PROMOTE MICROBIAL GROWTH (MOLD) THAT MAY CAUSE UNPLEASANT ODORS AND SERIOUS HEALTH-RELATED INDOOR AIR QUALITY PROBLEMS. <u>IF MOLD IS FOUND, IT MUST BE REMOVED IMMEDIATELY AND THAT PORTION OF THE UNIT PROPERLY CLEANED AND SANITIZED</u>.

Air Filters

Catalog data tables provide filter size, type and quantity.

Throwaway Filters

To replace throwaway filters, install new filters with the directional arrows pointing in direction of airflow.

NOTE: FILTERS MUST HAVE AN AIRTIGHT SEAL TO PREVENT AIR BYPASS. IF USING OTHER THAN TRANE-SUPPLIED FILTERS, APPLY FOAM GASKETING TO THE VERTICAL EDGES OF THE FILTER.

Permanent Filters

To clean permanent filters, wash under a stream of water to remove dirt and lint. Remove oil filter with a wash of mild alkali solution. Rinse in clean, hot water and allow to dry. Coat both sides of the filter by immersing or spraying it with Air Maze Filter Lote W or an equivalent. Allow to drain and dry for about 12 hours.

Cartridge or Bag Filters

To install cartridge or bag filters, complete the following:

⚠ WARNING

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

1. Open the filter section access door and remove the filters and block-offs from their installed position.
2. Keeping the bag filters folded, slide each filter into the filter rack, pushing them tightly against the unit. Pleats should be in the vertical position.
3. If using the optional pre-filters, slide them into the appropriate filter rack.
4. If fixed and adjustable block-offs are provided with the unit, slide the fixed block-offs into the filter track before the adjustable block-off. The adjustable block-off should always be installed last, next to the access door.
5. Close and secure the access door. If the door can be closed without compressing the filter, adjust the block-off by loosening its screws and position it to provide an airtight seal.

Fans

Inspecting and Cleaning Fans

Fan sections of air handlers should be inspected every six months at a minimum or more frequently if operating experience dictates. Accumulated dirt and organic matter on the interior surfaces of fans should be cleaned immediately. The suggested procedure for cleaning these surfaces is:

1. Disconnect all electrical power to the unit.
2. Don the appropriate personal protective equipment (PPE).
3. Use a portable vacuum with HEPA filtration to remove the loose dirt and organic matter. The filter should be 99.97% efficient at 0.3 micron particle size.
4. If no microbial growth (mold) exists, thoroughly clean the fan and associated components with an industrial cleaning solution. Carefully follow the cleaning solution manufacturers instructions regarding use of their product.
5. If microbial growth (mold) is present, remove the contamination (Step 2) and thoroughly clean the affected area with an EPA-approved sanitizer specifically designed for HVAC use. Carefully follow the sanitizer manufacturers instructions regarding the use of the product.
6. Rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
7. Allow the unit to dry completely before putting it back into service.
8. Use caution to assure that any contaminated material does not contact other areas of the unit or building. **Properly dispose of all contaminated materials and cleaning solution**.

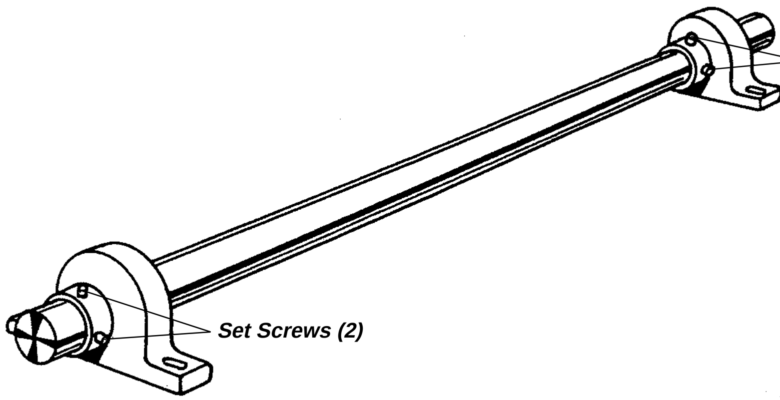
<u>IMPORTANT</u>: IF MICROBIAL GROWTH (MOLD) WAS FOUND, THE CAUSE OF THE CONTAMINATION MUST BE DETERMINED AND ACTION TAKEN TO ASSURE IT DOES NOT RECUR.

Fan Bearings and Motors

Bearing Set screw Alignment

Align bearing set screws as illustrated in *Figure 50* . Reference *Table 45* for bearing set screw torque.

Figure 50
Bearing Setscrew Alignment



Fan Bearing Lubrication

Table 49
Recommendations for Grease-Lubricated Fan Bearings

	Greasing Intervals	
Operating Conditions	**-20°F to +140°F**	**140°F to 200°F**
Clean, Dry	3-6 months	1-3 months
Dirty, Dry	1-3 months	1-4 weeks
Dirty, Wet, High Humid.	1-4 weeks	1-14 days
Recommended Greases	**Recommended Operating Range**	
Texaco-Multi Fak #2	-20°F to +250°F	
Shell Alvania #2	-20°F to +250°F	
Mobil Mobilux #2	-20°F to +250°F	
Exxon Unirex #2	-20°F to +250°F	
Texaco Prem. RB	-20°F to +250°F	
Mobil 532	-20°F to +250°F	
Exxon Beacon	-65°F to +250°	
Keystone 84H	-40°F to +225°F	
Shaft Size (In)	Max. Grease Cap. of Bearing (Oz.)	
1/2 to 3/4	1/8	
7/8 to 1-3/16	3/8	
1-1/4 to 1-1/2	5/8	
1-11/16 to 1-15/16	7/8	
2 to 2-7/16	1-1/4	
2-1/2 to 2-15/16	2	

Note: Greases used should conform to NLGI No. 2 penetration.

Fan bearings should be lubricated with a lithium base grease which conforms to NLGI Number 2 for consistency. See *Table 49* and *Table 50* for recommended lubricants and bearing grease capacities.

⚠ CAUTION

Improper lubrication can result in premature bearing failure.

Do not mix greases with different bases within the bearing. This can cause an audible squealing noise that may be transmitted through the system ductwork. Premature bearing failure may result.

To lubricate the fan bearings, complete the following:

⚠ WARNING

Disconnect electrical power source before servicing the unit. If unit must be on for maintenance procedures, exercise extreme caution. Failure to do so may result in personal injury or death from electrical shock or entanglement in moving parts.

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to “windmilling.” The impeller should be

secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

1. Disconnect main power switch.
2. Check grease lines for tight connections at the grease fitting.
3. Using a manual low pressure grease gun, add grease until a light bead of grease appears at the bearing grease seal. Turn the fan wheel manually while adding grease.

Fan Motors

Inspect fan motors periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection and lubrication. *Table 51* lists recommended motor greasing intervals. Motor lubrication instructions are found on the motor tag or nameplate. For a list of compatible greases, see *Table 49* .

Table 50
Fan Bearing Maximum Grease Capacity

Shaft Size in inches	Capacity in fl. oz.
1/2 - 3/4	1/7
7/8 - 1-3/16	3/8
1-1/4 - 1-1/2	5/8
1-11/16 - 1-15/16	7/8
2 - 2-7/16	1-1/4
2-1/2 - 2-15/16	2

Table 51
Recommended Motor Greasing Schedule

Avg. Daily Operating Hours	Avg. Environment	.3 to 7.5 HP Motors	10 to 30 HP Motors
8-16	Clean and Dry	Every 5 years	Every 3 years
12-24	Moderate Dirt or Moisture	Every 2 years	Every year
Any	Severe (very dirty or high temperatures)	Every 6 months	Every 3 months

To relubricate the motor, consult the maintenance tag provided by the vendor.

Refer to *Table 48* for minimum torque of motor mounting and bearings bolts.

⚠ WARNING

Disconnect power source for motor lubrication. Failure to do so may result in injury or death.

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to “windmilling.” The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

Coil Cleaning

The frequency of required cleaning is dependent on the operating hours of the system, filter maintenance and efficiency and dirt load.

IMPORTANT: COILS BECOME EXTERNALLY FOULED AS A RESULT OF NORMAL OPERATION. DIRT ON THE SURFACE OF THE COIL REDUCES IT’S ABILITY TO TRANSFER HEAT THAT CAN RESULT IN COMFORT PROBLEMS, INCREASED RESISTANCE TO AIR FLOW AND THUS INCREASED OPERATING ENERGY COSTS. IF THE DIRT ON THE SURFACE OF THE COIL BECOMES WET, SUCH AS COMMONLY OCCURS WITH COOLING COILS, MICROBIAL GROWTH (MOLD) CAN RESULT THAT MAY CAUSE UNPLEASANT ODORS AND SERIOUS HEALTH-RELATED INDOOR AIR QUALITY PROBLEMS.

Steam, hot water and chilled water coils

Steam, hot water and chilled water coils should be kept clean to maintain maximum performance. If fins become dirty, clean with steam and detergent, hot water spray and detergent, or one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.

⚠ WARNING

Follow all directions provided with chemical cleaners to avoid personal injury and/or coil damage. Commercially available chemical cleaners may contain caustic or hazardous agents.

1 Disconnect all electrical power to the unit.

2 Don the appropriate personal protective equipment (PPE).

3 Gain access to the coil section of the unit (both sides).

4 Use a soft brush to remove loose debris from both sides of the coil.

5 Use a steam cleaning machine, starting from the top of the coil and working downward. Clean the leaving air side of the coil first, then the entering air side. Use a block-off to prevent steam from blowing through the coil and into a dry section of the unit.

6 Repeat step 5 as necessary.

7 Confirm that the drain line is open following the cleaning.

8 Allow the unit to dry thoroughly before putting the system back in service.

9 Straighten any coil fins that may have been damaged during the cleaning process with a fin rake.

10 Replace all panels and parts and restore electrical power to the unit.

11 Use caution to assure that any contaminated material does not contact other areas of the unit or building. **Properly dispose of all contaminated materials and cleaning solution.**

Type K cooling coils

Type K cooling coils have removable headers for cleaning. A small nylon or fiber brush may be used to clean the tubes. After cleaning, flush with water. When removing any header, replace the rubber sealing gasket and be sure that it seats properly when header is installed. If necessary, pull out turbulators, clean the tubes and replace turbulators. When header covers are replaced, apply washers under the bolt heads. Bolts should be evenly tightened to 50 pound-feet of torque.

Refrigerant coils

Refrigerant coils should be kept clean to maintain maximum performance. If fins become dirty, clean with cold water and detergent, or one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.

⚠ CAUTION

Follow directions provided with the cleaner to avoid coil damage.

⚠ WARNING

Never use steam or hot water to clean a refrigerant coil. Dangerous pressures may be built up by the improper application of heat resulting in equipment damage or personal injury.

1 Follow steps 1-4 from **Steam and Water Coil** Cleaning procedure preceding.

2 Mix a high quality coil cleaning detergent with water according to the manufacturers instructions. If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Carefully follow the detergent manufacturers instructions on the use of the product.

3 Place the mixed solution in a garden pump-up sprayer or high pressure sprayer. If a high pressure sprayer is used, note the following:

- ❑ Maintain a minimum nozzle spray angle of 15 degrees.
- ❑ Spray perpendicular to the coil face.
- ❑ Protect other areas of the air handler and internal controls from contact with moisture or the cleaning solution.
- ❑ Keep the nozzle at least 6 inches from the coil.
- ❑ Do <u>not</u> exceed 600 psi.

4 Spray the leaving air side of the coil first, then the entering air side. Use a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork. Carefully follow the cleaning solution manufactures usage instructions.

5 Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.

6 Repeat steps 4 and 5 as necessary.

7 Straighten any coil fins that may have been damaged during the cleaning process with a fin rake.

8 Confirm that the drain line remains open following the cleaning process.

9 Replace all panels and parts and restore electrical power to the unit.

10 Allow the unit to dry thoroughly before putting the system back into service.

11 Use caution to assure that any contaminated material does not contact other areas of the unit or building. **Properly dispose of all contaminated materials and cleaning solution**.

Coil Winterization

Provisions must be made to drain coils that are not in use when subjected to freezing temperatures. Coil type NS may be adequately drained in its pitched position within the unit and the installer must provide appropriate piping for adequate drainage.

Coil types UU, D, DD, (provided with drain and vent) K, W, WC, and P can be adequately drained as installed in their level position.

⚠ CAUTION

Failure to properly drain and vent coils when not in use during freezing temperatures may result in coil freeze-up damage.

⚠ CAUTION

Use caution in removing header plugs from P2, P4 and P8 coils. Over torquing may result in twisted tubes.

Type UW Coil - (Leveled/pitched— not fully drainable)

Remove the vent and drain plugs and blow the coils out as completely as possible with compressed air. The coils should then be filled and drained several times with full strength inhibited ethylene glycol, so that it will mix thoroughly with the water retained in the coil. Drain the coil out as completely as possible.

Type K Coils

To winterize Type K coils, remove the header covers. If tubes are fouled, clean with nylon or fiber brush. To ensure that no water will remain in the coil, do not replace the header covers until the coils are put back into service. When the coils are put back into service, new gaskets must be used. When header covers are replaced, apply washers under the bolt heads and tighten bolts evenly to 50 pound-feet. Bolts should be tightened beginning in the center and working toward the outside.

Troubleshooting

Use the table in this section to assist in identifying the cause or causes of a malfunction in T-Series Climate Changer operation. The column header "*RECOMMENDED ACTION*" suggests repair procedures.

NOTE: THIS TABLE IS INTENDED AS A DIAGNOSTIC AID ONLY. FOR DETAILED REPAIR PROCEDURES, CONTACT YOUR LOCAL TRANE SERVICE COMPANY.

⚠ WARNING

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

Disconnect electrical power prior to access into a fan or ductwork. Even when locked out electrically, fans may cause injury or damage if the impeller is subject to "windmilling." The impeller should be secured to physically restrict rotational movement. Failure to secure impeller can cause severe personal injury or death.

Table 52
T-Series Climate Changer Trouble Analysis

SYMPTOM	*PROBABLE CAUSE*	*RECOMMENDED ACTION*
Bearing is excessively hot	*First start after relubrication (Grease distribution)*	*Allow machine to cool down and restart.*
	Over-lubrication	*Clean surface of grease and purge.*
	Over tensioned belts	*Adjust belt tension.*
	No lubricant	*Apply lubricant. Check bearings for damage.*
	Misaligned bearing	*Correct alignment. Check shaft level.*
Motor fails to start	*Blown fuse or open circuit breaker*	*Replace fuse or reset circuit breaker.*
	Overload trip	*Check and reset overload.*
	Improper wiring or connections	*Check wiring with diagram supplied on unit.*
	Improper current supply	*Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.*
	Mechanical failure	*Check that motor and drive rotate freely. Check bearing lubricant.*
Motor stalls	*Open phase*	*Check line for an open phase.*
	Overloaded motor	*Reduce load or replace with larger motor.*
	Low line voltage	*Check voltage across AC line. Correct voltage if possible.*
Excessive vibration	*Poor alignment*	*Align bearing set screws (Figure 50). Loosen and retighten bearing set screws.*
	Shipping spacers not removed	*Remove shipping spacers and/or bolts. See Figure 18 and Figure 19 .*
	Over tensioned belts	*Adjust belt tension.*
	Misaligned drive	*Align drive.*

Table 52
T-Series Climate Changer Trouble Analysis

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Motor runs and then dies down	*Partial loss of line voltage*	*Check for loose connections. Determine adequacy of main power supply.*
	Stator shorts when motor warms up	*Replace stator.*
Motor does not come up to speed	*Low voltage at motor terminals*	*Check voltage across AC line and correct voltage loss if possible.*
	Line wiring to motor too small	*Replace with larger sized wiring.*
Motor overheats	*Overloaded motor*	*Reduce load or replace with a larger motor.*
	Motor fan is clogged with dirt preventing proper ventilation	*Remove fan cover, clean fan and replace cover.*
Excessive motor noise	*Motor mounting bolts loose*	*Tighten motor mounting bolts.*
	Rigid coupling connections	*Replace with flexible connections.*
	Worn motor bearings	*Replace bearings and seals.*
	Fan rubbing on fan cover	*Remove interference in motor fan housing.*
Rapid motor bearing wear	*Excessive overhung load due to overtensioned drive*	*Check belt tension and overhung load.*
	Excessive overhung load due to a small diameter motor sheave	*Replace sheave with larger one.*
Loose fan belt	*Motor is poorly positioned*	*Adjust belt tension.*
	Worn or damaged belt	*Replace belt or belt set. Check sheave alignment.*
	Worn sheaves	*Replace sheaves.*
Shorter belt life	*Worn sheaves*	*Replace sheaves.*
	Misaligned belt	*Realign drive with MVP sheave set at mean pitch diameter.*
	Grease or oil on belts	*Check for leaky bearings. Clean belts and sheaves.*
	Belt slipping	*Adjust tension.*
	Belts rubbing	*Remove obstruction or realign drive for clearance.*
Bearing noise	*Poor alignment*	*Loosen bearing set screws and realign (See Figure 50 .)*
	Inadequate lubrication	*Grease bearing(s).*
Low coil capacity (Chilled water)	*Air is bypassing coil*	*Prevent bypass with block-offs.*
	Coil tubes are blocked	*Clean and unblock tubes.*
	Incorrect airflow	*Check fan operating conditions.*
	Incorrect gpm	*Check water pumps, valves and lines for obstructions.*
	Incorrect water temperature	*Provide proper water temperature.*
Low coil capacity (Refrigerant)	*Air is bypassing coil*	*Prevent bypass with block-offs.*
	Coil tubes are blocked	*Clean and unblock tubes.*
	Incorrect airflow	*Check fan operating conditions.*
	Expansion valve not operating	*Check sensing bulb location and TXV operation.*

Table 52
T-Series Climate Changer Trouble Analysis

SYMPTOM	***PROBABLE CAUSE***	***RECOMMENDED ACTION***
	Poor refrigerant distribution	*Check for blockage in distributor and tubes.*
Drain pan is overflowing	*Plugged drain line*	*Clean drain line.*
	Unit not level	*Level unit.*
Standing water in drain pan	*Improper trap design*	*Design trap for unit.*
Excess dirt in unit	*Missing filters*	*Replace filters.*
	Filter bypass	*Reduce filter bypass.*
Mold inside air handler	*Standing water in drain pan*	*See "Standing water" symptom.*

Airstack **PACKAGED CHILLER** Friday, March 07, 2008

JOB NAME	Intermed	**ENGINEER**	
LOCATION		**ARCHITECT**	
CUSTOMER		**CONTRACTOR**	

Multistack Order Number	021-I007	**Submitted by**	Jeff Charette / EW
Customer P.O. Number		**Quote #**	QEW110720075
Sales Representative	Jeff Charette	**Approved by**	**Date:**

Total Number of Modules: 4.0 (Dimensions Do Not Include J-Boxes)

Overall Height(in): 77 13/16 **Width:** 72 **Length:** 148 **Wet Weight:** 7200 lbs

CHILLED WATER DESIGN

Master Module ASP-30A (MF)	1	
Slave Front ASP-__A (SF)	0	
Slave Front ASP-__A (SF)	0	
Slave Rear ASP-30A (SR)	1	
Slave Rear ASP-__A (SR)	0	

Chilled Water: 40 % Propylene Glycol

Entering Temperature	50.0	°F
Leaving Temperature	40.0	°F
Flow Rate	144.5	GPM
Evaporator ΔP	7.6	Feet

AMBIENT AIR TEMPERATURE

Design:	95.0	°F
Low:	-20.0	°F

FULL LOAD CHILLER PERFORMANCE

Cooling Capacity:	52.4	Tons
Power Input:	60.9	KW
EER:	10.3	

FREE COOL DESIGN

Free Cool Front ASP-00F (FF)	N/A
Free Cool Rear ASP-00F (FR)	N/A

Chilled Water:

Entering Temp	N/A	°F
Leaving Temp	N/A	°F
Flow Rate (each)	N/A	GPM
Total Flow Rate	N/A	GPM
Operating ΔP	N/A	Feet
Bypass ΔP	N/A	Feet

ACCESSORY MODULES

160 Gal. SS Tank Module(s) ASP-00T	1
Glycol Feeder Module(s) ASP-00G	0
Pump Module(s) ASP-00P	1

PUMP DESIGN

Pump Size	3x3x8	
Flow Rate	144.5	GPM
Pump	7.5	hp
Total Head	57.6	Feet

Assumes 50 ft of external head

CHILLER FEATURES

- Stainless Steel Evaporator
- Lead Compressor Sequencing (24hrs)
- Automatic Internal Rescheduling If Fault Occurs
- Automatic Logging Of Any Fault Condition
- Electronic Chilled Water Control
- Multiple Independent Ref. Systems
- Quick Interconnect Modular Design
- Aluminum Fin/Copper Tube Condenser Coils
- Dual Condenser Fans Per Module Designed For Quiet Operation
- Pressure Controlled 1750 RPM Fan Motors
- Filters In Evaporator Supply Headers
- Stainless Steel Inlet Header
- R-22 Refrigerant
- 5 Year Compressor Warranty
- Single Point Power
- Low Ambient Operation to -20°F
- Lifting Frame
- Mini-glycol Feeder & Expansion Tank in Pump Module

ELECTRICAL DATA

MAIN POWER SUPPLY 460 / 60 / 3

FANS: 3.5 FLA per fan motor

ELECTRICAL CIRCUIT(S) CAPACITY

	CHILLER CIRCUIT*
Minimum Circuit Ampacity (amps)	132
Maximum Over Current Protection (MOP)	175

ASP-30A: 25 RLA per compressor

ASP-00P: 11 FLA per module

*All chillers require completion of at least one of these columns.

** Compressor RLA's are obtained at ARI Conditions

First Letter	Second Letter
M=Master Chiller Module	F=Front Module
S=Slave Chiller Module	R=Rear Module
P=Pump Module	
F=Free Cool Module	
G=Glycol Feeder Module	

CHILLER LAYOUT

→ Tank	SR	J
PF	MF	→

IMPORTANT: To assure full equipment design performance, life and reliability, the MULTISTACK chiller must be piped in accordance with Installation Manual unless specifically authorized otherwise by MULTISTACK in writing.

REISSUE

	REVISION	BY	DATE
D			
F			
-			

MULTISTACK
Sparta, Wisconsin 54656
ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS

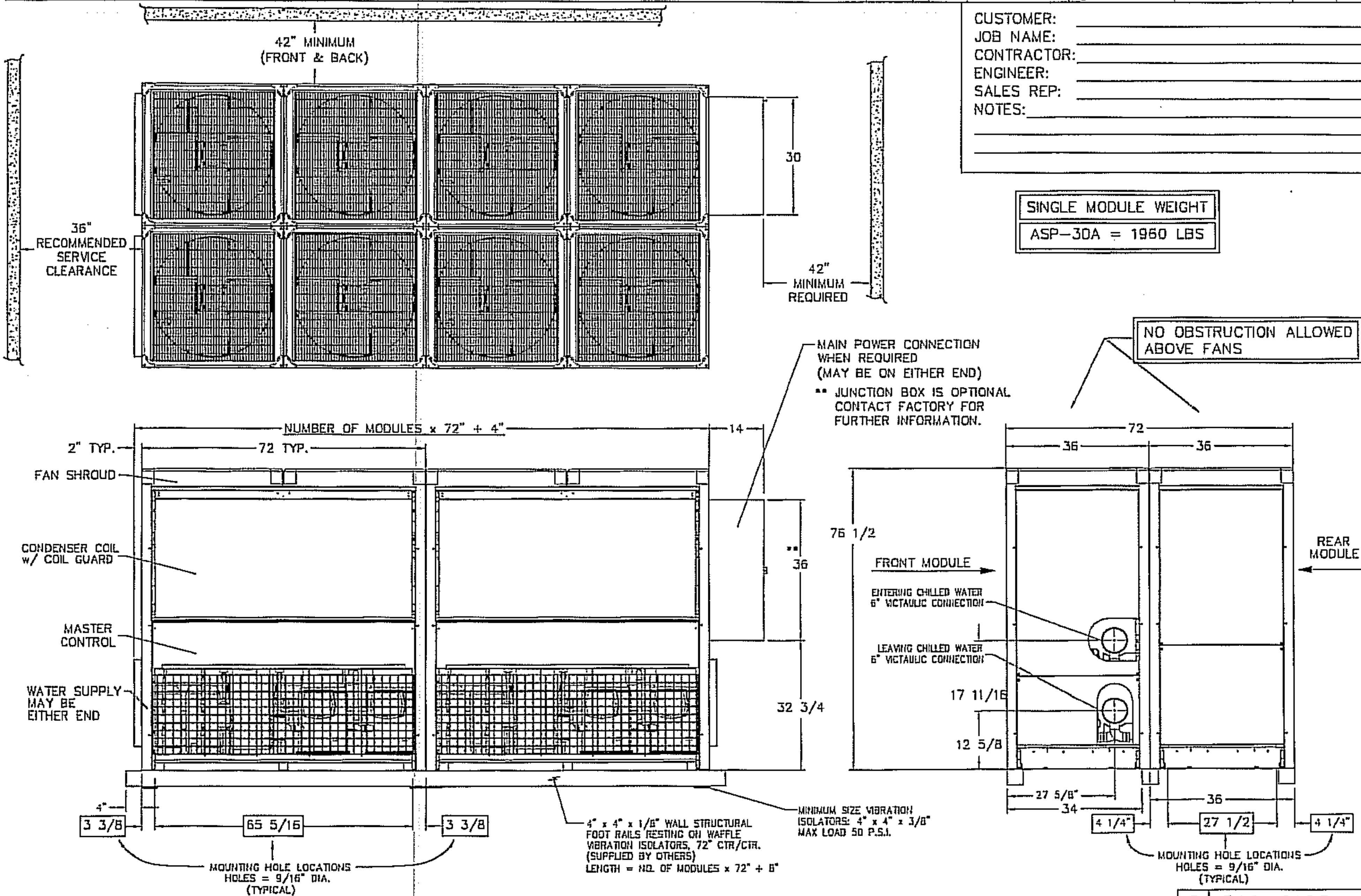
C | 500-0168

SUBMITTAL
ASP-30A
6" HEADERS

SIMILAR TO:	FIRST USED ON ASSY NO:	STD DIGR SPEC	
DRAWN BY: KRO DATE: 2/6/08	CHECKED BY: DATE:	DIGR APPR DATE:	SCALE: NONE

CUSTOMER:
JOB NAME:
CONTRACTOR:
ENGINEER:
SALES REP:
NOTES:

SINGLE MODULE WEIGHT
ASP-30A = 1960 LBS



C | 500-0168

ARMSTRONG SUBMITTAL

Series 4382 3x3x8 Close Coupled Vertical Centrifugal dualArm Pump

Project Number:
Name:
Reference:
Location:
Engineer:
Contractor:

Representative: Multistack
1065 Maple Avenue, Sparta, WI
Phone: 608-366-2400, Fax:
Order No: **Date:**
Submitted by: Ed Watson **Date:** 1/31/2008
Approved by: **Date:**

PUMP DESIGN DATA

Tag Num:	
Service:	
Location:	
No. of Pumps:	1
Capacity:	144.5 usgpm
Head:	58 ft
Piping:	Single
Suction Pressure:	0 ft
Liquid:	PropyleneGlycol:40
Op. Temperature:	45 °F
Viscosity:	10.28 cp
Sp.Gravity:	1.04
Suction Size:	3 in
Discharge Size:	3 in

MOTOR DESIGN DATA

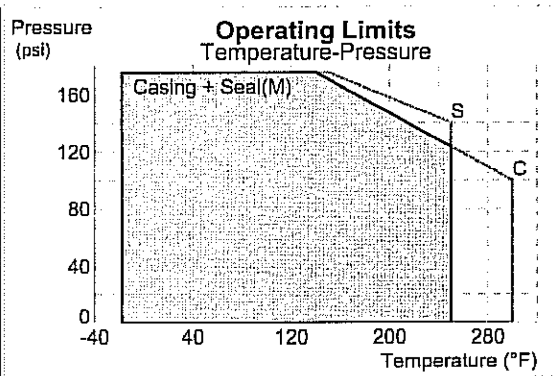
Motor Supplier:	Factory Choice
Motor Size:	7.5 hp @ 1800 rpm
Frame Size:	213JP
Enclosure:	TEFC
Cycle/Phase/Voltage:	60/3/460
Motor Eff:	Std
Insulation:	Class "B" Insulation (266.0 °F)
Starter Config:	DOL
Full Load/Starting (A)	11.0 / 63.5

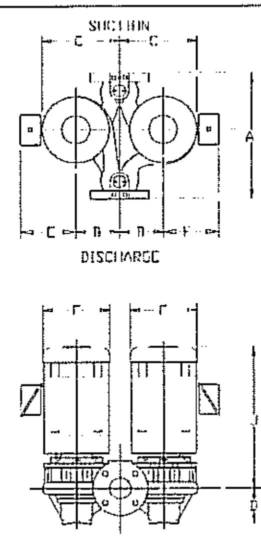
MECHANICAL SEAL DESIGN DATA

Manufacturer	John Crane
Manu. Code [JC 21]	JC 21, OP171
Seal Type	Inside Unbalanced
Rotating Face	Carbon
Stationary Seat	Ceramic
Secondary Seal	EPDM
Springs	Stainless Steel
Rotating Hardware	Stainless Steel

MATERIALS OF CONSTRUCTION

Construction	BF (Bronze Fitted)
ANSI Flange Rating	125 lb. (Cast Iron)
Casing	Cast Iron (A48-30)
Impeller	Bronze (B584-844)
Shaft Sleeve	Bronze (B584-844)
Flush Line	Bronze (B584-844)
Casing Gasket	Confined Non-Asbestos Fiber





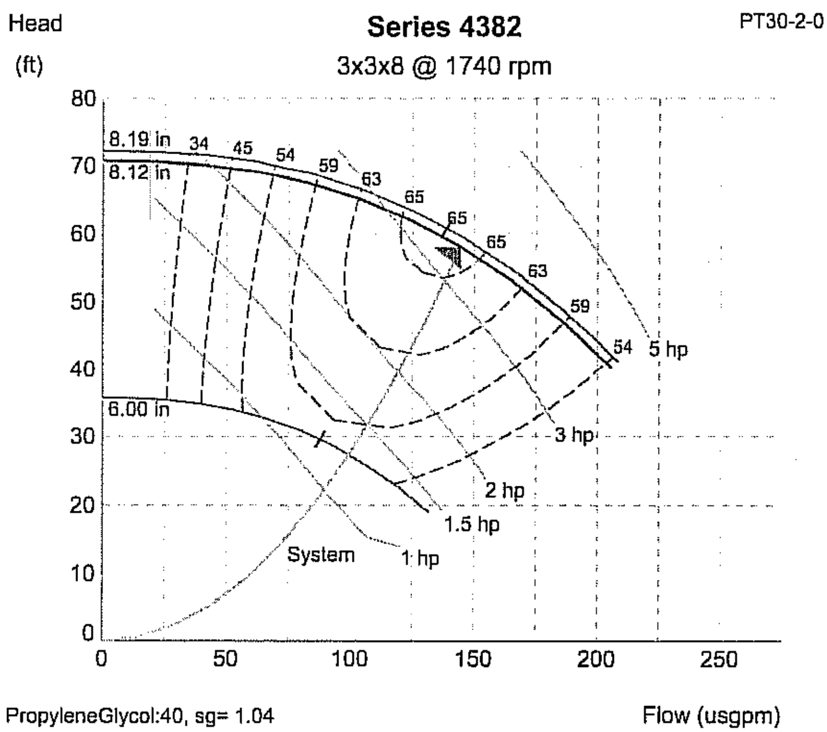
DIMENSIONAL DATA (in, lbs, hp) NOT for CONSTRUCTION

A	B	C	D	P.Wgt	E	F	H or J	M.Wgt	Seal	Im.bore	Wgt.
19.06	7	12.63	5.09	320	8.25	12.13	21.69	220	1.63	1.25	540

6.5a 1/31/2008, 11:46:44, Ed Watson, Multistack, 608-366-2400

ARMSTRONG SUBMITTAL

Series 4382
3x3x8
Close Coupled Vertical Centrifugal dualArm Pump



--- Admin Data ---
Tag Num:
Service:
Location:

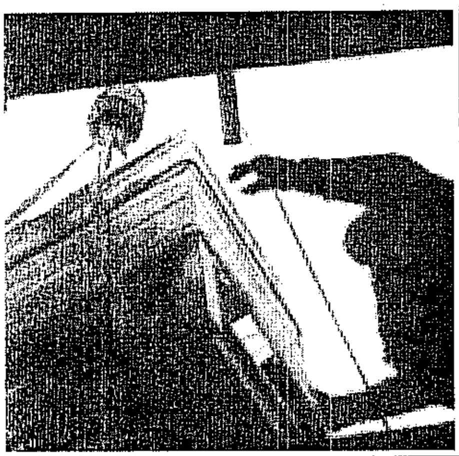
--- Motor Data ---
Motor Size: 7.5 hp
Motor Speed: 1800 rpm

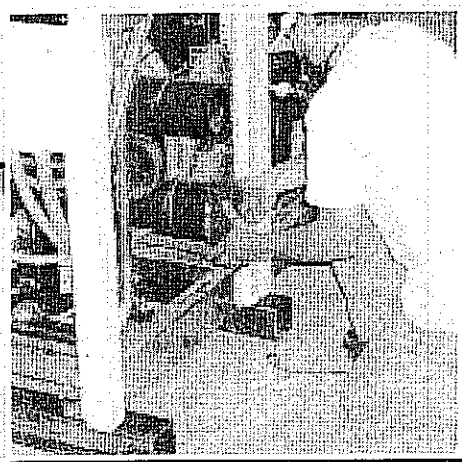
--- Design Duty Point ---
Flow: 144.5 usgpm
Head: 58 ft
Impeller: 8.12 in

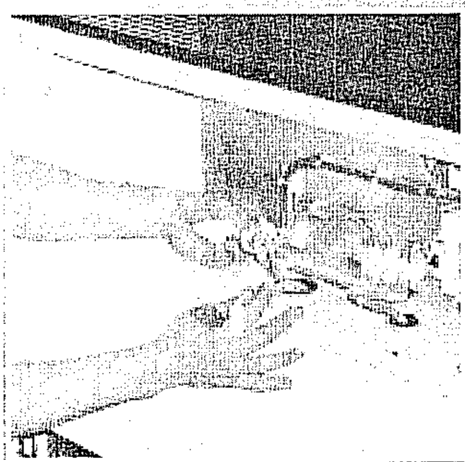
--- Performance Data ---
- NPSHR: 7.707 ft
- Eff. @ Design: 64.29 %
- BHP @ Design: 3.42 hp
- %Mtr Safety: 119.18%
- BEP @ Design Imp.: 64.35 % @ 137.1 usgpm
- BHP @ Runout: 4.14 hp @ 205.6 usgpm
- %max imp. range: 96.79 %

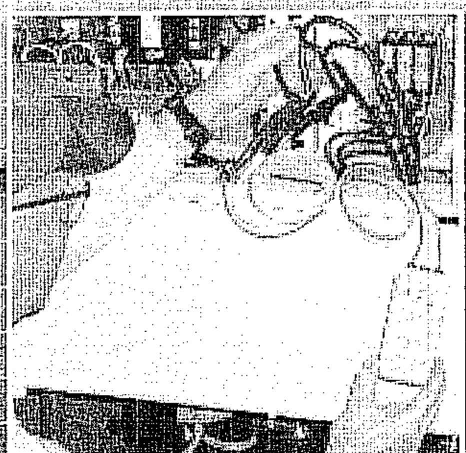
Airstack®

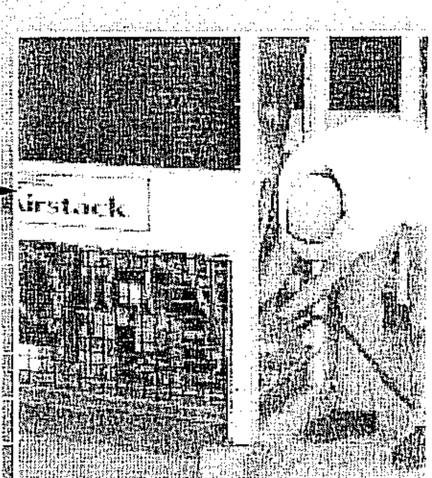
Air Cooled Packaged Chiller







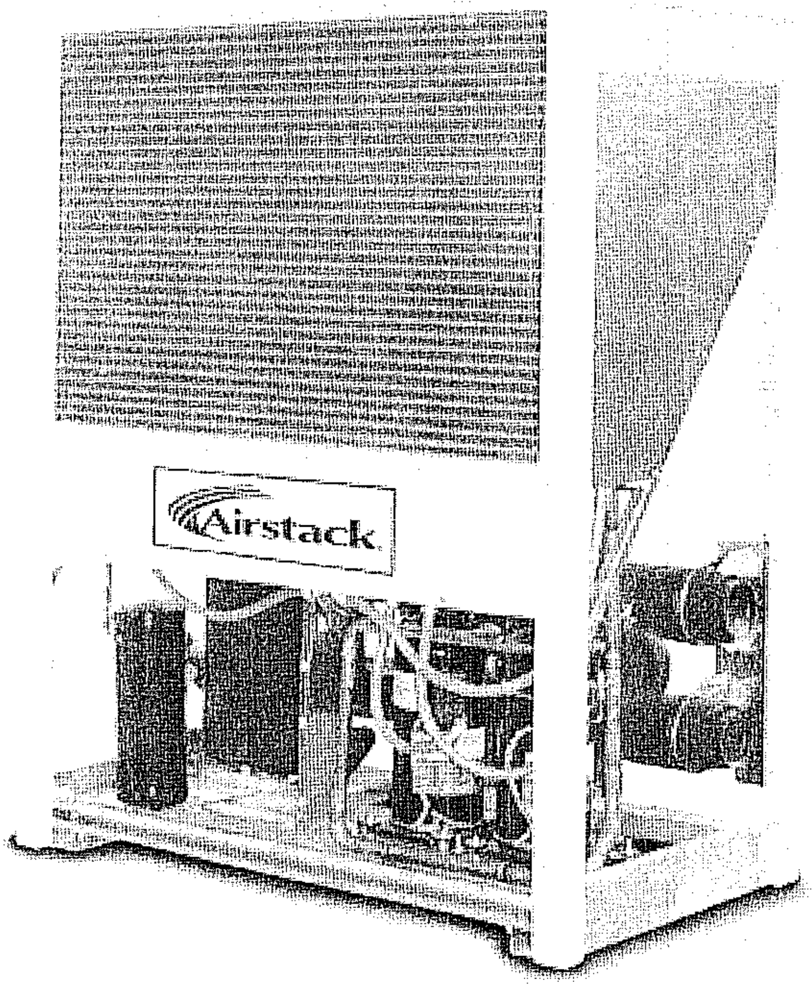




Installation Manual

Air Cooled Chiller

ACPI080805
Rev. 10-16-07
F 22



Introduction

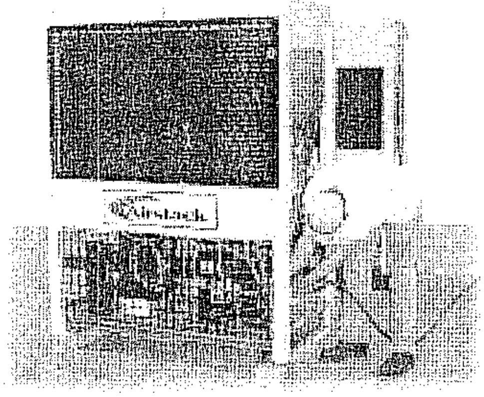
The AIRSTACK "ASP" is a modular air-cooled chiller system with a nominal capacity of 10, 15, 20, and 30 tons per module. The chiller system consists of a Master module (front module with controller), front and rear modules, free cooling module, and a pump module. This system utilizes a fully hermetic scroll compressor, 316 stainless steel brazed plate heat exchanger, 4 or 6 row copper tube, aluminum fin, condenser coils and a microprocessor– based control. Operating capacity is based on the entering chilled liquid temperature. Precise control and system reliability is best served in this fashion.

This manual was created for the express purpose of assisting the owner or installing contractor of the AIRSTACK Packaged Air Cooled Product "ASP".

Please review the material contained in this document carefully before installing and operating this equipment. Additional inquires regarding installation and operation should be directed to AIRSTACK or its authorized agents. Failure to handle, install and operate this equipment in accordance with this manual may result in damage to the equipment and/or personal injury. Failure to comply may void some or all of the AIRSTACK warranty options.

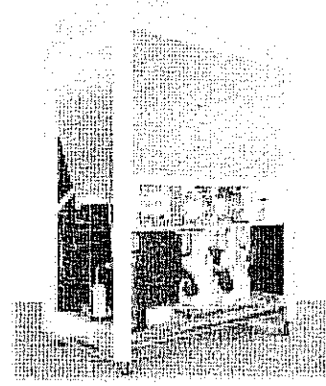
Any questions regarding the content of this Installation Manual, the handling or installation of the AIRSTACK Chiller components, should be directed immediately to your authorized representative or to the **Service Department** at **(608) 366-2400** or **FAX (608) 366-2450**.

Equipment Description



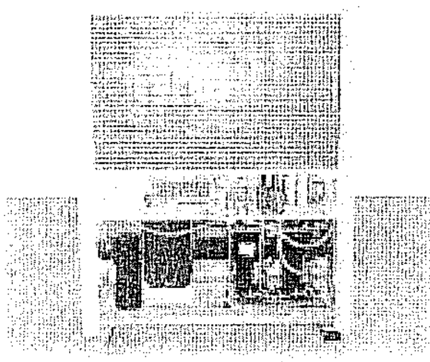
AIRSTACK "ASP"

The chiller will consist of **Modules** (one master, fronts, and backs), with an optional **Free Cooling Module** (no compressors), and an optional **Water Pump Module.**



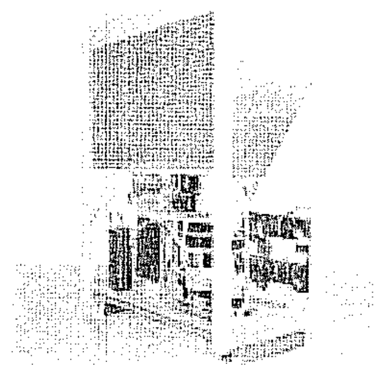
Master Module

The **Master Module** for each chiller is designated at the factory. This module includes the **Microprocessor Display.**



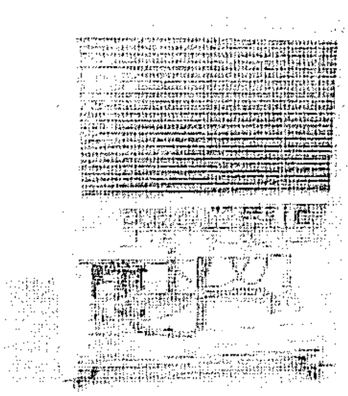
Front Module

Front Modules contain the 4" water header distribution pipes and has a slave control board. This module will bolt together with the **Rear Module. Note:** ASP 30 uses 5" header.



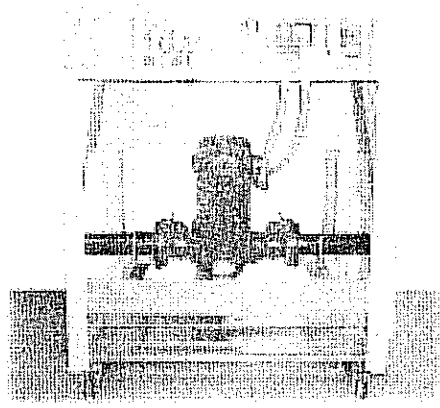
Rear Module

This module will be attached to the **Front Module** by vertical frame bolts and the evaporator is connected by cross over pipes to the Front Modules water header pipes. It also has its own slave board.



Free Cooling Modules

This module has fin and tube coils for free cooling operation and no mechanical refrigeration (no compressors). The module contains a 3-way diverting valve for either enabling free cooling or by-pass for mechanical cooling.



Pump Package Module

This module contains a centrifugal dual-arm pump and water distribution headers. This module is for installations where no pump is provided for the chilled water system or when additional pumping capacity is required.

Important Module Configurations

ASP-00P Pump Module

1. When present, a Pump Module is only allowed in the "Front" position.
2. Incoming water to the chiller system must enter at the Pump Module.
3. Leaving chilled water may be from either end of the chiller.
4. An ASP-10A, 15A, 20A, or 30A Chiller Module may not be attached in the rear module position of a Pump Module.

ASP-00F Free Cool Module

1. When present, incoming system water must enter through the Free Cool Modules prior to entering an ASP-10A, 15A, 20A, or 30A Chiller Module.
2. You may **NOT** attach a Rear ASP-10A, 15A, 20A, or 30A Chiller Module to a Chiller Module.
3. You may **NOT** attach a Rear ASP-10A, 15A, 20A, or 30A Chiller Module to a Front Free Cool Module.
4. Only a Free Cool Module may be attached to the rear of a Pump Module.

ASP-00G Glycol Feeder Module

1. An ASP-00G Glycol Feeder Module may be attached in any rear position.

ASP-10A, 15A, 20A, or 30A Chiller Module

1. Maximum number of ASP-10A, 15A, 20A, or 30A modules with a single Master Module is 10 (i.e. (1) Front Master, (4) Front-Slaves, and (5) Rear-Slaves).
2. You may have more than one Master Module in a single Chiller Bank.
3. Piping sides of an ASP-10A, 15A, 20A, or 30A Chiller without Free Cool or Pump Modules attached are field selectable.
4. Master Module must be on the Front Side of the Chiller.

Valid Configurations

SR	SR	SR	SR	GR
MF	SF	SF	SF	SF

	SR	SR
PF	MF	SF

FR		SR	SR	
PF	FF	MF	SF	SF

SR	GR	SR	SR	SR	
MF	SF	SF	MF	SF	SF

Invalid Configurations

SR	SR	SR	SR	SR	***SR***
MF	SF	SF	SF	SF	

Problem: Too many Slaves on one Master.
Solution: Add an additional Master in place of one of the Slaves.

SR	SR	SR
PF	MF	SF

Problem: Slave cannot be attached to rear of Pump Module.
Solution: Move Slave to front position on opposite end of chiller.

	SR	SR
MF	***PF***	SF

Problem: Pump Module must be on entering waterside of chiller.
Solution: Swap position of Pump with Master Module.

FR	***SR***	SR	SR
PF	FF	MF	SF

Problem: Slave module is attached to the rear of a Free Cool Module.
Solution: Move this Slave to the right of the last Front Slave.

SR	SR	SR
PF	MF	***GF***

Problem: Glycol Feeder Module is attached in a front position.
Solution: Move Glycol Feeder Module to rear position & exchange Slave Rear Module for Slave Front Module.

Contact your local Airstack Representative for other configurations.

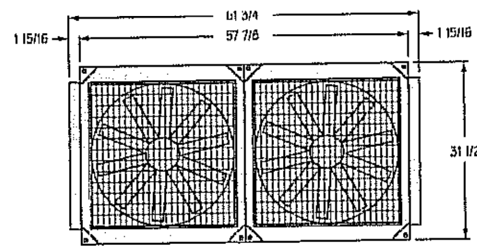
LEGEND: **First Letter**
M = Master Chiller Module (ASP-10A, 15A, 20A, 30A)
S = Slave Chiller Module (ASP-10A, 15A, 20A, 30A)
P = Pump Module (ASP-00P)
F = Free Cool Module (ASP-00F)
G = Glycol Feeder Module (ASP-00G)
Second Letter
F = Front Module
R = Rear Module

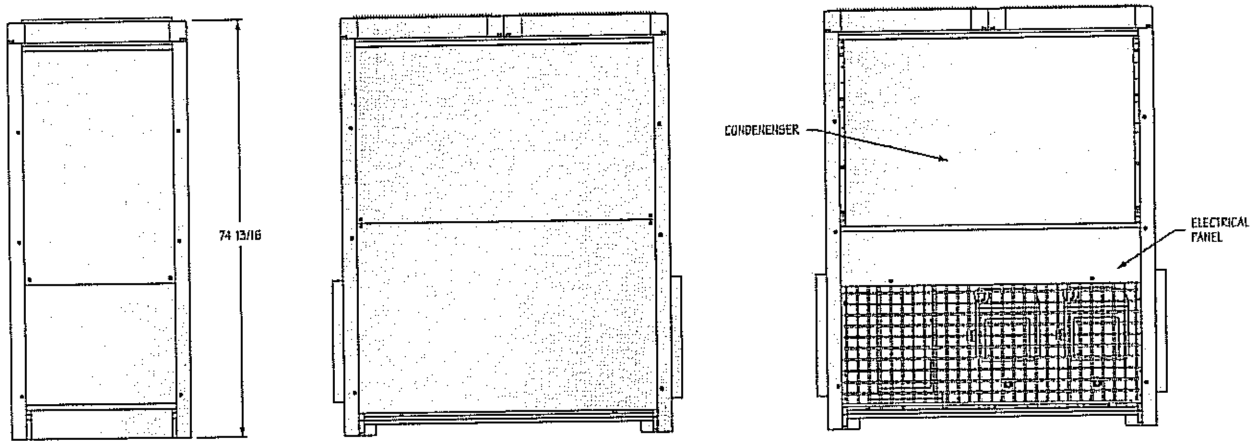
Modules

Single Module *ASP 10, 15, 20*

NOTES:

1. All Modules have same dimensions.
2. No obstructions allowed above Condenser Fans.
3. Required service clearance at Module ends: 36".
4. Required Air Intake clearance: 42".
5. Required clearance from any high voltage panel: 42".

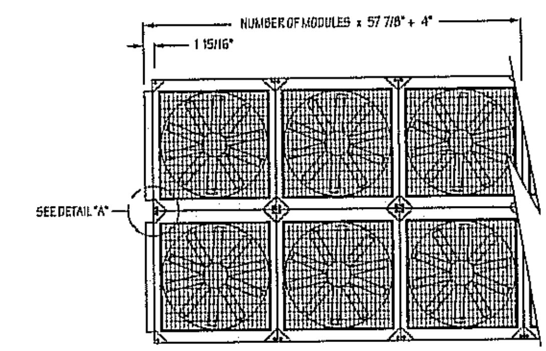


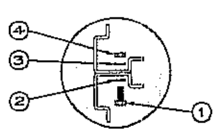


Multiple Modules *ASP 10, 15, 20*

NOTES:

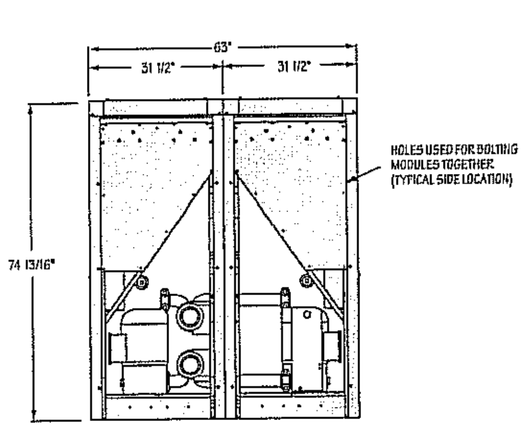
1. Modules are bolted together in field.
2. Hardware quantities are specific to each Chiller (# of modules).
3. All Modules have same dimensions.
4. No Obstructions allowed above condenser fans.
5. Required service clearance at Module ends: 36".
6. Required air intake clearance: 42".
7. Required clearance from any high voltage panel: 42".

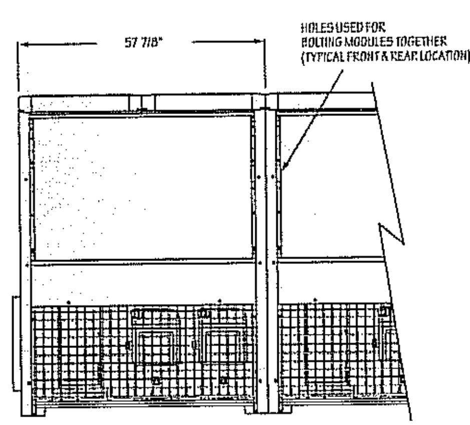




DETAIL "A"

TYPICAL CONNECTION DETAIL



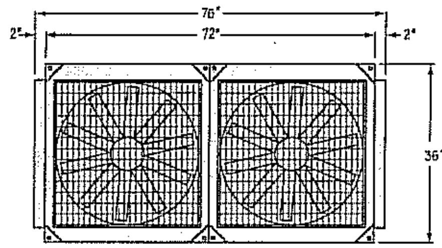


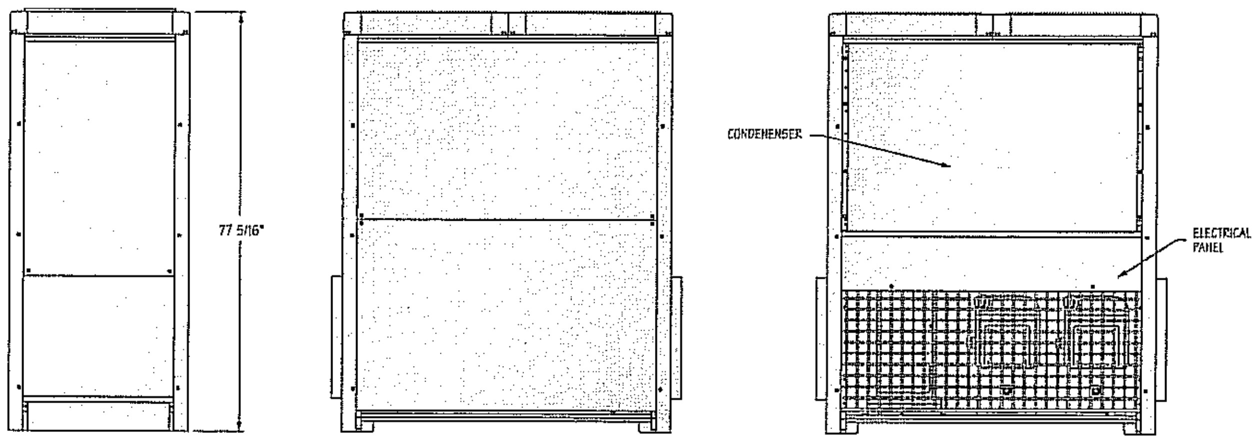
Modules

Single Module ASP 30

NOTES:

1. All Modules have same dimensions.
2. No obstructions allowed above Condenser Fans.
3. Required service clearance at Module ends: 36".
4. Required Air Intake clearance: 42".
5. Required clearance from any high voltage panel: 42".

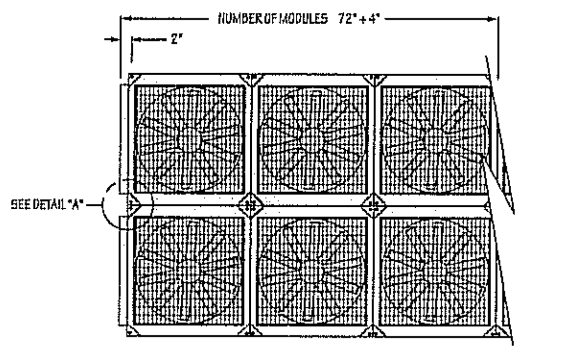


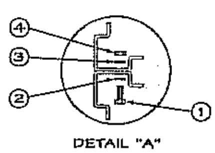


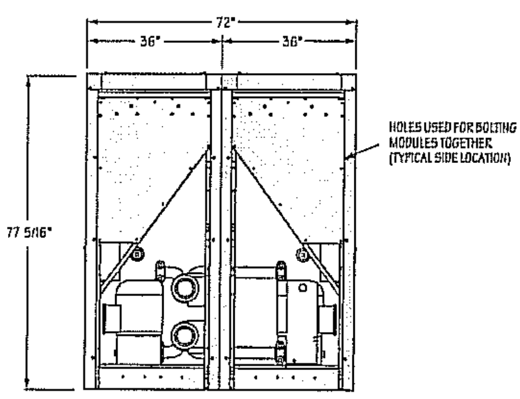
Multiple Modules ASP 30

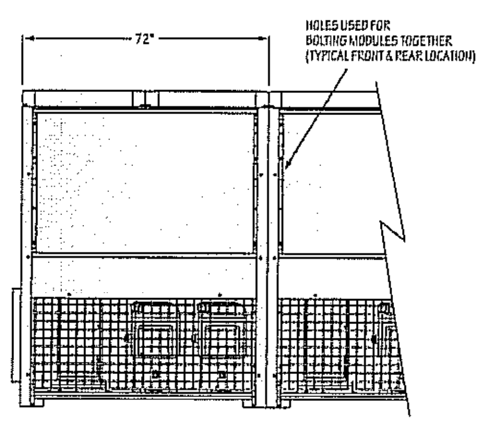
NOTES:

1. Modules are bolted together in field.
2. Hardware quantities are specific to each Chiller (# of modules).
3. All Modules have same dimensions.
4. No Obstructions allowed above condenser fans.
5. Required service clearance at Module ends: 36".
6. Required air intake clearance: 42".
7. Required clearance from any high voltage panel: 42".





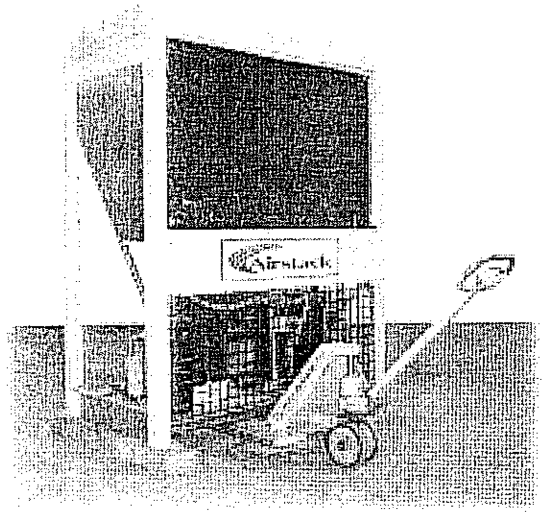




Transportation Claims

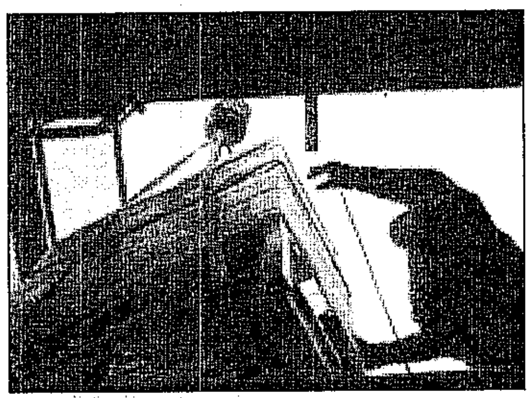
If the AIRSTACK product is damaged in any way during shipping and handling by the transportation company or any of it's agents, the owner, or installing contractor should promptly file a claim with the transportation company and so advise AIRSTACK.

Handling of Modules



Fork Lift or Pallet Jack

The modules can safely be lifted and maneuvered with a forklift or pallet jack. Forks can be positioned under the evaporator and between the tandem compressors.

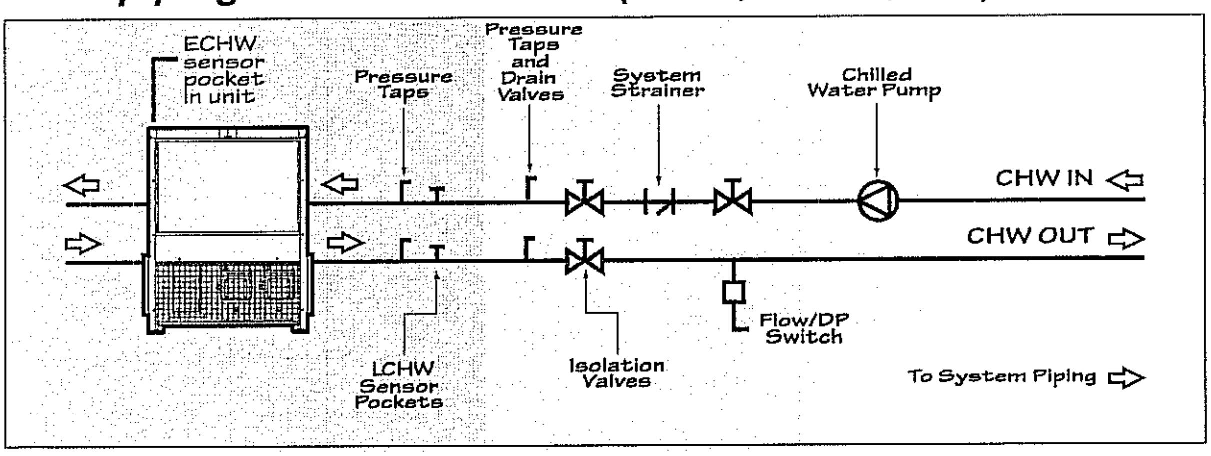


Use of a Crane or Other Lifting Devices

If lifting modules by crane ensure the slings (**do not use chains**) do not damage the modules. The lift points are at the corners of the base of the chiller. The modules are shipped with the panels pre-fitted. The use of a spreader bar will prevent damage.

Site Preparation

CHW piping recommendations (stubs, valves, etc.)



The above components are required to ensure proper performance of the **AIRSTACK "ASP" chiller.** All piping must be properly supported at coupling connections and suitable intervals. It is the responsibility of the installing contractor to ensure all water connections conform to local and national codes. The drawing shows piping exiting on right end. Depending on location of master module, exit can be on either end. Dark shaded area provided with chiller.

Site Preparation

Pipe System Flushing Procedure

Prior to connecting the Airstack chiller to the water/glycol-piping loop, the system piping should be flushed with a detergent and hot water (110-130° F) to remove previously accumulated dirt and/or other organic residue. After removal of organic residue, flushing should continue with a diluted phosphoric, sulfamic, or citric acid mixture if inorganic scale is present in system. (Note: Cleaning chemicals such as Nu-Calgon "Imperial Grade" Scale Remover part number 4360-84 or equivalent suitable for both organic residue and scale removal may be substituted). Any other detergents and acids shall not be combined unless approved by chemical manufacturers. Only chemicals compatible with 316 stainless steel, copper and carbon steel shall be used. (Any concentrations of hydrochloric or sulfuric acid or chloride containing chemicals shall not be allowed to come in contact with copper brazed 316 stainless steel evaporators.)

During the flushing, 30 mesh (max.) Y strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove collected residue. The flushing process shall take no less than 6 hours, or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturers instructions. After flushing, the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been removed.

Prior to supplying water to the Airstack chiller, the Water Treatment Specification shall be consulted for requirements regarding the water quality during chiller operation. The Airstack service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance.

Airstack.

P.O. Box 510
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Sparta, WI 54656

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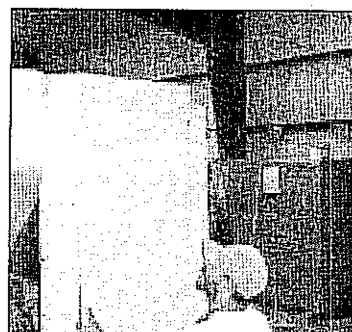
E-mail: info@airstack.com
http://www.airstack.com

Airstack® is manufactured by Multistack®

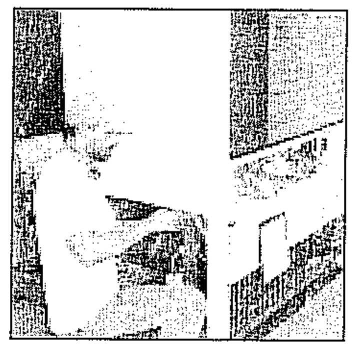
Site Preparation

Clearances

Required Service Clearance At Module Ends ......36"
Required Air Intake Clearance ....42"
Required Clearance From Any
High Voltage Panel ....42"



TOP VIEW



FRONT VIEW

Site Preparation

Water Treatment / Specification

Supply water for the evaporator water circuits shall be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers, using 316 stainless steel brazed plate heat exchangers and carbon steel headers, is maintained within the following parameters:

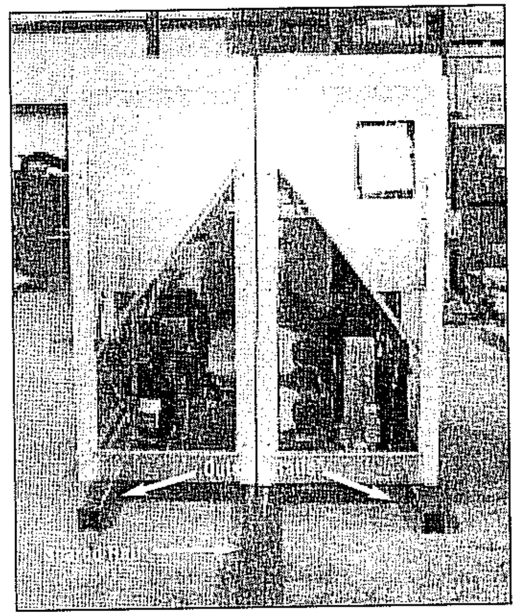
ph	>7 and <9
Total Dissolved Solids (TDS)	Less than 1000 ppm
Hardness as CaCO3	30 to 500 ppm
Alkalinity as CaCO	30 to 500 ppm
Chlorides	Less than 200 ppm
Sulfates	Less than 200 ppm

Installing Single & Multiple Modules

The modules should be mounted on a level surface with steel rails. This will ensure proper alignment of all fittings.

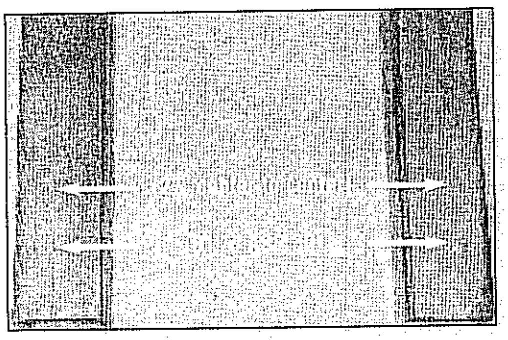
Rails should run parallel with module water flow (headers). For maximum stability *3 rails should be used, 1 rail for each outside edge and 1 rail to be shared in the center.*

The outside rails should be placed flush with outside frame. Internal rail shares half the distance (2") with Rear and Front modules.

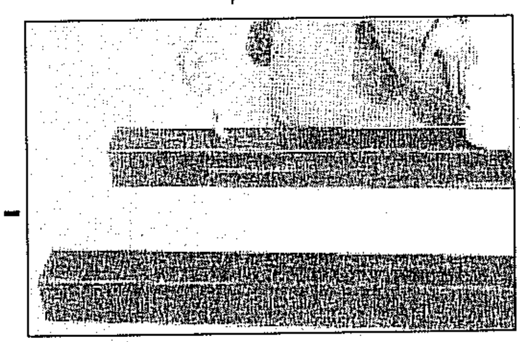


!!! Planning Ahead !!!

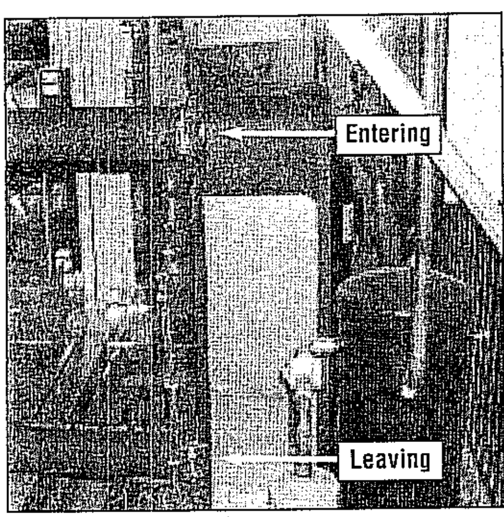
To ensure all warranties and a successful installation, a Factory Authorized Technician is required to perform start-up of the Airstack Chiller. If start-up is to be performed directly by Airstack, a minimum of 2 weeks notice is required. Please call the Airstack Service Department at (608) 366-2400 to schedule.



1. Starting with the master front modules, position on rails (27" center to center).



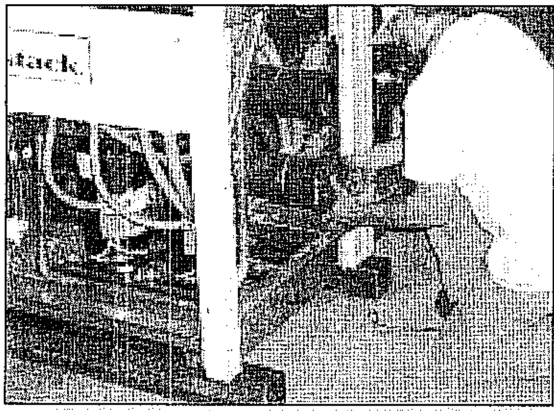
2. Lubricate rails with solid vegetable shortening (Crisco™) or other non-petroleum lubricant.



3. Install the 18-inch long evaporator heat exchanger connecting pipes. Also install the provided CHW sensor into the leaving pipe.

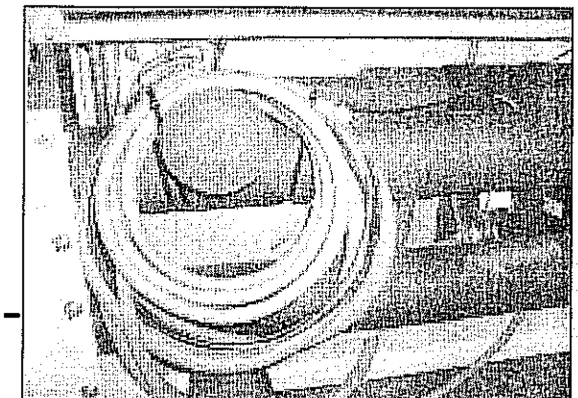
Note: *Consult a qualified seismic expert for seismic restraint information.*

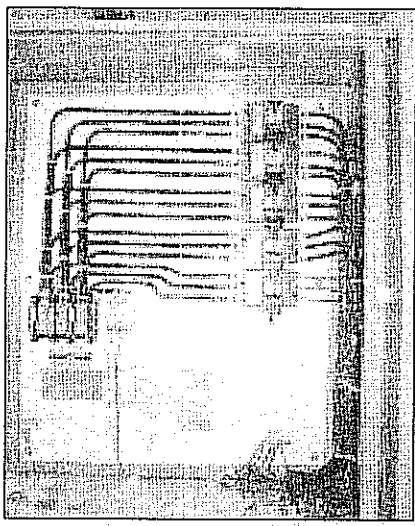
Installing Single and Multiple Modules Continued



4. Lubricate gaskets with a vegetable-based lubricant and hand tighten only. Make sure the bottom connector pipe and the sensor pocket is positioned to accept the sensor for the rear module.

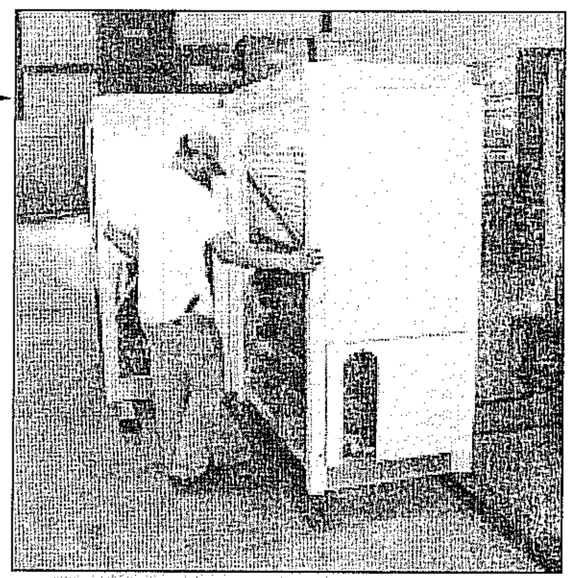
5. Note: If the chiller has a single point power box, the coiled wire and conduit should be run to the power box as the modules are installed.





6. Termination of each module to the power box should be done by the electrician.

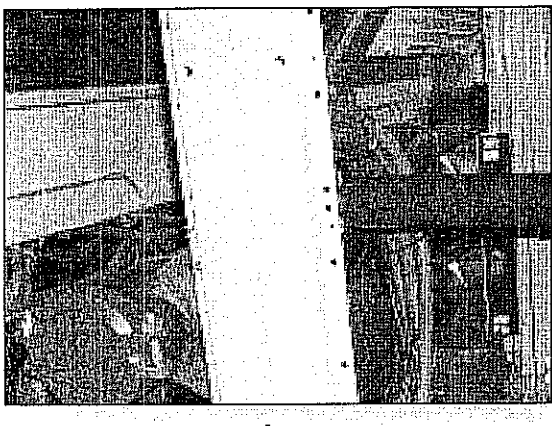
7. Position the rear module on the rails. Align the rear module with the front module.



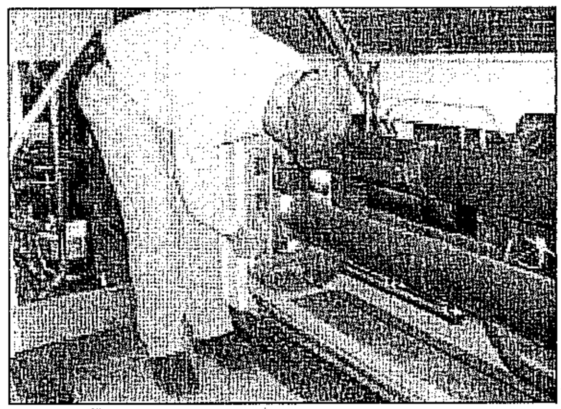
Airstack.

Continue to the next page for step 8 of Airstack module installation.

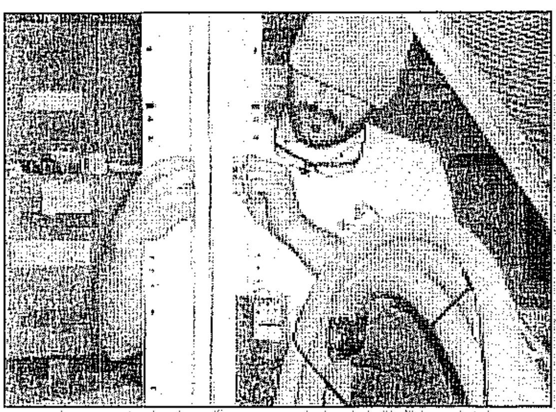
Installing Single and Multiple Modules Continued



8. Fit the connector pipes from the front module to the rear module, lubricate the gasket, and tighten both front and rear couplings at this time. You may need to slide the evaporator mounting plate forward or backward to accomplish this.



9. By loosening the 4 bolts on the plate you can slide the evaporator to the correct distance. If further adjustments are needed, you can loosen the header pipes and front evaporator plate as well.



10. To secure the front and rear modules, align the 3 holes on both ends and install the (6) 3/8" bolts provided.

The Next Step

For installation of subsequent modules, follow the same procedure as discussed previously, always begin with the front module. Before installing further rear modules, align the 4" water header pipes, lubricate and install the gaskets and couplings connecting to the previous modules header pipe. When bolting the second full module to the first full module, align the 3 outer holes on each end and install the 3/8" bolts provided.

Important Module Configurations

ASP-00P Pump Module

1. When present, a Pump Module is only allowed in the "Front" position.
2. Incoming water to the chiller system must enter at the Pump Module.
3. Leaving chilled water may be from either end of the chiller.
4. An ASP-10A, 15A, 20A, or 30A Chiller Module may not be attached in the rear module position of a Pump Module.

ASP-00F Free Cool Module

1. When present, incoming system water must enter through the Free Cool Modules prior to entering an ASP-10A, 15A, 20A, or 30A Chiller Module.
2. You may **NOT** attach a Rear ASP-10A, 15A, 20A, or 30A Chiller Module to a Chiller Module.
3. You may **NOT** attach a Rear ASP-10A, 15A, 20A, or 30A Chiller Module to a Front Free Cool Module.
4. Only a Free Cool Module may be attached to the rear of a Pump Module.

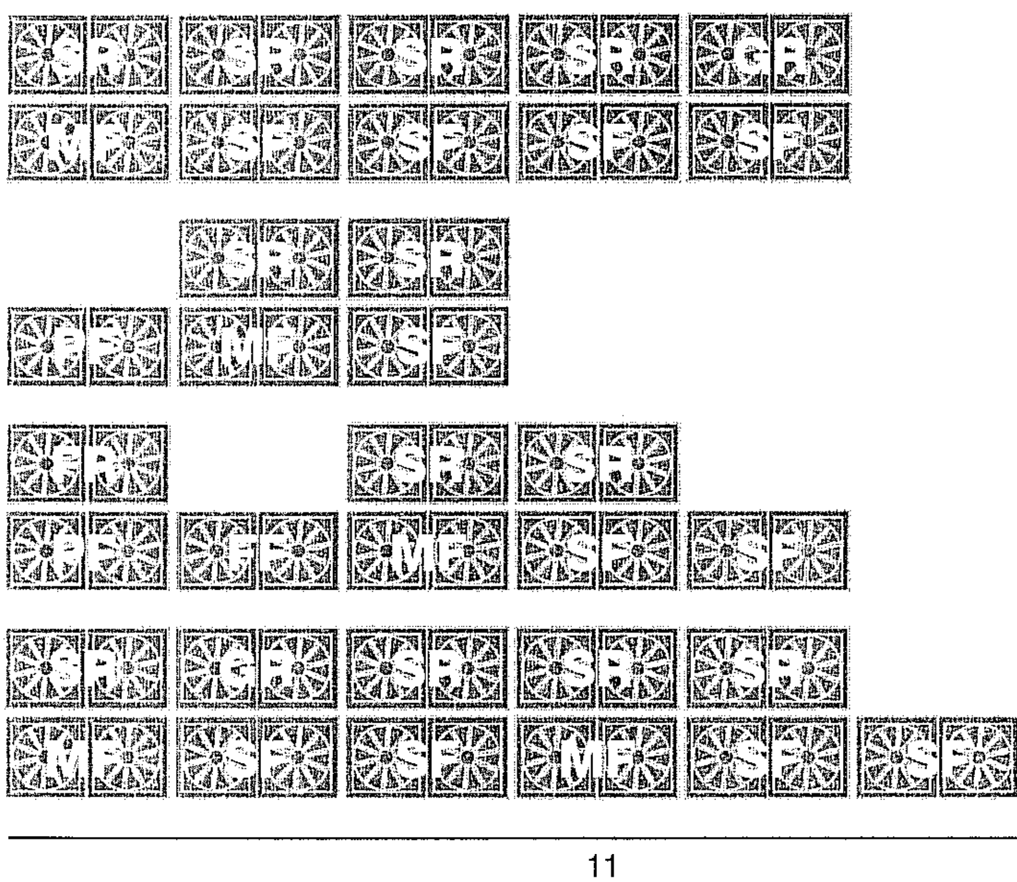
ASP-00G Glycol Feeder Module

1. An ASP-00G Glycol Feeder Module may be attached in any rear position.

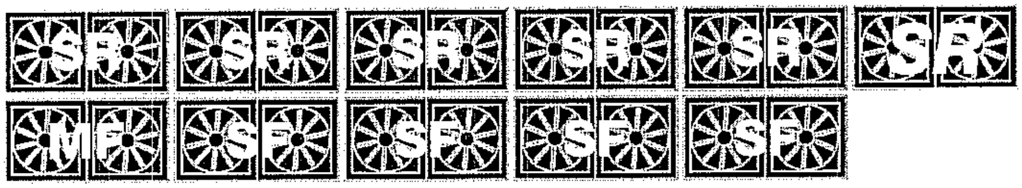
ASP-10A, 15A, 20A, or 30A Chiller Module

1. Maximum number of ASP-10A, 15A, 20A, or 30A modules with a single Master Module is 10 (i.e. (1) Front master, (4) Front-Slaves, and (5) Rear-Slaves).
2. You may have more than one Master Module in a single Chiller Bank.
3. Piping sides of an ASP-10A, 15A, 20A, or 30A Chiller without Free Cool or Pump Modules attached are field selectable.
4. Master Module must be on Front Side of the Chiller.

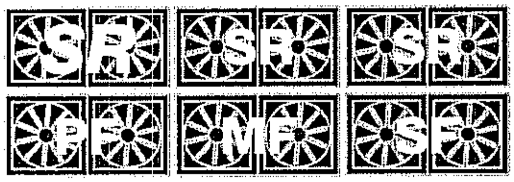
Valid Configurations



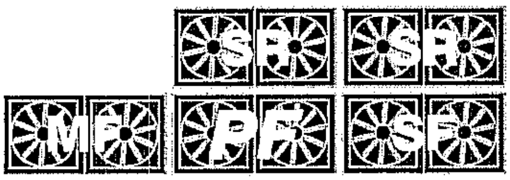
Invalid Configurations



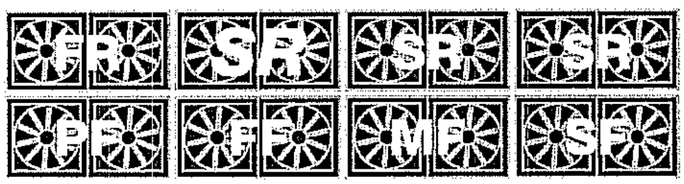
Problem: Too many Slaves on one Master.
Solution: Add an additional Master in place of one of the Slaves.



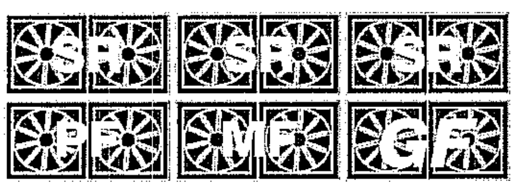
Problem: Slave cannot be attached to rear of Pump Module.
Solution: Move Slave to front position on opposite end of chiller.



Problem: Pump Module must be on entering waterside of chiller.
Solution: Swap position of Pump with Master Module.



Problem: Slave module is attached to the rear of a Free Cool Module.
Solution: Move this Slave to the right of the last Front Slave.



Problem: Glycol Feeder Module is attached in a front position.
Solution: Move Glycol Feeder Module to rear position & exchange Slave Rear Module for Slave Front Module.

Contact your local Airstack Representative for other configurations.

LEGEND

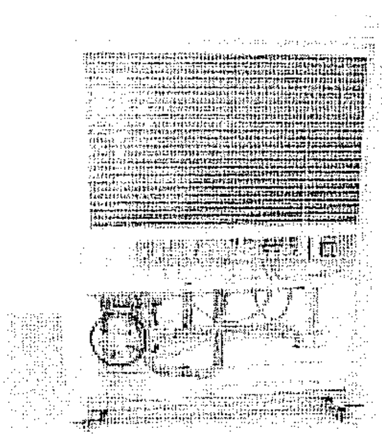
First Letter

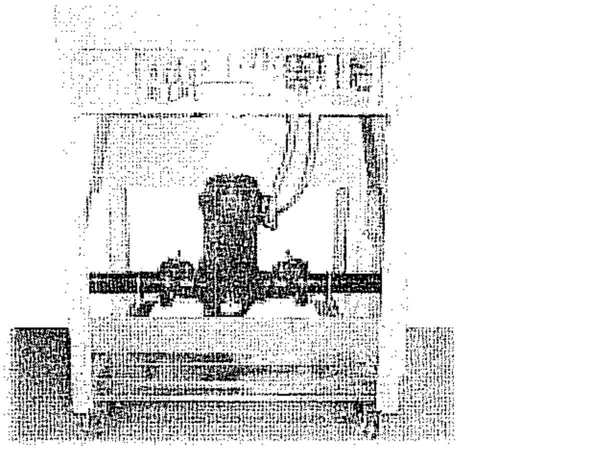
M = Master Chiller Module (ASP-10A, 15A, 20A, 30A)
S = Slave Chiller Module (ASP-10A, 15A, 20A, 30A)
P = Pump Module (ASP-00P)
F = Free Cool Module (ASP-00F)
G = Glycol Feeder Module (ASP-00G)

Second Letter

F = Front Module
R = Rear Module

Installation of Free Cool and Pump Module





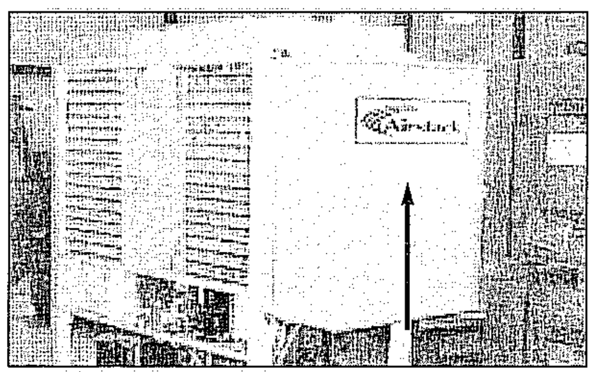
Venting Air from Free Cool Modules

1. Depress the red manual override button on the 3-way diverting valve and turn the manual adjustment wheel until the valve is closed all the way to the right, diverting the fluid through the coil.
2. Looking at the diverting valve, remove the left side fan grill in order to access the ¼" Schrader air bleeds on the piping at the coil.

Free cooling and pump modules must be installed at either end of the chiller bank. These modules are not to go in-between or to separate mechanical modules. These modules are to be installed in the same manner as the standard mechanical modules.

Main Power

Locate the power distribution box on the specified end of the chiller. Wire and conduit will need to be run from the distribution box to the front module of each chiller. The wire and conduit may be pre-sized and fabricated at the factory.



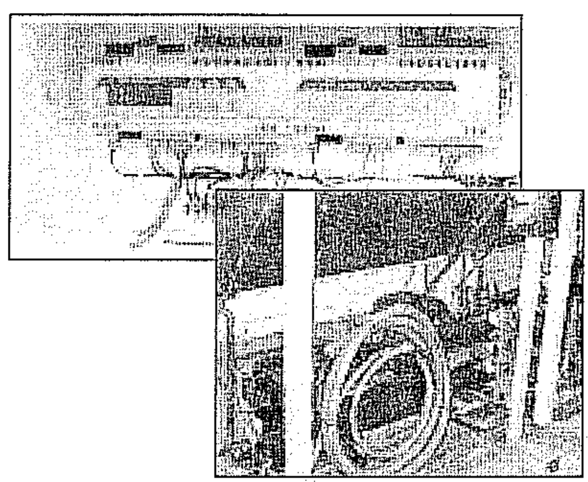
Power Distribution Box

Field Wiring

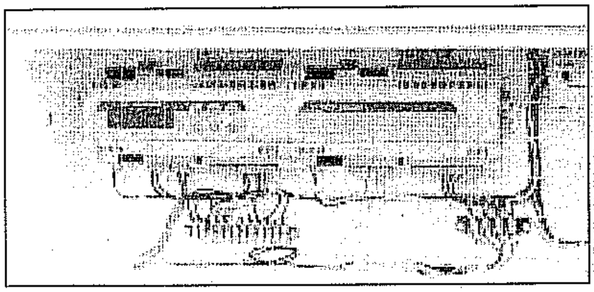
It is the responsibility of the contractor to supply and install a flow switch in the LCHW piping.

The master module of the ASP chiller has inputs for the following options: remote start/stop, run status, system alarm, 4-20ma input, and remote communication. Supply and return CHW sensors, module communication plugs, and communication interface cables are all provided with the chiller.

The sensors and cables will be installed and tested by the Factory Authorized Start-Up Technician. (See electrical diagrams for locations of all inputs/outputs.)

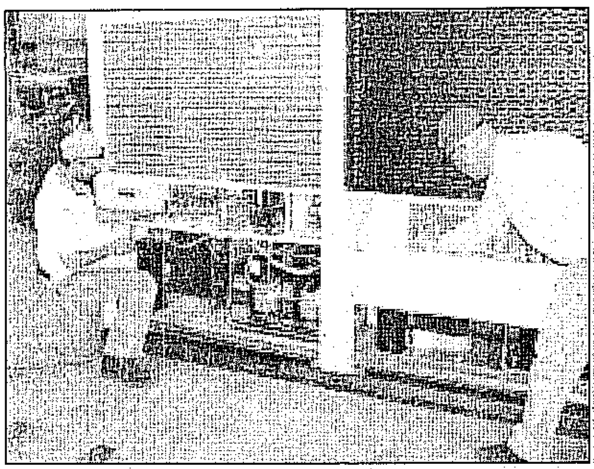


Electronic Components



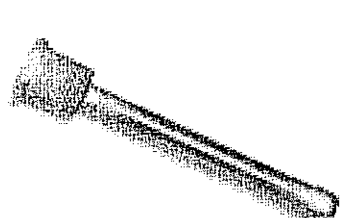
Microprocessor Display

This is the computer controller that is installed on the master module and controls all connected modules.



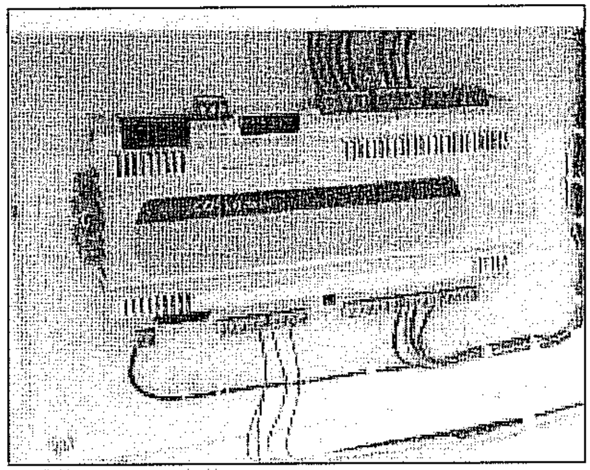
Communication

All modules are linked together through a communication cable. The communication port is J11 on the module slave board.



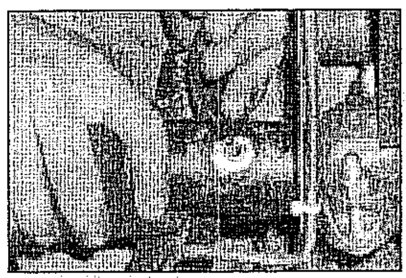
Sensor Well

The factory supplied LCHW system sensor well should be installed near the master module. Sensor well is 1/2" pipe thread.



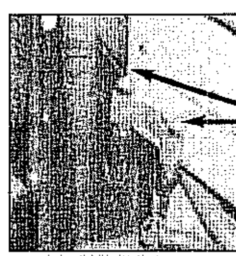
Module Slave Board

Each front and rear module has one of these. This board transfers communication from one module to the next.



Chilled Water Temperature Sensors

These sensors are factory supplied and field installed on the supply and return chilled water header stubs.



Compressor Pressure Transducers

These are factory installed on the suction and discharge lines of each refrigeration circuit to monitor the suction and discharge pressures.

Airstack

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Phone: (608) 366-2400, Fax #: (608) 366-2450
E-mail: info@airstack.com
http://www.airstack.com

"ASP" START-UP DATA LOG

1. System Variables set: **Upper Setpoint** _____ **(45°)** **Lower Setpoint** _____ **(10°)**
   Set Time & Date __________ T Diff__________
2. System Amps running at **A** _____ **B** _____ **C** _____
   System Capacity at: _____ .%
3. Verify all sensors reading properly? **YES** **NO**
4. ☐Sequencing ☐Odd/Even ☐ Modular ____________________

   Miscellaneous Observations:
   Pressure drop across chiller: **PSI IN** _____ **PSI Out** _____

	Compressor Amps							
	A.	B.	C.	ECHW	LCHW	Suct.T	Dis. P	Suc. P
Module 1								
Module 2								
Module 3								
Module 4								
Module 5								
Module 6								
Module 7								
Module 8								
Module 9								
Module 10								
Module 11								
Module 12								

Note: **HP** cut out is **350 psig** (manual reset) **Fan 1** cut in **225 psig**, cut out 150 psig
LP cut out is **15 psig** (auto cut in at 30 psig) **Fan 2** cut in **275 psig**, cut out 190 psig

COMPLETE FOLLOWING FOR FREE COOLED MODULES ONLY

Changeover Point set at	_____ °F	(default = 45°F)
Setpoint set at	_____ °F	(default = 50°F)
Displacement set at	_____	(default = 5.0)
Low Temp Cut out set at	_____ °F	(default = 36°F)
T Diff	_____	(default = 50)
Num Mods	_____	(default = 000)

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ASP INSTALLATION CHECKLIST AND REQUEST FOR AUTHORIZED START-UP ENGINEER

CUSTOMER: ______________________________

JOB NAME: ______________________________

JOB LOCATION: ______________________________

CUSTOMER ORDER NO.: ______________________________

The work as checked below is in process and will be completed by: Date ____________________. The service of a Airstack Authorized Start-up Engineer is requested on this date and it is understood that if the work checked below is not completed, the engineer's time and expenses will be billed to us by Airstack. Terms Net 30 days. *Airstack to be notified at least ten (10) working days in advance of the start-up date.*

	Yes	No	Not Applicable
CHILLED WATER			
Piping complete and connected to Airstack Units.	☐	☐	☐
Water system filled and vented.	☐	☐	☐
Pumps installed (Rotation checked).	☐	☐	☐
Recommended strainers installed.	☐	☐	☐
Controls (3-way valves & by-pass valves, etc.) operable.	☐	☐	☐
Water system operated and flow balanced to meet unit design requirements.	☐	☐	☐
Strainers checked for unusual debris.	☐	☐	☐
Flow or differential pressure switch installed.	☐	☐	☐
ELECTRICAL			
Power wiring complete and in accordance with nameplate rating on unit and prepared for connection in accordance with installation manual.	☐	☐	☐
NOTE: No power is to be applied to unit prior to inspection by authorized engineer.			
All interlock wiring complete between control panel and complies with Airstack specifications and with applicable codes.	☐	☐	☐
MISCELLANEOUS			
Chiller sensor wells, gauges, controls installed	☐	☐	☐
A minimum system load of 50% of total building load is available for testing and adjusting controls.	☐	☐	☐

We understood that authorized representatives of the installing electrical and piping contractor must be available during the start-up period and that coordination is our responsibility.

We further understand that the services of an Authorized Start-up Engineer will be furnished for a period of not more than sixteen (16) consecutive normal working hours and we agree that a charge for time and expenses will be made by Airstack if services are required for longer than sixteen (16) consecutive normal working hours or if repeat calls are required through no fault of Airstack.

Signed

______________________________ Title

______________________________ Company Telephone

______________________________ Company Name

______________________________ Job Location Telephone

______________________________ Company Location

Airstack
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"ASP" START-UP DATA LOG

START-UP DATE: ______________________ SHIP DATE: ______________

JOB NAME: ______________________ JOB NUMBER: ______________

ADDRESS: ______________________

AIRSTACK REPRESENTATIVE: ______________________

MODEL NUMBER: ______________________

★★★MODULE SERIAL NUMBERS ★★★

(Indicate Master Module with an **X**, Indicate **FC** if Free Cool Module, Indicate **P** if Pump Module)

1. ______________ (front) ______________ (rear)
2. ______________ (front) ______________ (rear)
3. ______________ (front) ______________ (rear)
4. ______________ (front) ______________ (rear)
5. ______________ (front) ______________ (rear)
6. ______________ (front) ______________ (rear)

INSTALLATION CHECKLIST

CIRCLE CORRECT RESPONSE

1. Chiller mounted on rails or suitable surface?	YES	NO
2. Any visible damage?	YES	NO
3. Any apparent oil and/or refrigerant leaks?	YES	NO
4. Sensor pockets installed?	YES	NO
5. Chilled water flow or DP switch installed? Type ____	YES	NO
6. Chilled water system strainer installed? Mesh ____	YES	NO
7. Chilled water isolation valves installed?	YES	NO

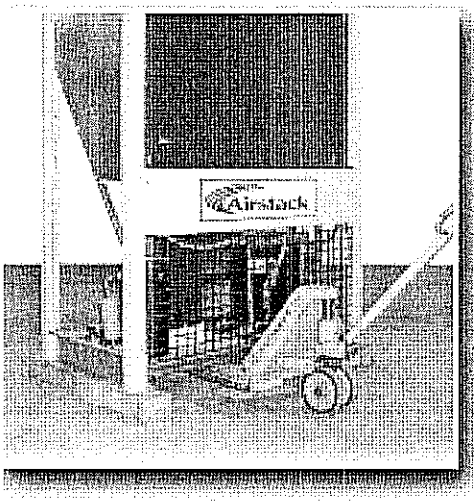
ELECTRICAL AND CONTROLS CHECKLIST

1. All electrical connections tight and correct?	YES	NO
2. Power wiring sufficient to carry F.L.A.?	YES	NO

3. Voltage levels:
   PHASES 1 + 2 ____ 1 + 3 ____ 2 + 3 ____ 1 + G ____ 2 + G ____ 3 + G ____

______________________ ______________________

Start-Up Service Technician **Owner or Contractor Acceptance**



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http://www.airstack.com

Airstack® is manufactured by Multistack®

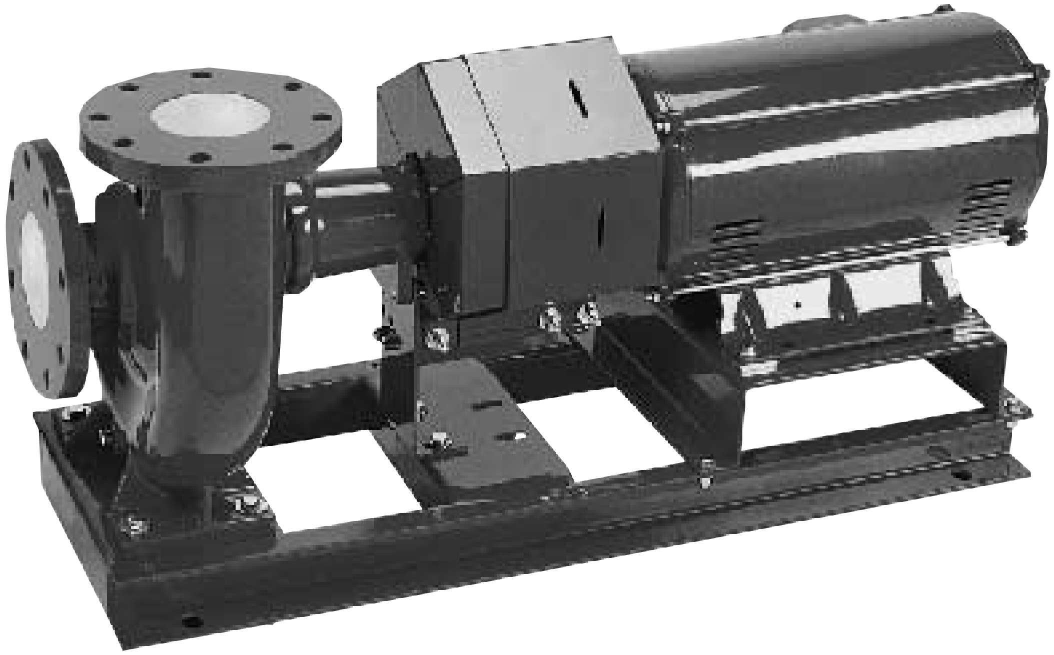
Contact: Your local **AIRSTACK** Air Cooled Packaged Chiller representative for additional information or assistance.

Bell & Gossett

INSTRUCTION MANUAL

P81673

REVISION F



Series 1510 and 1510/Universal Centrifugal Pumps

Installation, Operation and Service Instructions

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

Bell & Gossett

ITT Industries

Engineered for life

DESCRIPTION

The Series 1510 centrifugal pump is a frame mounted pump which features – high efficiency, rugged construction, foot mounted volute with back pullout bearing frame, center drop out coupler and regreasable bearings. These features make installation, operation and service easy to perform.

PUMP APPLICATION

The standard Series 1510 centrifugal pump's bronze fitted construction make it ideal for service with following liquids: unheated domestic and fresh water, boiler feed water, condensate, hydronic cooling or heating, pressure boosting, general pumping and benign liquids.

For other applications contact your local B&G Representative.

OPERATION LIMITS

Unless special provisions have been made for your pump by Bell & Gossett, the operational limits for Series 1510 Pumps are as follows:

Maximum Working Pressure
Listed on pump nameplate.

SEAL OPERATING LIMITS

Standard Seals
BUNA-PH Limitations 7-9; Temperature Range -40 to +225°F
EPTH-PH Limitations 7-11; Temperature Range -40 to + 250°F
For use on closed or open systems which are relatively free of dirt and/or other abrasive particles.

Flushed Single Seals
PH Limitations 7-9; Temperature Range 0 to +250°F†
NOTE: On closed or open low pressure systems that contain a high concentration of abrasives an external flush is required.

Flushed Double Seals
PH Limitations 7-9; Temperature Range 0 to +250°F
NOTE: On closed or open low pressure systems that contain a high concentration of abrasives an external flush is required.

Packing
PH Limitations 7-9; Temperature Range 0 to +200°F
For use on open or closed systems which require a large amount of makeup water, as well as systems which are subjected to widely varying chemical conditions and solids buildup.

† For operating temperatures above 250°F a cooled flush is required and is recommended for temperatures above 225°F for optimum seal life. On closed systems cooling is accomplished by inserting a small heat exchanger in the flush line to cool the seal flushing fluid.

Flush-line Filters and Sediment Separators are available on special request.

SAFETY INSTRUCTIONS

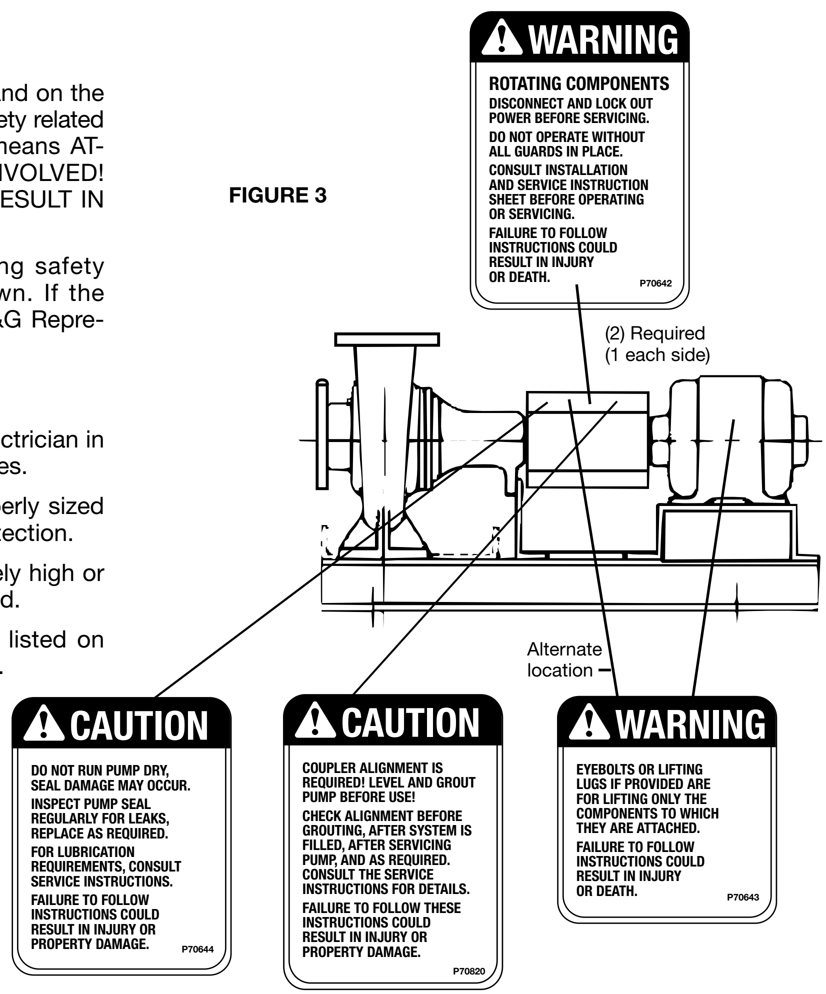
This safety alert symbol will be used in this manual and on the pump Safety Instruction decal to draw attention to safety related instructions. When used, the safety alert symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED! FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN A SAFETY HAZARD.

Your Series 1510 Pump should have the following safety instruction decals located approximately as shown. If the decals are missing or illegible contact your local B&G Representative for a replacement.

Additional Safety Requirements:

1. Electrical connections to be made by qualified Electrician in accordance with all National, State and Local codes.
2. Motor must have properly sized starter with properly sized heaters to provide overload and undervoltage protection.
3. If pump, motor or piping are operating at extremely high or low temperatures, guarding or insulation is required.
4. The maximum working pressure of the pump is listed on the pump nameplate, do not exceed this pressure.

FIGURE 3



ADDITIONAL SAFETY REQUIREMENTS:

ELECTRICAL SAFETY:

WARNING: Electrical Shock Hazard
Electrical connections to be made by a qualified electrician in accordance with all applicable codes, ordinances, and good practices. Failure to follow these instructions could result in serious personal injury or death, or property damage.

WARNING: Electrical Overload Hazard
Three phase motors must have properly sized heaters to provide overload and undervoltage protection. Single phase motors have built-in overload protectors. Failure to follow these instructions could result in serious personal injury or death, or property damage.

THERMAL SAFETY:

WARNING: Extreme Temperature Hazard
If pump, motor, or piping are operating at extremely high or low temperatures, guarding or insulation is required. Failure to follow these instructions could result in serious personal injury or death, or property damage.

MECHANICAL SAFETY:

WARNING: Unexpected Startup Hazard
Disconnect and lockout power before servicing. Failure to follow these instructions could result in serious personal injury or death, or property damage.

WARNING: Excessive System Pressure Hazard
The maximum working pressure of the pump is listed on the nameplate, do not exceed this pressure. Failure to follow these instructions could result in serious personal injury or death, or property damage.

WARNING: Excessive Pressure Hazard
Volumetric Expansion
The heating of water and other fluids causes volumetric expansion. The associated forces may cause failure of system components and release of high temperature fluids. This will be prevented by installing properly sized and located compression tanks and pressure relief valves. Failure to follow these instructions could result in serious personal injury or death, or property damage.

PUMP LOCATION

Locate the pump so there is sufficient room for inspection, maintenance and service. If the use of a hoist or tackle is needed, allow ample head room.

WARNING: FALLING OBJECT HAZARD
Eyebolts or lifting lugs if provided are for lifting only the components to which they are attached. Failure to follow these instructions could result in serious personal injury or death, or property damage.

If lifting of the entire pump is required, do so with slings placed under the base rails as shown.

The best pump location for sound and vibration absorption is on a concrete floor with subsoil underneath. If the pump location is overhead, special precautions should be undertaken to reduce possible sound transmission, consult a sound specialist.

If the pump is not on a closed system, it should be placed as near as possible to the source of the liquid supply, and located to permit installation with the fewest number of bends or elbows in the suction pipe.

The installation must be evaluated to determine that the Net Positive Suction Head Available (NPSHA) meets or exceeds the Net Positive Suction Head Required (NPSHR), as stated by the pump performance curve.

IMPORTANT

Do not install and operate Bell & Gossett Pumps, 3D Valves, Suction Diffusers, etc., in closed systems unless the system is constructed with properly sized safety devices and control devices. Such devices include the use of properly sized and located pressure relief valves, compression tanks, pressure controls, temperature controls, and flow controls as appropriate. If the system does not include these devices, consult the responsible engineer or architect before making pumps operational.

FIGURE 4

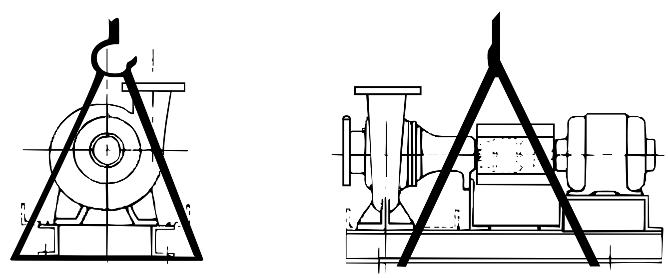
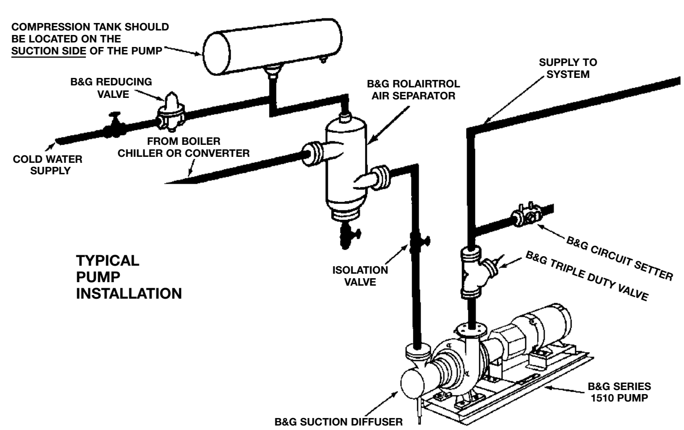


FIGURE 5



INSTALLATION

This pump is built to provide years of service if installed properly and attached to a suitable foundation. A base of concrete weighing 2½ times the weight of the pump is recommended. (Check the shipping ticket for pump weight.)

If possible, tie the concrete pad in with the finished floor. Use foundation bolts and larger pipe-sleeves to give room for final bolt location. (See Figure 6A.)

FIGURE 6A

INSTALLATION OF FOUNDATION BOLTS

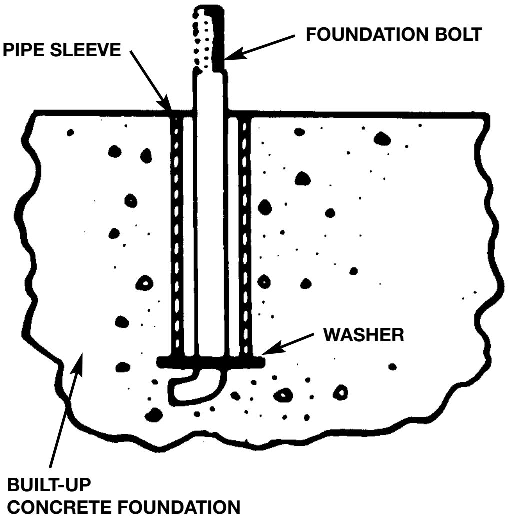
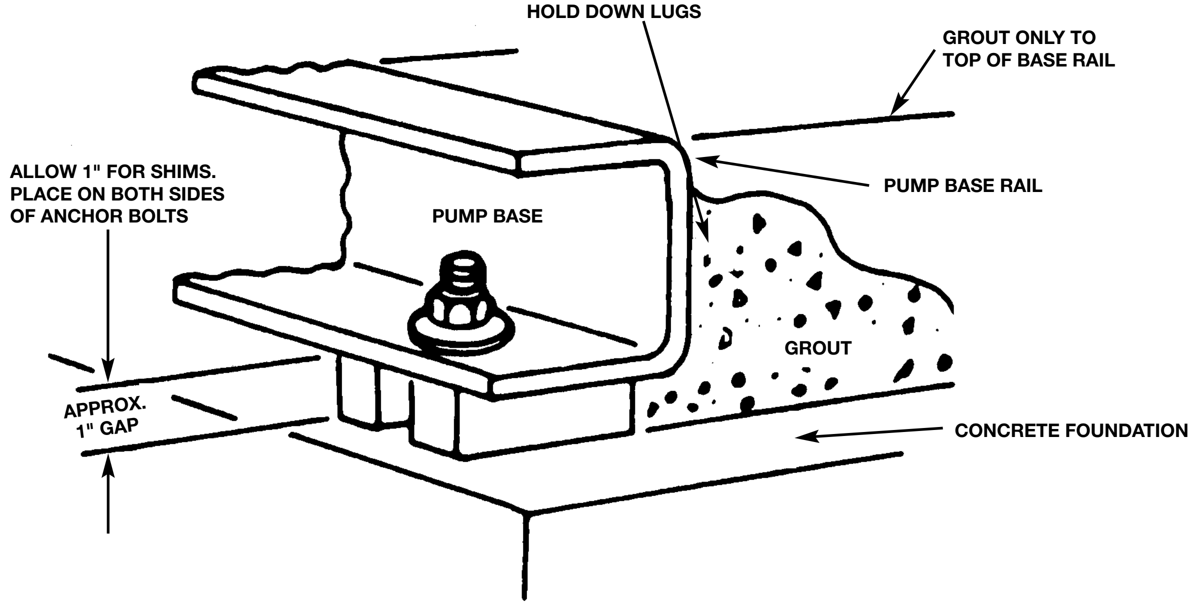


FIGURE 6B **LEVELING OF PUMP BASE ON CONCRETE FOUNDATION**



LEVELING

Place the pump on its concrete foundation supporting it with steel wedges or shims totaling 1" in thickness. These wedges or shims should be put on both sides of each anchor-bolt to provide a means of leveling the base. (See Figure 6B.)

IT IS VERY IMPORTANT THAT THE PUMP-BASE BE SET LEVEL TO AVOID ANY MECHANICAL DIFFICULTIES WITH THE MOTOR OR PUMP. THIS PUMP WAS PROPERLY ALIGNED (IF FURNISHED WITH A MOTOR) AT THE FACTORY. HOWEVER, SINCE ALL PUMP BASES ARE FLEXIBLE THEY MAY SPRING AND TWIST DURING SHIPMENT. DON'T PIPE THE PUMP UNTIL IT IS REALIGNED. AFTER PIPING IS COMPLETED AND AFTER THE PUMP IS GROUTED-IN AND BOLTED-DOWN, ALIGN IT AGAIN. IT MAY BE NECESSARY TO RE-ADJUST THE ALIGNMENT FROM TIME TO TIME WHILE THE UNIT AND FOUNDATION ARE NEW.

GROUTING

After the pump has been leveled, securely bolted to the floor, and properly aligned, a good grade of non-shrinking grout should be poured inside the pump base. To hold wedges or shims in place, allow the grout to flow around them. (See Figure 6B).

ROTATION

Pump rotation is clockwise when viewed from back of the motor. An arrow is also located on the pump to show the direction of rotation.

COUPLER ALIGNMENT

All alignment should be done by moving or shimming the motor only. Adjustments in one direction may alter alignment in another. Therefore, check alignment in all directions after a correction is made. **Black rubber sleeves have different horsepower load ratings then orange Hytrel sleeves, they should not be interchanged.**

> **WARNING: UNEXPECTED STARTUP HAZARD**
> Disconnect and lockout power before servicing. Failure to follow these instructions could result in serious personal injury or death, or property damage.

Standard Sleeve Type Coupler with Black Rubber Sleeve

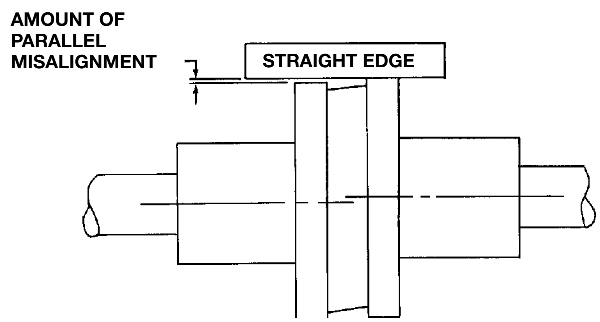
Before aligning the coupler, make sure there is at least 1/8" end clearance between the sleeve and the two coupler halves.

1. Check angular misalignment using a micrometer or caliper. Measure from the outside face of one flange to the outside face of the opposite flange at four points 90° apart. Refer to figure 7B. DO NOT ROTATE COUPLER. Misalignment up to 1/64" per inch of coupler radius is permissible.
2. At four points 90° apart (DO NOT ROTATE COUPLER), measure the parallel coupler misalignment by laying a straight edge across one coupler half and measuring the gap between the straight edge and opposite coupler half. Up to a 1/64" gap is permissible. Refer to figure 7A.

For Fine Alignment, Orange Hytrel Sleeves,
3500 RPM Operation, or All Other Coupler Types

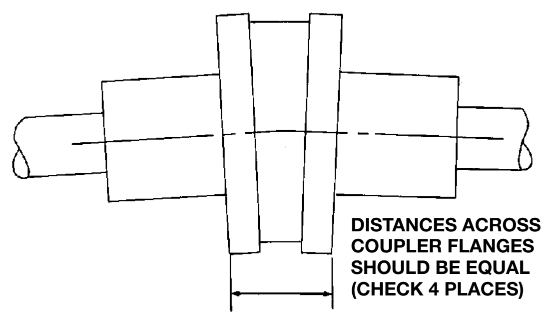
Use a dial indicator when greater alignment accuracy is required. Use the following alignment tolerances unless specified otherwise by the coupler manufacturer. On sleeve type couplers make sure there is at least 1/8" end clearance between the sleeve and the two coupler halves.

1. To check angular misalignment, mount the dial indicator base to one coupler half, or shaft, and position the dial indicator button on the front or rear face of the opposite coupler half. Set the dial to zero. Rotate both coupler halves **together**, making sure the indicator button always indicates off the same spot. Misalignment values within 0.004" TIR per inch of coupler radius are permissible.
2. To check parallel misalignment, mount the dial indicator base to one coupler half, or shaft, and position the dial indicator button on the outside diameter of the opposite coupler half. Set the dial to zero. Rotate both coupler halves **together**, making sure the indicator button always indicates off the same spot. Misalignment within 0.004" TIR is permissible.



PARALLEL ALIGNMENT CHECK

FIGURE 7A



ANGULAR ALIGNMENT CHECK

FIGURE 7B

> **WARNING: ROTATING COMPONENT HAZARD**
> Do not operate pump without all guards in place. Failure to follow these instructions could result in serious personal injury or death, or property damage.

PIPING

Always install a section of straight pipe between the suction side of the pump and first elbow or install a B&G Suction Diffuser. This reduces turbulence of the suction by straightening out the flow of liquid before it enters the pump. The length should be equal to five times the diameter of the pipe.

Be sure to eliminate any pipe-strain on the pump. Support the suction and discharge pipes independently by use of pipe hangers near the pump. Line up the piping so that the bolt-holes in the pump flanges match the bolt-holes in the pipe flanges. DO NOT ATTEMPT TO SPRING THE SUCTION OR DISCHARGE LINES INTO POSITION. Coupling and bearing wear will result if suction or discharge lines are forced into position. The code for Pressure Piping (A.S.A.B. 31.1) lists many types of supports available for various applications.

As a rule, ordinary wire or band hangers are not adequate to maintain alignment. It is very important to provide a strong, rigid support for the suction and discharge lines.

Where considerable temperature changes are anticipated, fittings for absorbing expansion should be installed in the system in such a way as to avoid strain on the pump.

On an open-system with a suction-lift, use a foot-valve of equal or greater area than the pump suction piping. Prevent clogging by using a strainer at the suction inlet next to the foot-valve. The strainer should have an area three times that of the suction pipe with a mesh hole diameter of no less than 1/4".

When using an isolation base, flexible piping should be used on both the suction and discharge sides of the pump.

A Triple Duty Valve, such as the one manufactured by Bell & Gossett, installed in the discharge line will serve as a check valve to protect the pump from water hammer, as an isolation valve for servicing and for throttling.

NOTES:

1. The pipeline should have isolation valves around the pump and have a drain valve in the suction pipe.
2. When installing the suction and discharge connections to a threaded pump housing the use of teflon tape sealer or a high quality thread sealant is recommended.

PUMP INSULATION

When insulating a Series 1510 pump, ensure that the bearing assembly grease fittings remain accessible and visible. The vent slots on the sides and bottom of the bearing assembly should remain uncovered and completely open.

LUBRICATION

While pump is running regrease pump bearing with NLGI Grade #2 lithium base petroleum grease after every 2500 hours of operation or every 6 months whichever occurs first.

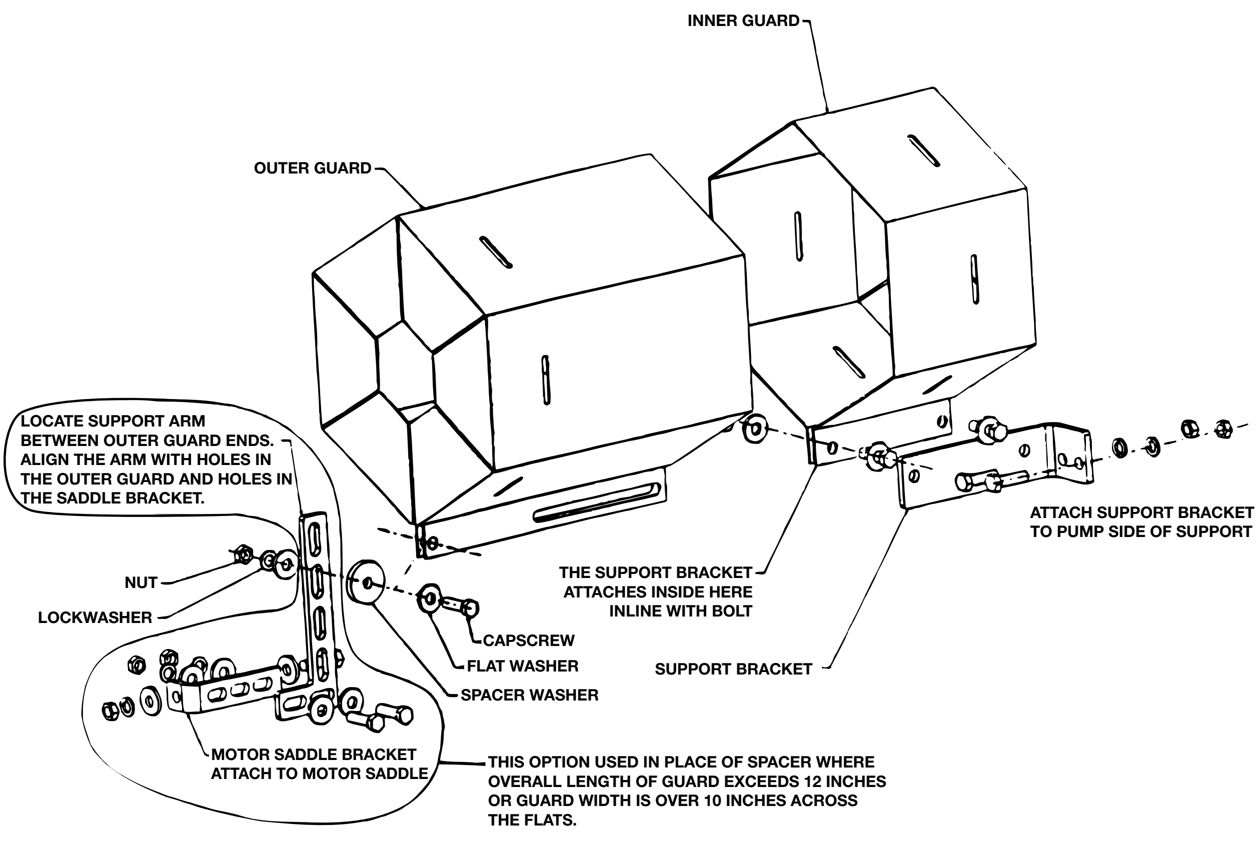
Lubricate motor per motor manufacturer's instructions.

GENERAL INSTRUCTIONS

1. Keep this pump and motor properly lubricated.
2. When there is a danger of freezing, drain the pump.
3. Inspect pump regularly for leaky seals or gaskets and loose or damaged components. Replace or repair as required.

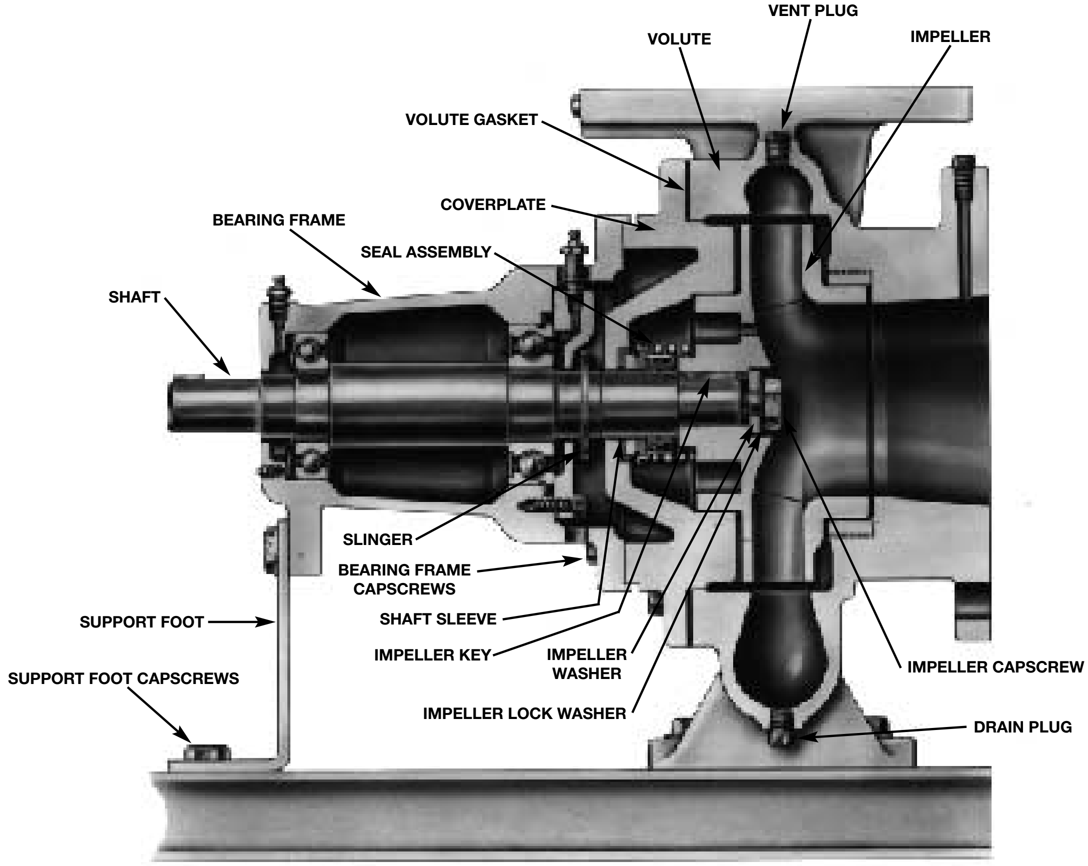
HEX GUARD EXPLODED VIEW FOR TYPICAL INSTALLATION

FIGURE 8



STANDARD MECHANICAL SEAL CONSTRUCTION

FIGURE 9



STUFFING BOX CONSTRUCTION

FIGURE 10

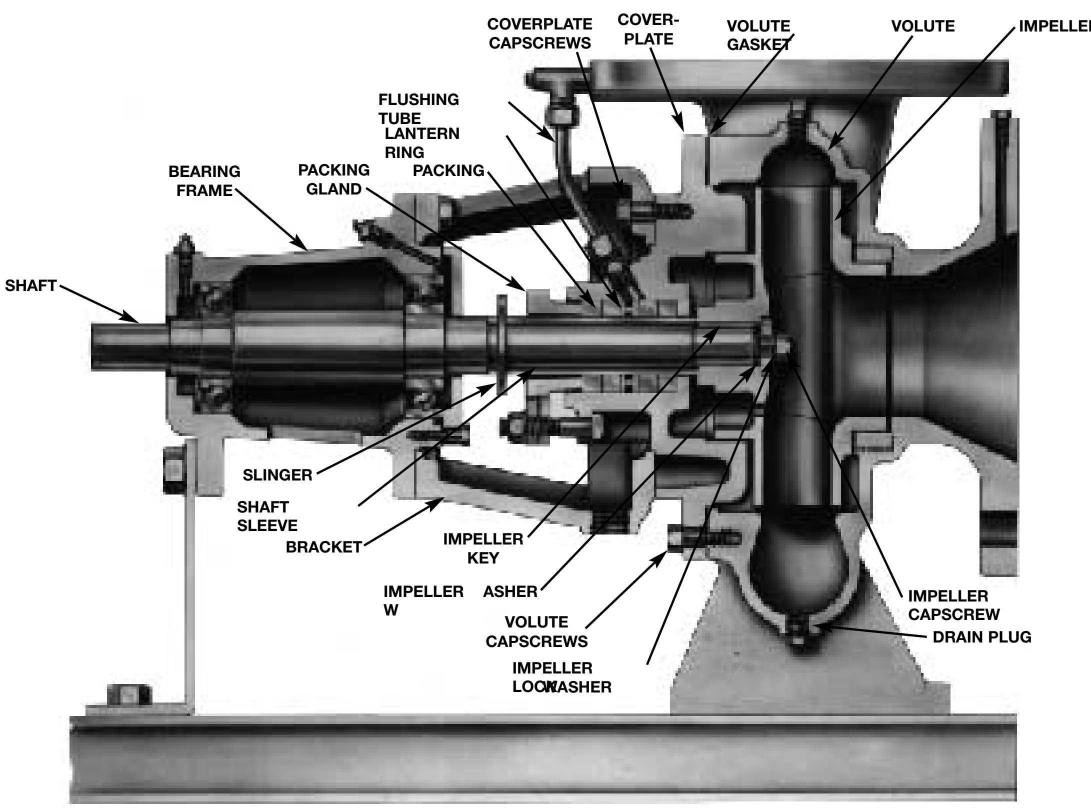


FIGURE 11
1510-S

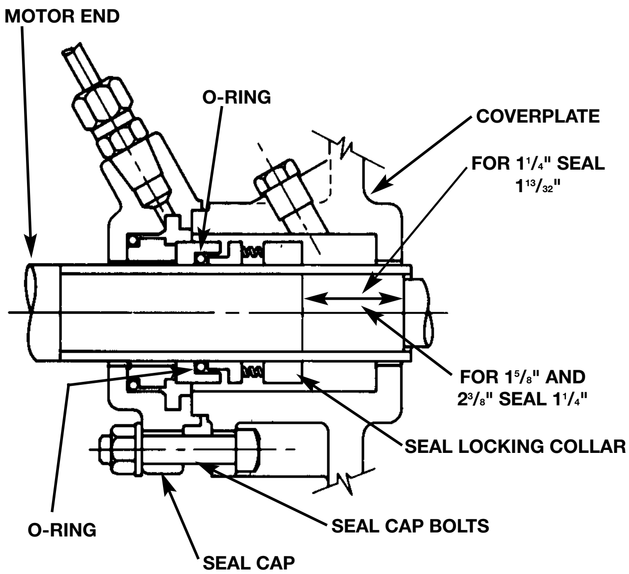
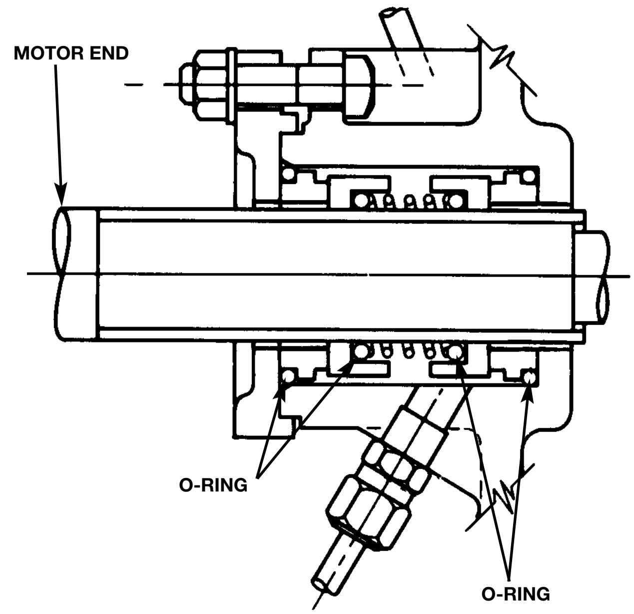


FIGURE 12
1510-D



SERVICE INSTRUCTIONS

> **WARNING: UNEXPECTED STARTUP HAZARD**
> Disconnect and lock out power before servicing. Failure to follow these instructions could result in serious personal injury or death, or property damage.

1. Close valves on suction and discharge sides of pump. (If no valves have been installed, it will be necessary to drain the system.)

> **CAUTION: EXTREME TEMPERATURE HAZARD**
> Allow pump temperature to reach acceptable levels before proceeding. Open drain valve, do not proceed until liquid stops coming out of drain valve. If liquid does not stop flowing from drain valve, isolation valves are not sealing and should be repaired before proceeding. After liquid stops flowing from the drain valve, leave valve open and continue. Remove the drain plug located on the bottom of the pump housing. Do not reinstall plug or close drain valve until re-assembly is completed. Failure to follow these instructions could result in property damage and/or moderate personal injury.

2. Remove the Hex Coupler Guard as follows (see figure 8):
   a. Remove the two cap screws that hold the outer (motor side) coupler guard to the support bracket(s).
   b. Spread the outer guard and pull it off the inner guard. **NOTE:** Do not spread the inner and outer guards more than necessary for guard removal. Over spreading the guards may alter their fit and appearance.
   c. Remove the cap screw that holds the inner guard to the support bracket.
   d. Spread the inner guard and pull it over the coupler.
3. Loosen set screws in both coupler halves and slide each half back as far as possible on its shaft. Remove coupler sleeve. Where a full diameter impeller is used, it may be necessary to remove the pump side coupler half and to slide the motor back on its base in order to gain sufficient clearance to remove the pump assembly from the volute.
4. Remove support foot capscrews. Loosen volute capscrews, do not remove them. Use capscrews in the jack screw holes (Not on 8G). Loosen the pump assembly from the volute.

> **WARNING: EXCESSIVE PRESSURE HAZARD**
> Make certain internal pressure of the pump is relieved before continuing. Failure to follow these instructions could result in serious personal injury or death, or property damage.

Remove seal flushing tube, if used.

Remove the volute capscrews and remove the pump assembly from the volute.

Continue to the section which pertains to your pump type.

1510 and 1510-F
With Standard Mechanical Seal – Figure 9

5. Remove the impeller capscrew, lock washer and washer. Remove the impeller.
6. Remove the rotating portion of the seal, use a screwdriver to loosen the rubber ring.
7. Remove the seal insert along with the insert gasket and retainer (if used).
8. Thoroughly clean the shaft sleeve and the coverplate seal cavity. Inspect for surface damage like pitting, corrosion, nicks or scratches. Replace if necessary.

9. Lubricate the shaft sleeve and coverplate seal cavity with soapy water (do not use petroleum lubricant). Install a new insert gasket and a new seal insert with indentation side down into the cup.
10. Slide a new rotating seal assembly onto the shaft sleeve. With a screwdriver push on the top of the compression ring until the seal is tight against the seal insert. Install seal spring, with narrow end toward seal.
11. Install impeller, impeller washer, lock washer and capscrew. Tighten capscrew per torque chart (See Table 1).
12. Install new volute gasket then install pump assembly into volute. Tighten volute capscrews per torque chart (See Table 1). Install seal flushing tube, if used. Install support foot capscrews and tighten per torque chart (See Table 1). Install coupler and align. Install drain plug, close drain valve.
13. Install the Hex Coupler Guard as follows:
    a. Spread the inner guard and place it over the coupler. **NOTE:** Do not spread the inner and outer guards more than necessary for guard installation. Over spreading the guards may alter their fit and appearance.
    b. With the inner guard straddling the support bracket, install a cap screw through the hole in the support bracket and guard located closest to the pump. Do not tighten the capscrew.
    c. Spread the outer guard and place it over the inner guard.
    d. Install the outer guard cap screws by following the step stated below which pertains to your particular pump:
        I) *For pumps with a motor saddle support bracket:* Ensure the outer guard is straddling the support arm, and install but do not tighten the two remaining cap screws.
        II) *For pumps without a motor saddle support bracket:* Insert the spacer washer between the holes located closest to the motor in the outer guard, and install but do not tighten the two remaining cap screws.
    e. Position the outer guard so it is centered around the shaft, and so there is less than a $^1/_4$" of shaft exposed.
    f. Holding the guard in this position, tighten the three cap screws.
14. Open isolation valves, inspect pump for leaks, if not leaking return pump to service.

1510-S Stuffing Box
With Special Single Mechanical Seal – Figure 10 and 11

5. Remove the impeller capscrew, lock washer and washer. Remove the impeller.
6. Remove hex nuts from seal cap bolts and remove coverplate capscrews. Remove coverplate from bracket.
7. Remove seal assembly. Thoroughly clean and inspect seal sleeve and seal cap, replace if required.
8. Lubricate shaft sleeve and seal cap with soapy water (do not use petroleum lubricant). Insert stationary seal with O-ring into the seal cap and slide onto the shaft. Replace the seal cap gasket. Slide rotating portion of the seal assembly onto shaft sleeve and lock in place. For $1^1/_4$" I.D. seals, the collar should be $1^{13}/_{32}$" from the impeller end of the shaft sleeve. For $1^5/_8$" and $2^3/_8$" I.D. seals, the distance should be $1^1/_4$". (See Figure 11).
9. Assemble coverplate to bracket, tighten capscrews per torque chart (See Table 1). Assemble seal cap to coverplate, tighten hex nuts on seal cap bolts per torque chart (See Table 1).
10. Go to Step 11 of 1510 Standard Mechanical Seal Instructions.

1510-D Stuffing Box
With Special Double Mechanical Seal – Figure 10 and 12

5. Remove the impeller capscrew, lock washer and washer. Remove the impeller.
6. Remove hex nuts from seal cap bolts and remove coverplate capscrews. Remove coverplate from bracket.
7. Remove seal assembly. Thoroughly clean and inspect shaft sleeve, seal cap, and coverplate seal cavity, replace if required.
8. Lubricate shaft sleeve, seal cap and coverplate cavity with soapy water (do not use petroleum lubricant). Insert one stationary seal and O-ring into seal cap and the other into the coverplate.* Slide the seal cap onto the shaft. Replace seal cap gasket.* Slide rotating portion of seal assembly onto shaft sleeve.
9. Assemble coverplate to bracket, tighten capscrews per torque chart (See Table 1). Assemble seal cap to coverplate, tighten hex nuts on seal cap bolts per torque chart (See Table 1).
10. Go to Step 11 of 1510 Standard Mechanical Seal Instructions.

*For $1^1/_4$" I.D. Seal both parts will be housed in the coverplate as shown in Figure 12. Seal cap gasket is not used.

1510-8G
With Standard Mechanical Seal – Figure 13

5. Remove the impeller nut and washer. Remove the impeller and impeller key.
6. Remove spacer sleeve and two nuts holding the gland to the stuffing box.
7. Pull the coverplate off the bearing frame assembly. Remove the seal, sleeve and gland.
8. Thoroughly clean the shaft, shaft sleeve and the coverplate seal cavity. Inspect for surface damage like pitting, corrosion, nicks or scratches.
9. Apply Dow Corning Silicone Rubber #732 or equal to the shaft at sleeve location. Slide the shaft sleeve onto the shaft and spin sleeve to distribute sealant. Wipe off excess.
10. Slide the seal gland (flat side towards the stuffing box) on the shaft.
11. Lubricate the outer surface of the shaft sleeve, interior of the stuffing box and seal elastomer with soapy water (do not use petroleum lubricant). Install the stationary element and rotating assembly of the mechanical seal on the shaft sleeve; being certain that the two wearing surfaces face each other and rotating half of the seal is installed closest to the impeller end.
12. Install the seal spring and spring retainer onto the shaft sleeve. Slide the coverplate onto the bearing frame.
13. Install spacer sleeve (over the shaft sleeve), impeller key, impeller, washer and impeller nut, then tighten impeller nut to 25-30 ft-lbs. Install and tighten the gland nuts evenly against the stuffing box.

14. Inspect volute "O" ring for damage, replace if necessary. Install "O" ring around coverplate seat. Slide the bearing frame / coverplate assembly into the volute (coverplate flush tube fitting must be to top). Install volute capscrews and gradually tighten with a star pattern (prevents impeller rub) to 25-30 ft-lbs. Install drain plug. Close drain valve.
15. Go to step 13 of 1510 Standard Mechanical Seal Instructions.

1510-PF Stuffing Box
With Packing – Figure 10

5. Remove the impeller capscrew, lock washer and washer. Remove the impeller and impeller key.
6. Remove hex nuts from packing gland and remove coverplate capscrews. Remove coverplate from bracket.
7. Remove packing rings from the stuffing box.
8. Check condition of shaft sleeve and replace if scored or otherwise damaged.
9. Insert two packing rings in the stuffing box followed by the lantern ring and then the remaining two pieces of packing. Make certain that the packing joints are staggered 90 degrees.
10. Install, but do not tighten the packing gland.
11. Install coverplate over the pump shaft, tighten capscrews per torque chart (See Table 1).
12. Tighten packing gland to compress packing, read note on packed pump operation.
13. Go to step 11 of 1510 Standard Seal Instructions.

NOTE ON PACKED PUMP OPERATION:

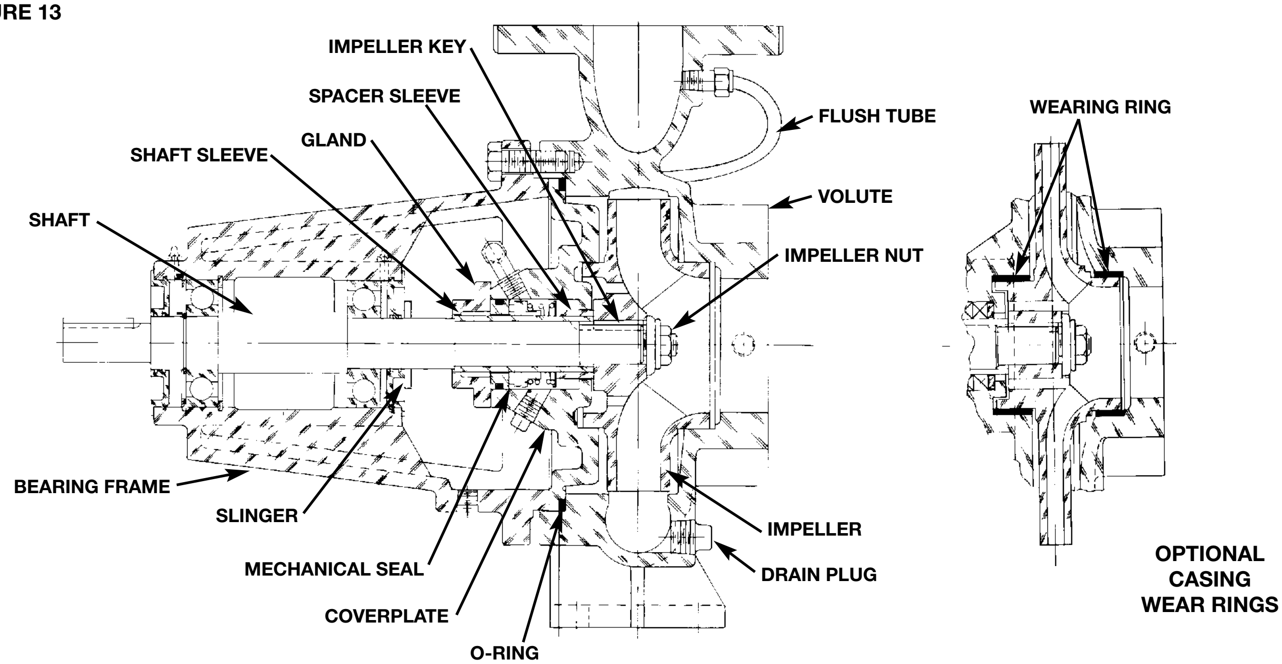
Before starting pump, back off packing gland nuts or screws until gland is loose. Re-tighten with fingers until gland is just snug against the first packing ring. Initially, water may run freely from packing. This is normal and should be allowed to continue for a period of time before further tightening of the gland. Tighten gland nuts slowly and uniformly, one flat at a time.

An adequate leakage rate is not one single value for all pumps and installations, but is the amount required to provide adequate cooling and lubrication. The required leakage will be largely influenced by operating pressure, fluid temperature, shaft speed, etc.

For fluid temperatures in the range of 32° to 190°F, average leakage rates of 60 to 80 drops per minute are recommended. However, each individual pump and installation will have unique operating conditions that will result in broadly variable leakage rate requirements.

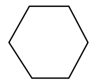
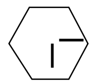
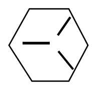
At fluid operating temperatures near the upper limit of 190°F, the maximum temperature rise of the leakage is particularly important. A packed pump should never operate with steam forming at the gland. This necessarily limits the temperature rise to a maximum of about 20°F. If the formation of steam persists at higher leakage rates, cooling water must be provided by means of an external supply, or a heat exchanger used to cool the by-pass flush.

FIGURE 13



8G – STANDARD MECHANICAL SEAL CONSTRUCTION

TABLE 1 – TORQUE CHART

		CAPSCREW TORQUE (FOOT-POUND)					
Capscrew Type	**Head Marking**	**Capscrew Diameter**					
		1/4	**5/16**	**3/8**	**7/16**	**1/2**	**5/8**
SAE Grade 1& 2 Stainless Steel	 	3	6	10	16	24	46
SAE Grade 5		8	17	30	50	76	48

DEALER SERVICING

If trouble occurs that cannot be rectified contact your local representative. He will need the following information in order to give you assistance.

1. Complete nameplate data of pump and motor.
2. Suction and discharge pipe pressure gauge readings.
3. Ampere draw of the motor.
4. A sketch of the pump hook-up and piping.

ITT Industries

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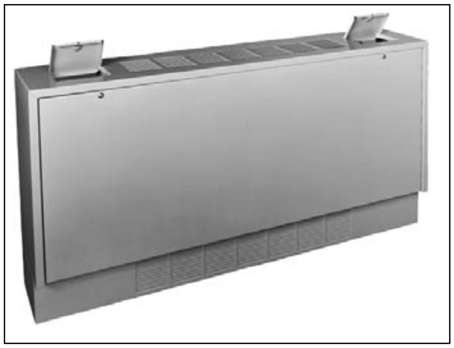
5H73211A1 Rev. C

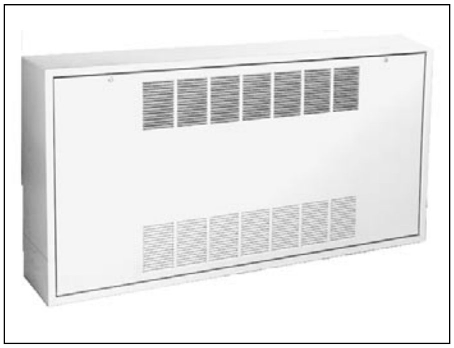
March, 2005

INSTALLATION AND SERVICE MANUAL
steam/hot water cabinet unit heaters

Floor Model C
Sizes 2 thru 14



Wall or Ceiling Model CW
Sizes 2 thru 14



Wall or Ceiling Recessed Model CW
Sizes 2 thru 14

Contents

IMPORTANT

The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.

Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report immediately to transportation company and your local Modine Sales Representative.
2. Check rating plate on unit to verify that power supply meets available electric power at point of installation.
3. Inspect unit received for conformance with description of product ordered (including specifications where applicable).

General Information

Installation and service instructions in this manual are applicable to the three types of steam/hot water cabinet unit heaters which should be installed in their proper applications for their most effective function as heating units.

The condensers are warranted for operation at hot water pressures up to 200 lbs. per sq. in. gauge, and or temperatures up to 240°F or steam pressures up to 10psig.

Motors are designed for continuous duty. They can operate in a maximum ambient temperature of 104°F (40°C).

The unit heaters are listed by the Canadian Standards Association as certified.

Model C units are fully exposed floor mounted types.

Model CW units are fully exposed wall or ceiling mounted types, or partially of fully recessed.

Cabinet unit heaters are available with a variety of options and control arrangements. Information on certain options and controls (when provided) is supplied separately from this manual.

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

⚠ DANGER

Units must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

1. Do not reuse any electrical component which has been wet. Such component must be replaced.
2. Do not operate the units within steam pressure greater than 10 psig. Steam pressure must be 10 psig. or lower to avoid excessive discharge air temperatures that could cause burns or personal injury.

SI (METRIC) CONVERSION FACTORS
Table 2.1

To Convert	Multiply By	To Obtain
"W.C. (inches water column)	0.24	kPa
psig	6.893	kpa
°F	(°F-32) × 0.555	°C
inches	25.4	mm
feet	0.305	meters
CFM	0.028	m^3/min
CFH	1.699	m^3/min
btu/ft^3	0.0374	mJ/m^3
pound	0.453	kg
btu/hr	0.000293	kW/hr
gallons	3.785	liters

UNIT LOCATION

⚠ DANGER

Units must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

1. Units should not be installed in atmospheres where corrosive fumes or sprays are present.
2. Be sure no obstructions block air intake or air discharge of unit heater.
3. Columns, machinery, partitions, and other obstacles should not interfere with air streams from unit heaters.
4. Unit heaters installed in a building exposed to a prevailing wind should be located to direct a major volume of heated air along the windward wall of the building.
5. Vertical delivery unit heaters should generally be located in the central area of the space to be heated. Place horizontal delivery units along the walls of the same building where heat loss is usually greatest.
6. Arrange horizontal delivery units so they do not blow directly at occupants.
7. When only vertical delivery units are installed, they should be located so exposed walls are blanketed by their air streams.
8. Mounting height is critical for optimum performance. Refer to Mounting Height on page 4 before installation.

IMPORTANT

Start-up and adjustment procedures should be performed by a qualified service agency.

INSTALLATION

Unit Mounting

1. Open front panel and line up end compartment with roughed-in piping and position unit at ceiling or wall location. (Hinged cabinet doors may be removed to facilitate unit installation.)
2. Fasten floor or wall mounted unit to wall studs through the four mounting holes in the back of the unit. For ceiling mounted units sizes 2-6, suspend four 1/4" threaded hanger studs from ceiling joists to match mounting holes in back of unit and fasten with lockwashers and hex nuts. (For sizes 8-14, use a 3/8" threaded rod.)

Perma-Lap® Frames

A Perma-Lap® frame (see Figure 10.3 on page 10) provides a finished appearance to a recessed wall or ceiling cabinet unit heater. The installation is easy and assures a perfect fit by neatly framing the heater and covering any irregularities between the heater and the opening in the wall or ceiling. Because the bond between wall or ceiling surfaces and the Perma-Lap® framing is permanent, there is no opportunity for air leakage which can cause wall streaking.

Since the enclosure front panel is never in contact with the wall or ceiling, servicing the heater involves simply removing the heater front panel and leaving the Perma-Lap® and cabinet enclosure permanently fixed in the recess opening.

Perma-Lap® frames allow flexibility in recessing depth. Enclosures may be flush, recessed or partially recessed. Desired unit projection on partially recessed units is accomplished by positioning the unit within the Perma-Lap® frame. The four sided Perma-Lap® frame has a 3/8” projection and a 1 ½” width.

Piping

⚠ CAUTION

1. Do not reuse any electrical component which has been wet. Such component must be replaced.
2. Do not operate the units within steam pressure greater than 10 psig. Steam pressure must be 10 psig. or lower to avoid excessive discharge air temperatures that could cause burns or personal injury.

1. On standard coil (single row), connections are 3/4" MPT on unit sizes 2 through 6.

   On high capacity coil (2 row), connections are 5/8" ID sweat on unit sizes 2 through 6.

   On unit sizes 8 through 14, either standard or high capacity coil, connections are 1" MPT.
2. Supply and return lines should be adequately sized to handle heating requirements under maximum load.
3. Attach air vent fitting at the high point of the piping in the unit on hot water systems.
4. Install piping to provide for expansion and contraction normally encountered with temperature changes.

Electrical Connections

⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.

⚠ CAUTION

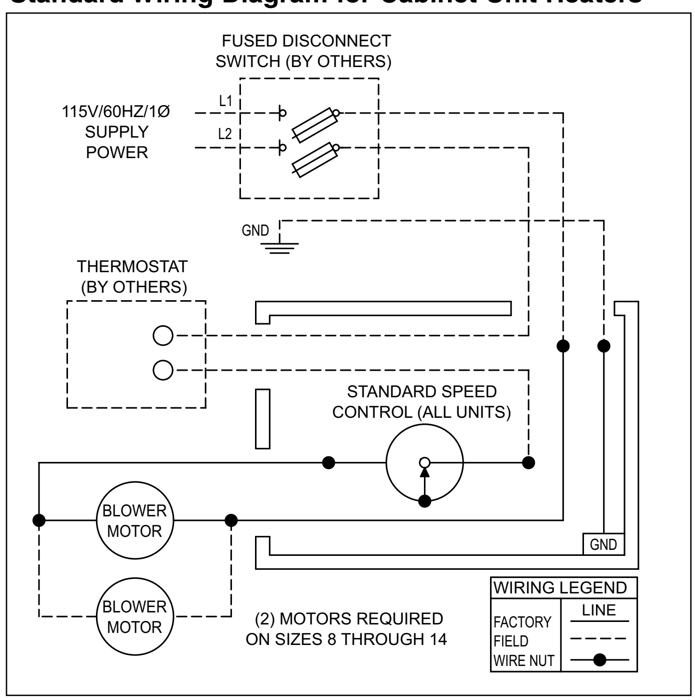
Failure to wire this unit according to this wiring diagram may result in injury to the installer or user. For deviations, contact the factory.

1. Installation of wiring must conform with local building codes, or in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Electrical Code.
2. Electric wiring must be sized to carry the full load amp draw of the motor and any controls that are used with the unit heater. Overcurrent protectors should be sized based on motor current rating shown on the unit serial plate, and applicable national electric code procedures.

   All units are provided with an electrical junction box. Make wiring connections from 115V/60Hz/1Ø building service to control box as shown on wiring diagram furnished with the unit.

   Any damage to or failure of Modine units caused by incorrect wiring of the units is not covered by Modine’s standard warranty.
3. Location of room thermostat, when supplied, should be in the natural circulating path of room air. Mount thermostat about five feet above floor level where it will not be affected by heat from the unit or other sources of drafts that would prevent it from properly controlling room temperature. See instructions packed with the thermostat.
4. With ceiling mounted units, a multi-speed remote fan switch is supplied as standard. The switch can be recessed into a standard 2 x 4 electrical wall box.

Figure 3.1
Standard Wiring Diagram for Cabinet Unit Heaters



INSTALLATION - MOUNTING HEIGHT / OPERATION

Mounting Height

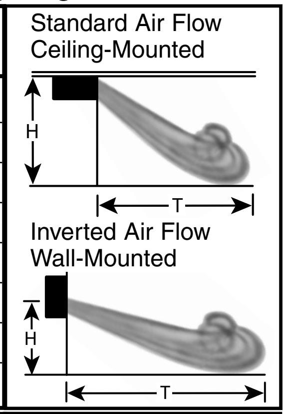
Height at which cabinet unit heaters are installed is critical. Maximum mounting heights for all units are listed in the tables below. The data in tables are based on operating conditions of 2 lbs. steam or 220°F entering water with 60°F entering air. When operating conditions are other than those above, refer to chart for mounting height correction factor. To obtain the maximum mounting height at actual operating conditions, multiply the appropriate factor from chart by the mounting height in Tables. The mounting heights must be followed closely to assure maximum comfort.

Strong opposing drafts, large obstructions in the air stream of the unit, and higher than normal discharge air temperatures (resulting from high steam pressures) can prevent the heated air discharged by the cabinet unit from reaching the floor.

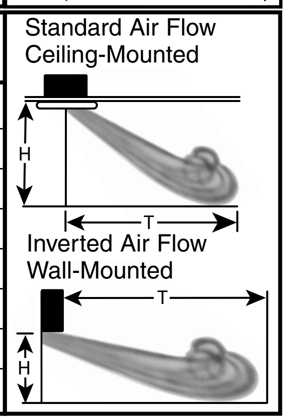
Under unfavorable conditions such as these, allowances must be made to assure maintenance of desired comfort.

Table / Figure 4.1
Maximum Mounting Height ①

Size	H (Ft.)	T (Ft.)
2	8	15
3	8	18
4	9	22
6	9	23
8	10	26
10	10	27
12	11	26
14	11	27



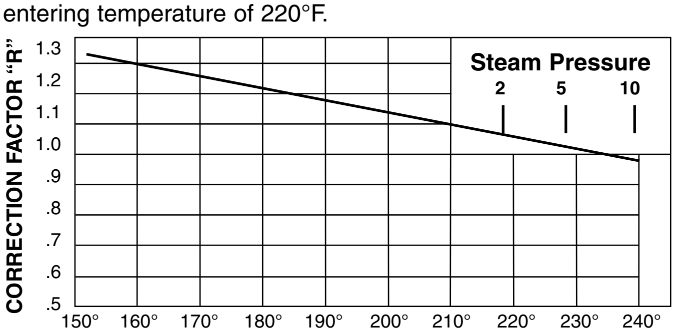
Size	H (Ft.)	T (Ft.)
2	7	8
3	8	10
4	8	11
6	8	12
8	10	16
10	10	18
12	11	20
14	11	21



① Maximum mounting height and corresponding heat throw of heaters operating at standard conditions (2 lbs. steam or 220°F entering water, 60° entering air).

Table 4.3
Maximum Mounting Heights Correction Factors

These correction factors are to be used as multipliers to correct the maximum recommended mounting heights "H" or heat throw "T" of cabinet unit heaters when operated with steam pressures other than 2 pounds or with water at other than entering temperature of 220°F.



OPERATION

1. Make sure fuses are installed in fused disconnect switches.
2. Check all electrical connections to assure they are secure.
3. Check rigidity of unit mounting. Tighten all fasteners, if necessary.
4. Inspect piping, strainers, traps, fittings, etc.

Initial Start-Up

1. Set thermostat to lowest position.
2. Turn on power supply to unit.
3. Open return gate valve, and then open supply gate valve to unit.
4. Raise thermostat setting to desired position.
5. Adjust louvers (if provided) for desired heat distribution.
6. To insure proper sequence of operation, cycle unit on and off a few times by raising and lowering thermostat setting.
7. Check for proper rotation of fan. See dimensional drawings on page 8 or 9 for indication of fan rotation.

Automatic Control Operations

Install one of the following operating systems for continuous automatic control.

Intermittent Fan Operation — Hot Coil

A room thermostat starts and stops the fan motor. An aquastat is sometimes strapped to the return piping to prevent fan operation when heat is not being supplied to the unit heater.

Continuous Fan Operation — Intermittent Hot/Cold Coil

A room thermostat controls a valve which opens to allow steam or hot water to supply the unit and closes to shut off the supply when the thermostat is satisfied.

INSTALLATION - AIR FLOW ARRANGEMENTS

Figure 5.1
Standard Air Flow

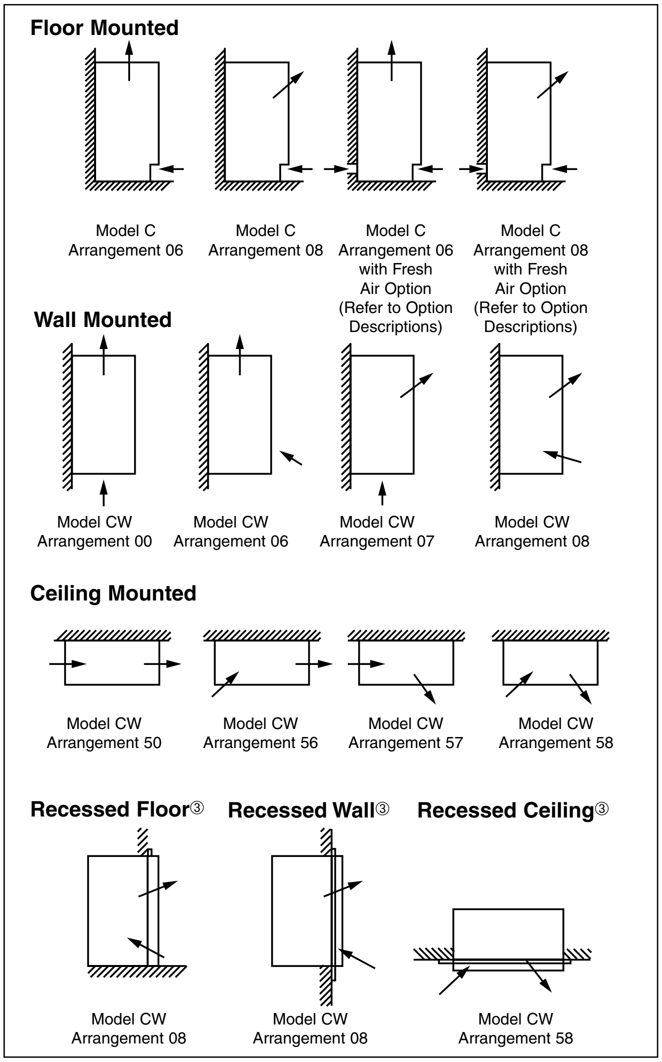
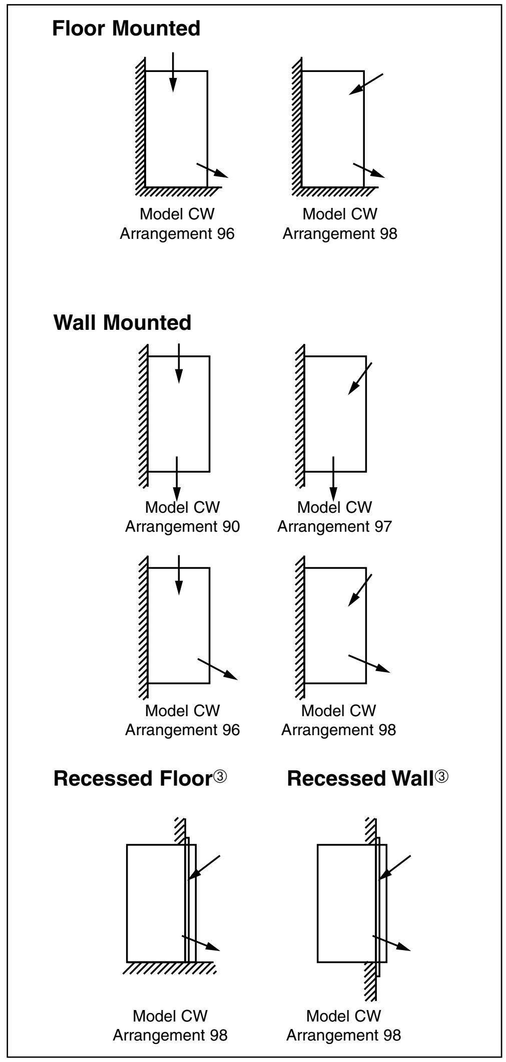


Figure 5.2
Inverted Air Flow



③ Perma-Lap® frame available for recessed units.

Figure 5.3 - Model Nomenclature

CW 0 6

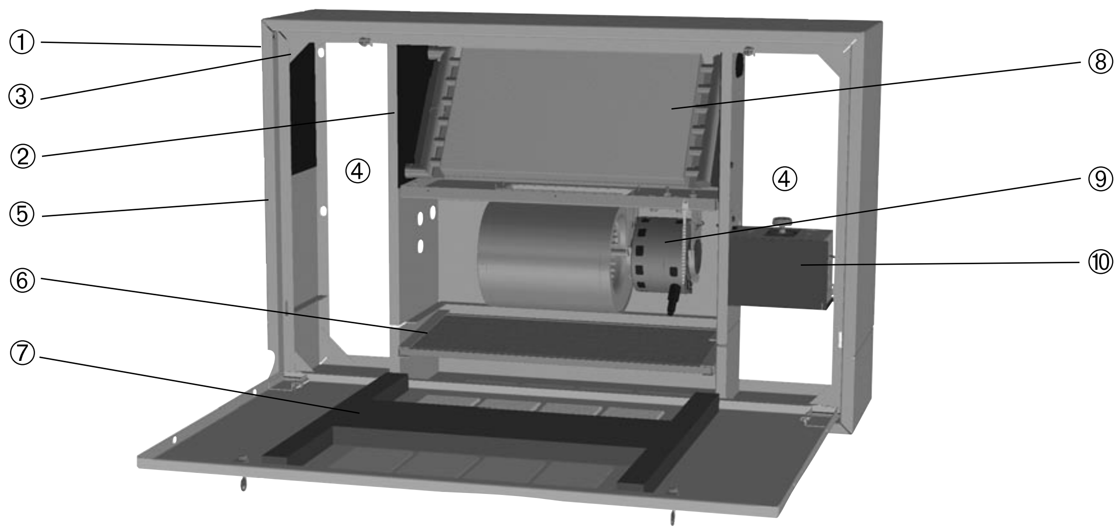
Model Type
C = Floor Unit
CW = Exposed, Recessed or Ceiling Unit

Arrangement
0 = Wall or Floor
5 = Ceiling
9 = Inverted

Airflow Direction
0 = Bottom in, Top Out
6 = Front In, Top Out
7 = Bottom In, Front Out
8 = Front In, Front Out

CONTROLS AND FEATURES

Figure 6.1
Controls and Features



Product Features and Benefits

Feature	Benefits
1. One-Piece Cabinet Top and Sides	1. Cabinet top and sides are formed from a single sheet of 18 gauge steel reducing the number of parting lines common to multi-piece construction. Fronts are 16 gauge. All louvers are stamped as standard.
2. Wrap-Around Partitions and Back Sheet	2. Inner partition panels and back sheet are die-formed from a single sheet of 18 gauge steel. This assures precision fit and alignment of all internal components and maximum cabinet rigidity.
3 All-Welded Construction	3. Cabinet unit heaters utilize five to eight structural components in the basic cabinet. The components are fixture-aligned and welded.
4. Cabinet End Pockets	4. The two cabinet end pockets provide ample space for convenient installation of piping and electrical wiring. Easy access reduces costs and installation time.
5. Cabinet Finish	5. After assembly and welding operations are completed, the entire cabinet unit is treated for prevention of rust and corrosion. Entire cabinet is finished with a tan color, baked on enamel finish, which may be used as a final coat or repainted.
6. Quick-Change Permanent Filters	6. Filters are removable without tools. After opening the unit's front panel, the filter easily slides out. Cleanable filters are provided as standard.
7. Insulation	7. Sound dampening insulation on all front panels.
8. Coils – Steam/Hot Water	8. All coils used in cabinet heaters use copper tube, aluminum fin construction with NPT connections; 3/4" for sizes 2 thru 6, and 1" for sizes 8 thru 14. Tubes are mechanically expanded into integral fin collars. Return bends and joints are silver alloy brazed and the coil is pressure-tested to 200 psi pressure. Field reversible coils allow piping to be made for left or right side connection, with left hand piping as factory standard.
9. Power Assembly	9. Blower platform, blower, and blower motor on all sizes are removable as a single unit. A direct drive, multi-speed, shaded pole motor with built in thermal overload protection powers the forward curved aluminum blower wheels. ;Right hand electrical as factory standard.
10. Speed Control	10. Solid state infinite speed control with off position.
11. Access Doors (not shown)	11. Tilt type access doors standard on model C units.

UNIT / MECHANICAL SPECIFICATIONS

Table 7.1
Unit Data Specifications

Unit Size ▶	2	3	4	6	8	10	12	14
Coil								
Standard – 1 Row Face Area, $Ft.^2$	1.0	1.3	1.6	2.3	3.4	3.4	4.6	4.6
High Capacity – 2 Row Face Area, $Ft.^2$	1.1	1.5	1.8	2.7	3.6	3.6	4.8	4.8
Standard Coil Connections	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	1" NPT	1" NPT	1" NPT	1" NPT
High Capacity Coil Connections	5/8" ID Sweat	5/8" ID Sweat	5/8" ID Sweat	5/8" ID Sweat	1" NPT	1" NPT	1" NPT	1" NPT
Blowers (Direct Drive)								
No./Dia. x Width (Inches)	1 / 5-1/4 x 7	1 / 5-3/4 x 7	2 / 5-1/4 x 7	2 / 5-3/4 x 7	3 / 5-3/4 x 7	3 / 5-3/4 x 7	4 / 5-3/4 x 7	4 / 5-3/4 x 7
High Speed (Rpm)	1050	1050	1050	1050	1050	1050	1050	1050
Low Speed (Rpm) ①	625	625	625	625	625	625	625	625
High CFM	250	330	450	620	840	1050	1240	1430
Low CFM ①	150	195	270	370	545	685	805	930
② **Motor HP**	1/30	1/30	1/20	1/20	1/30 1/20	1/30 1/20	1/20	1/20
Volts/Phase/Hertz	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60	115/1/60
Amps, Standard Shaded Pole Motors	1.7	1.7	2.37	2.37	4.07	4.07	4.74	4.74
Amps, Option #140 PSC Motor	.7	.7	1.05	1.05	1.75	1.75	2.10	2.10
Amps, Option #141 High Static Motor	4.6	4.6	4.6	4.6	9.2	9.2	9.2	9.2
Shipping Weight – Lbs.								
Model C	80	90	110	120	160	165	185	190
Model CW	90	100	120	130	170	175	195	200

① Standard solid state speed control offers infinite speed control between high and low speed/CFM.
② Sizes 2-6 have one motor. Sizes 8-14 have two motors.

Unit Mechanical Specifications

Cabinet

Floor models shall be provided with stamped louvers and a one inch high dust barrier at the bottom. The cabinet shall be 18-gauge steel with 16 gauge front panels. All painted surfaces shall be treated for corrosion resistance prior to being finished with a tan, baked on enamel finish, which may be used as a final coat or repainted. All unpainted steel shall be galvanized. (When specified) color as selected by architect shall be provided in one of 9 optional colors as shown on manufacturer's color chart 11-405.

Wall or ceiling models shall have cabinets with stamped louvers. The entire bottom of the unit must be enclosed. Access to the speed control shall be through the easy access 16-gauge front panels.

(Available, when specified, as optional equipment) an access door shall be provided for speed control access.

All models shall have two 9" minimum wide piping end pockets. All wall and ceiling units shall have safety hinged access panels that can be easily removed during installation.

Coils

The heating coils shall provide specified capacities and not exceed the pressure drop and GPM listed in this catalog. Coils shall be suitable for 200 PSI working pressure with 240°F water. Steam pressure shall not exceed 10 psi.

Motor Speed Control

The unit shall have a unit-mounted solid state motor speed control, with high through low speeds and off positions on all models.

Dampers (optional equipment)

When specified, the unit shall be equipped with a 25% galvanized steel fresh air blade damper. Model C, floor units only.

When dampers are specified, indicate one of the following:

1. These dampers shall be controlled from the end pocket with a manual control assembly that indicates the open and closed positions.

2. The damper shall be controlled by an electric, spring-return type motor, which will be energized when the blower motor is turned on thus moving the damper to the 25% or 100% position. It will be de-energized and close the damper when the blower motor is off.

Motors, Blowers and Drives

Blowers shall be of the centrifugal, forward curved type, to provide even air distribution and low sound level.
All units shall have shaded pole (permanent split capacitor available when specified as optional equipment) direct-drive motors. The motor and blower assembly shall be capable of being easily removed from the unit. Motors are built for continuous duty to NEMA standards.

Grilles (optional equipment)

When specified, aluminum linear bar inlet and/or outlet grilles shall be provided.

When specified, outlet grilles may have two-way deflection louvers.

Filters

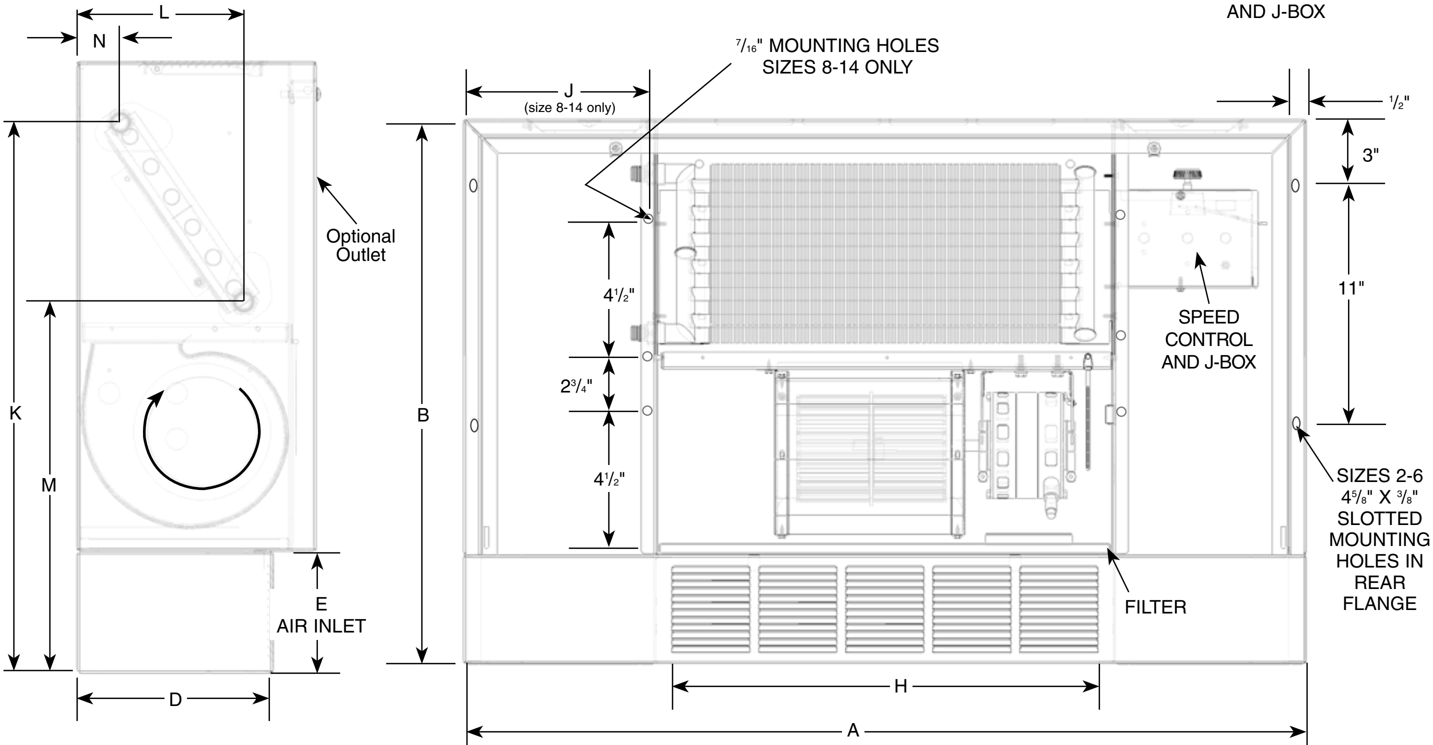
All air, both fresh and return, shall be filtered by a cleanable expanded aluminum filter.

DIMENSIONAL / MOTOR DATA

Floor Mounted

Figure 8.1
Floor Model C, Sizes 2-14
Steam/Hot Water Cabinet Unit Heaters

COIL CONNECTIONS
SIZES 2-6: 3/4" NPT FOR STANDARD COIL
5/8" I.D. SWEAT FOR TWO ROW COIL
SIZES 8-14: 1" NPT, ONE OR TWO ROW COIL



NOTE: Left hand piping is standard, right hand piping available when specified.
Bottoms of end compartments are open for piping and electrical access.

Table 8.1
Cabinet Dimensions (inches)

Unit Size	A	B	C	D	E	F	G	H	J	Approx. Shipping Weight lbs.
2	38-3/4	25	9-3/4	8	5	5-1/8	15-5/8	19-5/8	–	80
3	43-3/4	25	9-3/4	8	5	5-1/8	19-5/8	23-5/8	–	90
4	48-3/4	25	9-3/4	8	5	5-1/8	27-5/8	27-5/8	–	110
6	61-3/4	25	9-3/4	8	5	5-1/8	39-5/8	39-5/8	–	120
8	71-3/4	28	12	10	7	5-1/8	47-5/8	30-5/8	9-3/4	160
10	71-3/4	28	12	10	7	5-7/8	47-5/8	39-5/8	9-3/4	165
12	83-3/4	28	12	10	7	5-1/8	59-5/8	51-5/8	9-3/4	185
14	83-3/4	28	12	10	7	5-7/8	59-5/8	51-5/8	9-3/4	190

Table 8.2
Filter Dimensions (inches) ①

Unit Size					
2	8-1/2	x	20-3/4	x	1/2
3	8-1/2	x	25-3/4	x	1/2
4	8-1/2	x	30-3/4	x	1/2
6	8-1/2	x	43-3/4	x	1/2
8 & 10	10-3/4	x	49-3/4	x	1/2
12 & 14	10-3/4	x	61-3/4	x	1/2

① Filters are permanent/cleanable.

Table 8.3
Coil Connection Dimensions (inches)

Unit Size	K	L	M	N
2 thru 6	22-1/2	7-3/8	15-1/4	2-3/8
8 thru 14	25-5/8	9-1/4	18	1-5/8

Table 8.4
Motor Ratings (115 volts/60hz/1Ø)

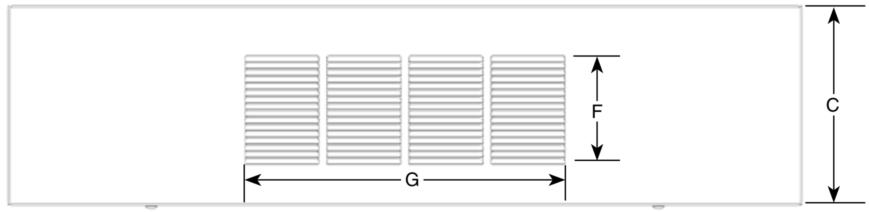
Unit size	Motor qty.	Standard Motor		PSC Motor Option 140		High Static Motor option 141	
		HP	Total Amps	HP	Total Amps	HP	Total Amps
2 + 3	1	1/30	1.7	1/30	0.70	0.4	4.60
4 + 6	1	1/20	2.37	1/20	1.05	0.4	4.60
8 + 10	1	1/30	4.07	1/30	1.75	0.8	9.20
	1	1/20		1/20		0.8	
12 + 14	2	1/20	4.74	1/20	2.10	0.8	9.20

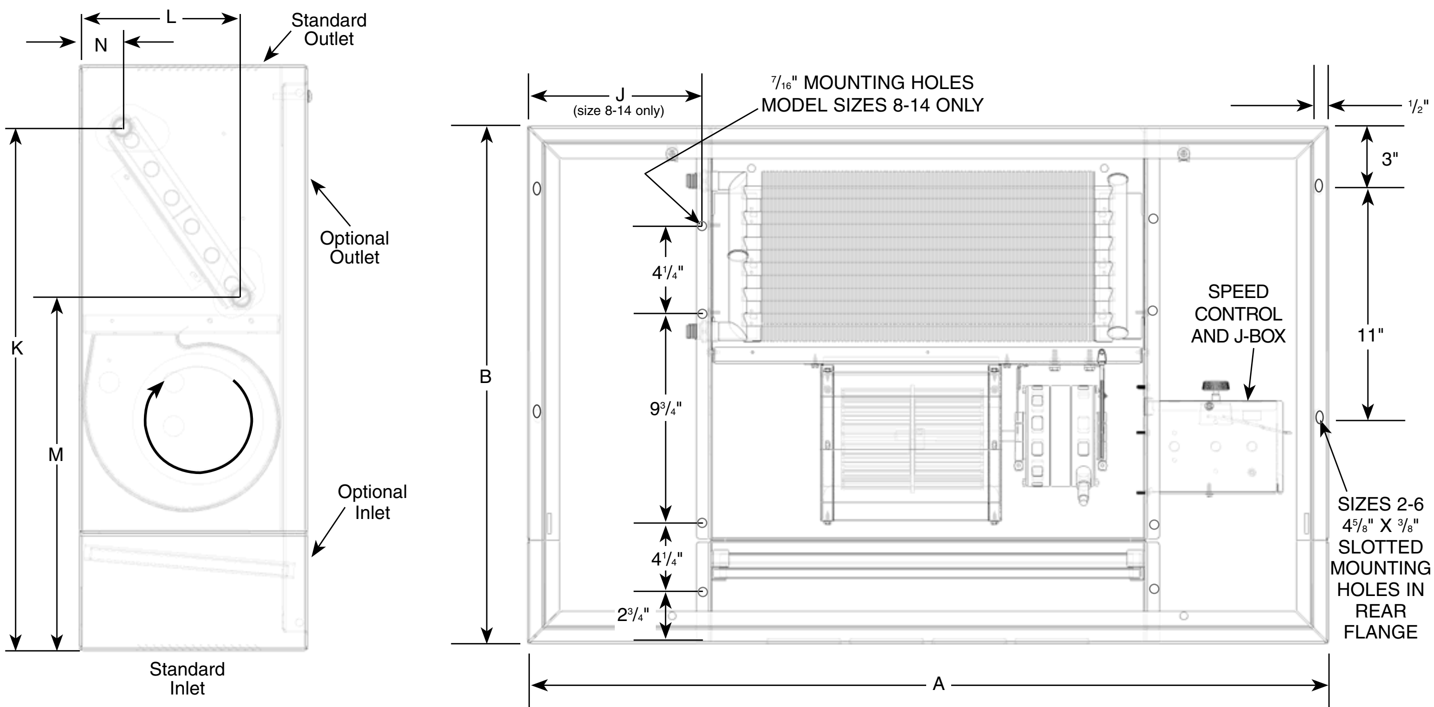
DIMENSIONAL / MOTOR DATA

Exposed or Recessed Wall / Ceiling Mounted

Figure 9.1
Wall or Ceiling Model CW, Sizes 2-14
Steam/Hot Water Cabinet Unit Heaters

COIL CONNECTIONS
SIZES 2-6: 3/4" NPT FOR STANDARD COIL
5/8" I.D. SWEAT FOR TWO ROW COIL
SIZES 8-14: 1" NPT, ONE OR TWO ROW COIL





NOTE: Left hand piping is standard, right hand piping available when specified.
Bottoms of end compartments are open for piping and electrical access.

Table 9.1
Cabinet Dimensions (inches)

Unit Size	A	B	C	F	G	J	Approx. Shipping Weight lbs.
2	38-3/4	25	9-3/4	5-1/8	15-5/8	–	90
3	43-3/4	25	9-3/4	5-1/8	19-5/8	–	100
4	48-3/4	25	9-3/4	5-1/8	27-5/8	–	120
6	61-3/4	25	9-3/4	5-1/8	39-5/8	–	130
8	71-3/4	28	12	5-1/8	47-5/8	9-3/4	170
10	71-3/4	28	12	5-7/8	47-5/8	9-3/4	175
12	83-3/4	28	12	5-1/8	59-5/8	9-3/4	195
14	83-3/4	28	12	5-7/8	59-5/8	9-3/4	200

Table 9.2
Filter Dimensions (inches) ①

Unit Size					
2	8-1/2	x	20-3/4	x	1/2
3	8-1/2	x	25-3/4	x	1/2
4	8-1/2	x	30-3/4	x	1/2
6	8-1/2	x	43-3/4	x	1/2
8 & 10	10-3/4	x	49-3/4	x	1/2
12 & 14	10-3/4	x	61-3/4	x	1/2

① Filters are permanent/cleanable.

Table 9.3
Coil Connection Dimensions (inches)

Unit Size	K	L	M	N
2 thru 6	22-1/2	7-3/8	15-1/4	2-3/8
8 thru 14	25-5/8	9-1/4	18	1-5/8

Table 9.4
Motor Ratings (115 volts/60hz/1Ø)

Unit size	Motor qty.	Standard Motor		PSC Motor Option 140		High Static Motor option 141	
		HP	Total Amps	HP	Total Amps	HP	Total Amps
2 + 3	1	1/30	1.7	1/30	0.70	0.4	4.60
4 + 6	1	1/20	2.37	1/20	1.05	0.4	4.60
8 + 10	1	1/30	4.07	1/30	1.75	0.8	9.20
	1	1/20		1/20		0.8	
12 + 14	2	1/20	4.74	1/20	2.10	0.8	9.20

DIMENSIONAL DATA - ACCESSORIES / OPTIONS

Figure 10.1
Model CW - Duct Collars

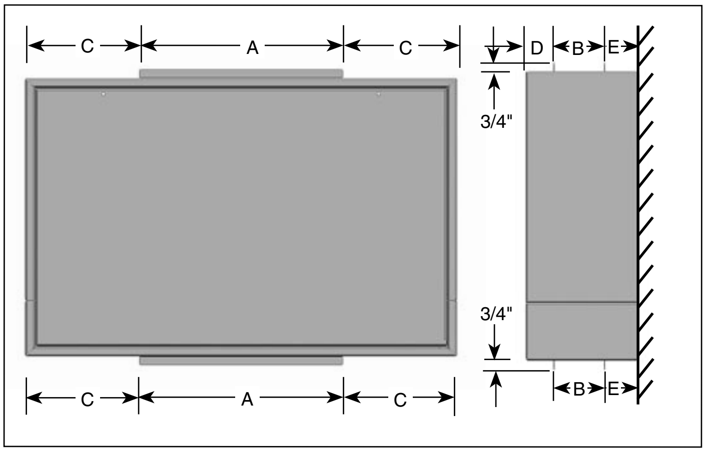


Table 10.1 ① ②
Options 122 and 123 - Model CW
100% Air Inlet or Outlet Duct Collars

Unit Size	A	B	C	D	E
2	18-1/4	4-1/4	10-3/8	2-1/2	3
3	23-1/4	4-1/4	10-3/8	2-1/2	3
4	28-1/4	4-1/4	10-3/8	2-1/2	3
6	41-1/4	4-1/4	10-3/8	2-1/2	3
8	44-1/4	4-1/4	10-7/8	2-1/2	5-1/4
10	44-1/4	5-1/4	10-7/8	2-1/2	4-1/4
12	58-1/4	4-1/4	12-7/8	2-1/2	5-1/4
14	58-1/4	5-1/4	12-7/8	2-1/2	4-1/4

Figure 10.2
Model C - Outside Air Duct Collar

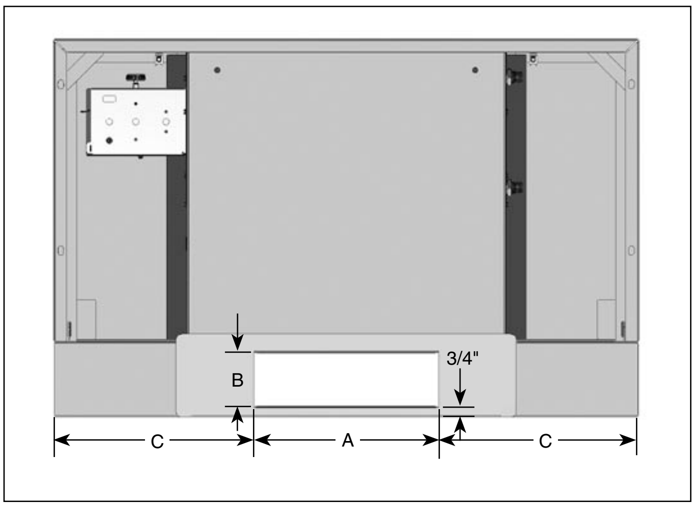
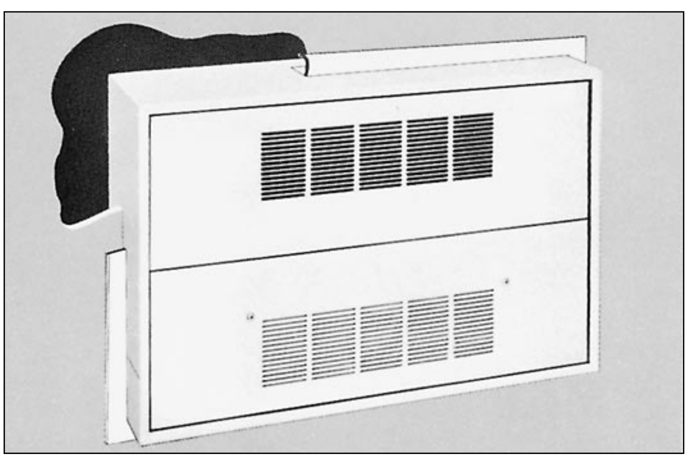


Table 10.2 ① ②
Options 124, 125, 134, 135 and 137 - Model C
25% and 100% Fresh Air Duct Collar

	Outside Air Percentage					
	25%			100%		
	Options 124, 134 and 137			Options 125 and 135		
Unit Size	**A**	**B**	**C**	**A**	**B**	**C**
2	12 1/4	3 1/2	13 1/4	18 1/2	4 1/4	10 1/8
3	12 1/4	3 1/2	15 3/4	23 1/2	4 1/4	10 1/8
4	12 1/4	3 1/2	18 1/4	28 1/2	4 1/4	10 1/8
6	12 1/4	3 1/2	24 3/4	41 1/2	4 1/4	10 1/8
8	24 1/4	3 1/2	23 3/4	44 1/2	4 1/4	13 5/8
10	24 1/4	3 1/2	23 3/4	44 1/2	5 1/4	13 5/8
12	24 1/4	3 1/2	29 3/4	58 1/2	4 1/4	12 5/8
14	24 1/4	3 1/2	29 3/4	58 1/2	5 1/4	12 5/8

① All dimensions are in inches.
② Includes 3/4" top and bottom duct flanges for duct connection.

Figure 10.3
Model CW - Permalap Frame



MAINTENANCE / SERVICE

All heating equipment should be serviced before each heating season to assure proper operations. The following items may be required to have more frequent service scheduled based on the environment in which the unit is installed, and the frequency of the equipment operation.

Motors

A. Cleaning

Remove grease and dirt on motor during each inspection or lubrication. Open frame motors should be blown clean every heating season, or whenever coils are cleaned, whichever is sooner.

B. Lubrication

1. Lubricate motor according to manufacturer's instructions located on the motor.
2. When no motor oiling instructions are on the motor, oil the motor every two thousand hours of operation with SAE20 non-detergent motor oil for units in normal applications. Adjust oiling according to usage and atmosphere.
3. Some motors do not have oil fittings. These motors are lubricated for long life and do not require further lubrication.
4. Check motor shaft for excessive end play every 3 to 5 years.

C. Overload Protection

A change in line voltage higher or lower than motor nameplate rating may cause overheating and serious motor damage. Check plant voltage conditions. A separate manual starter with thermal overload protection device is recommended for those units that do not have motors with built-in overload protection.

Coils

A. Cleaning

Clean coil at least once a year; more often under unfavorable conditions. Unless coil is kept reasonably free of dirt, lint and grease, its original heating capacity will be reduced — possibly to a serious degree, and motor damage may result.

Two commonly used cleaning methods are:

1. Loosen dirt by brushing fins with a soft brush on side where air enters coil and then turn on fan to blow dirt from unit.
2. Use high pressure air hose to loosen dirt by blowing from side where air leaves coil (side adjacent to louvers on blow-through units; side adjacent to fan on draw-through units).

Coils subjected to corrosive fumes should be checked and cleaned frequently.

Do not use any commercial solvent that could deteriate the coil and do not use any liquid or steam sprays that could damage electrical components.

Good filter maintenance will minimize the frequency of coil cleaning.

B. Internal Corrosion Safeguards

1. Provide controlled water treatment — don't use excess of boiler compounds. Contact your boiler compound supplier for proper usage or the services of a water treatment laboratory.
2. Periodic internal flushing of the coils is recommended in areas where water supply is suspected of causing scale. Use an alkaline-chelant solution and introduce it at the main pump of the hydronic system. Flush thoroughly.

⚠ WARNING

Using inorganic or mineral acids, such as muriatic (hydrochloric) acid, even though inhibited, may lead to severe damage including corrosion and leakage.

3. De-aerate boiler feed-water (particularly if large amount of new water is used).
4. Insure rapid continuous and adequate condensate drainage by properly sized and installed traps and piping. Check traps for sticking. Clean strainers ahead of traps. (When traps don't work, condensate accumulates in unit heater coil; water hammer results.)
5. Adequately vent each unit.
6. Use low pressure steam when possible.

Casings

A. Cleaning

1. Periodic cleaning of casings is recommended to remove dirt, grease and corrosive substances that may injure finish. Rusted or corroded spots should be cleaned and repainted.
2. Clean air filters every three months or sooner depending on dust conditions.

B. General Inspection

Tighten fan guard and motor bracket. Check fan for proper clearance, free rotation and firm connection to shaft.

When servicing is complete, tag unit to indicate date of inspection, lubrication and cleaning.

SERVICE

If a qualified service person cannot solve the problem, consult your local plumbing/electrical contractor or local Modine representative.

When servicing, repairing or replacing parts on these units always give the complete Model Number and Serial Number from the unit identification plate.

Replacement Parts

When requesting parts please contact your local representative. Please have full model and serial number available.

WARRANTY

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

Heat Exchangers

For Seller's non-separated combustion Gas-Fired Unit Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Low Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 66 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

Heat Exchanger (Condensers) for all Seller's products except non-separated combustion Gas-Fired Unit Heaters and Infrared Heaters, all Burners except Infrared Heaters, and Sheet Metal for all Seller's products

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER (CONDENSER) OR BURNER WHICH SHALL, WITHIN ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

Burners

For Seller's Low Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 30 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

For Seller's High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 126 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

All Other Components Excluding Heat Exchanger (Condenser), Burner, and Sheet Metal

For all Seller's products except Direct-Fired Heaters and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY PART OR PARTS WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Direct-Fired Heaters and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW IS LIMITED TO REPAIR OR REPLACEMENT AT THE SELLER'S OPTION ANY PART OR PARTS WHICH SHALL WITHIN A PERIOD OF ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 18 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF THE SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

Modine Manufacturing Company has a continuous product improvement program; it reserves the right to change design and specifications without notice.

MODINE

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September, 2005

INSTALLATION AND SERVICE MANUAL
steam/hot water unit heaters

Model HSB
Horizontal Delivery
Top/Bottom
Inlet/Outlet

Model HC
Horizontal Delivery
Side
Inlet/Outlet

Models V/VN
Vertical Delivery

Model PT/PTN
"Power-throw"

IMPORTANT

The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.

Inspection On Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local factory sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at point of installation.
3. Inspect unit received for conformance with description of product ordered (including specifications where applicable).

C US

General Information

Installation and service instructions in this manual are applicable to the three types of steam/hot water unit heaters which should be installed in their proper applications for their most effective function as overhead heating units.

The copper condensers are warranted for operation at steam or hot water pressures up to 150 lbs. per sq. in. gauge, and or temperatures up to 375°F, cupronickel tube units are warranted for operating pressures up to 250 PSI and operating temperatures up to 400°F. Canadian Standards Association (CSA) requriements state that explosion-proof units may not be used with a fluid temperature in excess of 329°F and still maintain their explosion-proof rating, for national electric code ignition temperature rating T3B for grain dust.

Motors are designed for continuous duty. They can operate in a maximum ambient temperature of 104°F (40°C).

The unit heaters are listed by the Canadian Standards Association as certified and Canadian Registered heat exchangers CRN OH 9234.5.

⚠ CAUTION

Do not remove outlet fan guard from vertical type unit heaters.

Steam horizontal and vertical delivery unit heaters are available in both standard and low-outlet temperature models. Low outlet temperature models are recommended primarily for installation on heating systems with steam pressures of 30 to 150 PSI. When used at these steam pressures they provide lower outlet air temperatures for longer heat throw and, because of wider fin spacing, they are less susceptible to clogging in dusty atmospheres.

The model number of each unit heater indicates its rated Btu/Hr. capacity/1000 at 2 lbs. steam pressure and 60°F entering air temperature. For example an HSB-63 has an output of 63,000 Btu/Hr. at 2 lbs. steam and 60°F entering air.

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

⚠ DANGER

Appliances with power codes 01, 02, 04, 05, and 10 must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance as indicated on the serial plate, is not 5% greater than the rated voltage.
5. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

1. Do not remove outlet fan guard from vertical type unit heaters.
2. Do not install units below 8 feet measured from the bottom of the unit to the floor.
3. Do not reuse any electrical component which has been wet. Such component must be replaced.
4. Ensure that the supply voltage to the appliance, as indicated on the serial plate is not 5% less than the rated voltage.

IMPORTANT

1. Start-up and adjustment procedures should be performed by a qualified service agency.
2. To check most of the Possible Remedies in the troubleshooting guide listed in Table 15.1, refer to the applicable sections of the manual.

Table of Contents

SI (METRIC) CONVERSION FACTORS Table 2.1

To Convert	Multiply By	To Obtain
"W.C.	0.249	kPa
°F	(°F-32) x 5/9	°C
Btu	1.06	kJ
Btu/ft^3	37.3	kJ/m^3
Btu/hr	0.000293	kW
CFH (ft^3/hr)	0.000472	m^3/min
CFH (ft^3/hr)	0.00000787	m^3/s
CFM (ft^3/min)	0.0283	m^3/min
CFM (ft^3/min)	0.000472	m^3/s

To Convert	Multiply By	To Obtain
feet	0.305	m
Gal/Hr.	0.00379	m^3/hr
Gal/Hr.	3.79	l/hr
gallons	3.79	l
Horsepower	746	W
inches	25.4	mm
pound	0.454	kg
psig	6.89	kPa
psig	27.7	"W.C.

UNIT LOCATION / UNIT MOUNTING

UNIT LOCATION

⚠ DANGER

Appliances with power codes 01, 02, 04, 05, and 10 must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

1. Units should not be installed in atmospheres where corrosive fumes or sprays are present.
2. Be sure no obstructions block air intake or air discharge of unit heater.
3. Locate horizontal delivery unit heaters so air streams of individual units wipe the exposed walls of the building with either parallel or angular flow without blowing directly against the walls. Heaters should be spaced so the air stream from one supports the air stream from another heater. See Figure 3.1.
4. Columns, machinery, partitions, and other obstacles should not interfere with air streams from unit heaters.
5. Unit heaters installed in a building exposed to a prevailing wind should be located to direct a major volume of heated air along the windward wall of the building.
6. Large expanses of glass, or large doors that are frequently opened, should be covered by long-throw unit heaters such as large horizontal delivery of "Power-Throw" unit heaters.
7. Vertical delivery unit heaters should generally be located in the central area of the space to be heated. Place horizontal delivery units along the walls of the same building where heat loss is usually greatest. See Figure 3.3.
8. Arrange horizontal delivery units so they do not blow directly at occupants. Air streams from this type of unit should be directed down aisles, into open spaces on the floor, or along exterior walls.
9. When only vertical delivery units are installed, they should be located so exposed walls are blanketed by their air streams. See Figure 3.2.

Figure 3.1 - Horizontal Delivery Unit Location

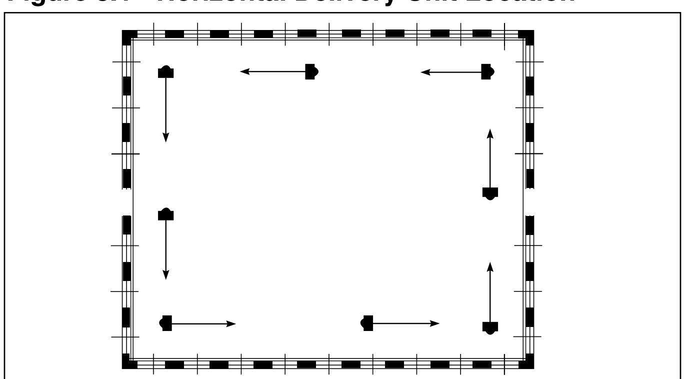


Figure 3.2
Unit Locations of Vertical Units In Narrow Buildings

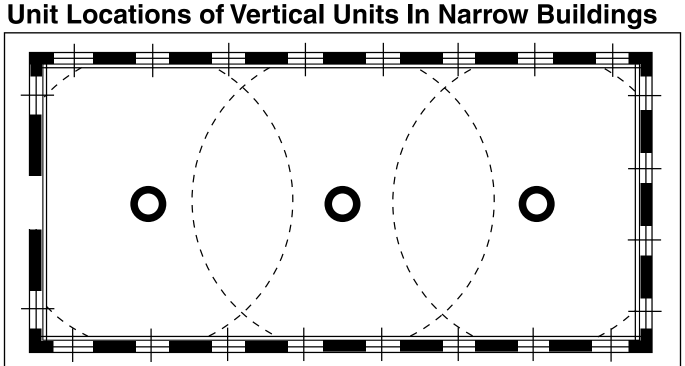
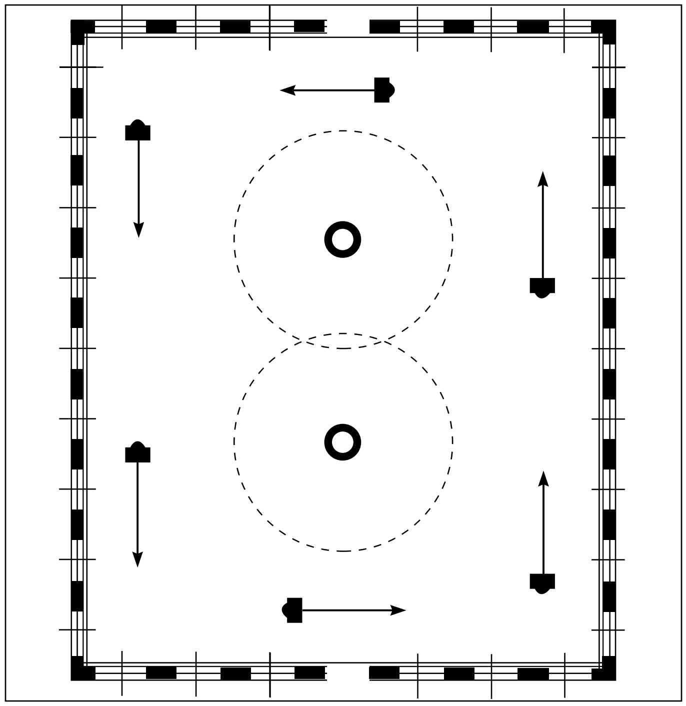


Figure 3.3
Combination Horizontal and Vertical Delivery Unit Installation



UNIT MOUNTING

⚠ CAUTION

Do not install units below 8 feet measured from the bottom of the unit to the floor.

Do not install unit above recommended maximum mounting heights. Height at which unit heaters are installed is critical. Maximum mounting heights for all units are listed in Table 4.1 and the height dimensions are shown in Figures 4.3 through 4.7. Maximum mounting heights for vertical models are given for units with or without optional air deflectors. The data in Table 4.1 is based on operating conditions of 2 lbs. steam or 220°F entering water with 60°F entering air. When operating conditions are other than those above, refer to Figure 4.2 for maximum mounting height correction factor. To obtain the maximum mounting at actual operating conditions, multiply the appropriate factor from Figure 4.2 by the mounting height in Table 4.1. The maximum mounting height for all units is that height above which the unit heater will not deliver heated air to the floor at standard rating conditions.

Deflector Mounting

If an optional air deflector has been furnished for vertical units, it is always shipped separately and can be attached to the unit before suspension. Vertical louvers for horizontal units and horizontal louvers for "Power-Throw" units can also be added and positioned before installation. Cone-jet and louver-type deflectors must be attached with angle brackets and machine screws to the bottom cover of the unit. Refer to mounting instructions which are furnished with each deflector.

Depending on supply or return piping arrangement, there is a possibility of interference between certain anemostat air deflectors and piping on some vertical air delivery unit heaters. Check dimensions.

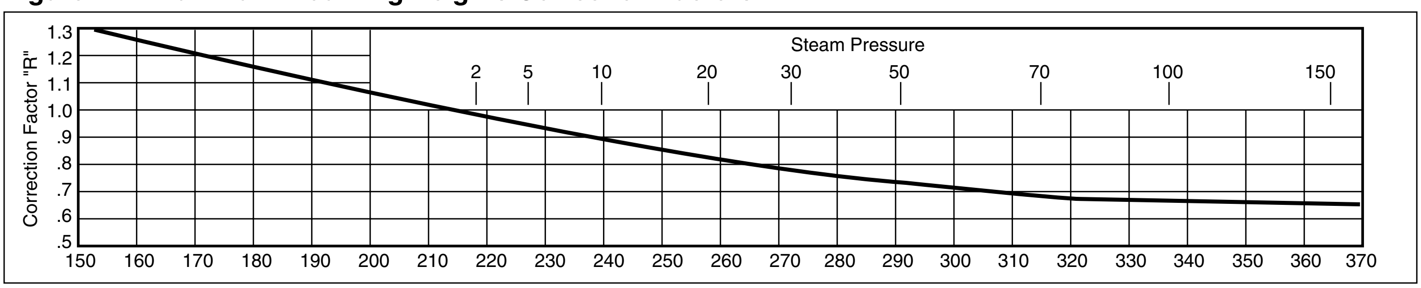
UNIT MOUNTING

Table 4.1 - Maximum Mounting Heights

Horizontal Type ①			"Power-Throw" Type ②			Vertical Type with Deflectors ②								
							No Deflector		Cone-Jet		Truncone		Louvers	
Model No.	Height–Ft. Std.	L.O.T.	Model No.	Height–Ft. Std.	L.O.T.	Model No.	Height–Ft. Std.	L.O.T.	Height–Ft. Std.	L.O.T.	Height–Ft. Std.	L.O.T.	Height–Ft. Std.	L.O.T.
HSB/HC-18	8	9	—	—	—	V/VN-42 ②	11	13	15	17	8	9	13	15
HSB/HC-24	9	11	—	—	—	V/VN-59 ②	14	16	19	22	9	11	16	18
HSB/HC-33	10	12	—	—	—	V/VN-78 ②	15	19	20	26	11	14	17	22
HSB/HC-47	12	14	—	—	—	V/VN-95 ②	15	19	20	26	11	14	17	22
HSB/HC-63	14	16	—	—	—	V/VN-139 ②	18	23	24	31	13	17	21	26
HSB/HC-86	15	17	—	—	—	V/VN-161 ②	20	26	27	35	14	18	23	30
HSB/HC-108	17	19	—	—	—	V/VN-193 ②	22	27	30	36	16	19	25	31
HSB/HC-121	16	18	—	—	—	V/VN-212 ②	22	27	30	36	16	19	25	31
HSB/HC-165	19	21	—	—	—	V/VN-247 ②	26	32	34	42	17	21	30	37
HSB/HC-193	18	—	PT/PTN-279 ②	16	—	V/VN-279 ②	30	36	37	45	18	22	35	41
HSB/HC-258	19	22	PT/PTN-333 ②	17	—	V/VN-333 ②	30	36	37	45	17	20	35	41
HSB/HC-290	20	23	PT/PTN-385 ②	17	—	V/VN-385 ②	30	36	36	43	17	20	35	41
HSB/HC-340	20	23	PT/PTN-500 ②	18	—	V/VN-500 ②	37	45	44	54	19	24	42	51
—	—	—	PT/PTN-610 ②	20	22	V/VN-610 ②	36	44	43	52	19	24	41	50
—	—	—	PT-952	21	—	V-952 ②	37	45	45	61	45	53	—	—

① With horizontal louvers opened 30° from the vertical plane. HSB units have top and bottom piping connections, HC units have side connections. All have copper tubes.
② V and PT models have copper tubes, VN and PTN models have cupronickel tubes.
Mounting heights are maximum for heaters operating at standard conditions (2 lbs. steam or 220°F water with 60°F entering air). Heights listed for Louver or Cone-Jet are with deflectors in fully-opened position. Refer to Figure 4.2 for correction of mounting heights under other operating conditions. Maximum mounting height will be reduced as entering air temperatures exceed 60°F.

Figure 4.2 - Maximum Mounting Heights Correction Factors



These correction factors are to be used as multipliers to correct the maximum recommended mounting heights of unit heaters when operated with steam pressures other than 2 pounds or with water at other than average temperature of 220°F.

Figure 4.3 - Horizontal Unit Delivery

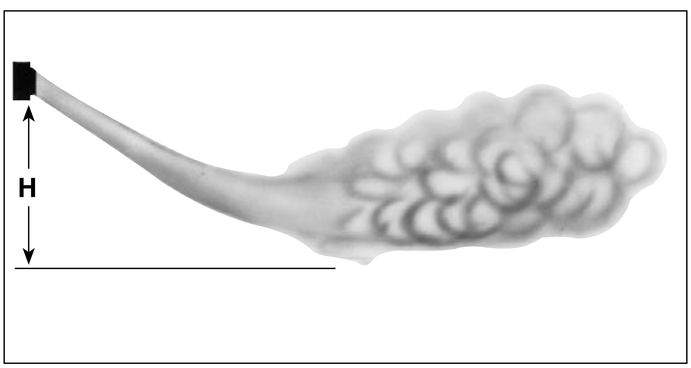


Figure 4.4 - Vertical One-Way & Two-Way Louvers

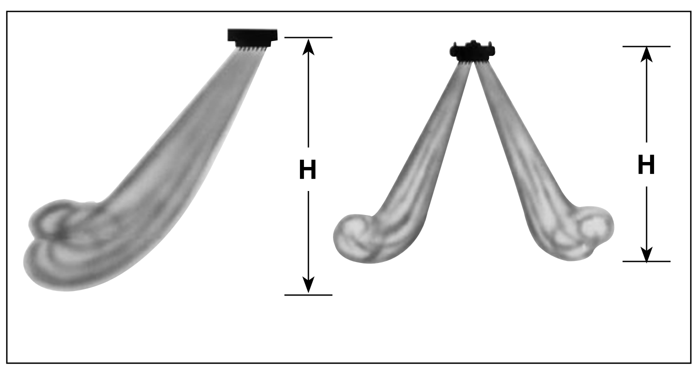


Figure 4.3 Vertical Cone Jet

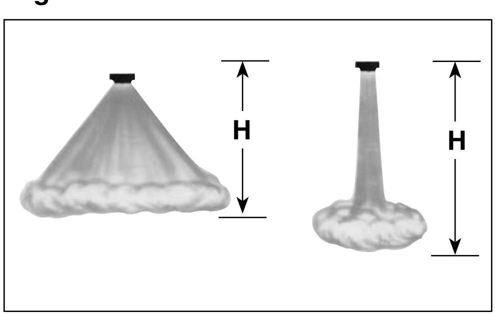
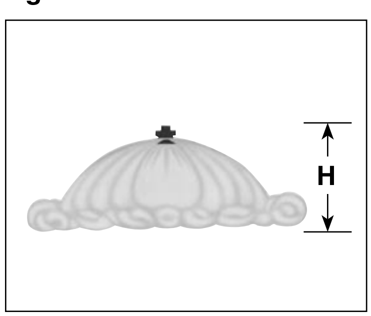


Figure 4.6 - Vertical Truncone



UNIT SUSPENSION / INSTALLATION

UNIT SUSPENSION

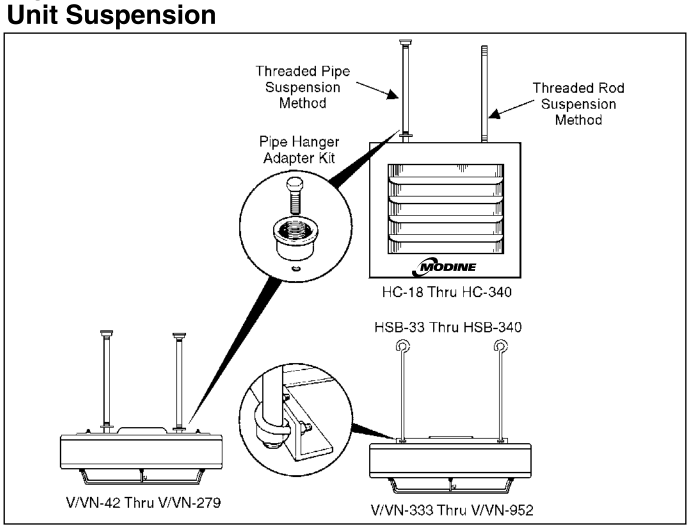
Horizontal delivery units, Model HSB/HC Series. All horizontal delivery units, except Models HSB-18 and HSB-24, have two tapped holes (1/2"-13) in the top for unit suspension. HSB-18 and HSB-24 models do not require independent suspension and are installed directly on their supply piping. Models HC have two tapped holes (HC 18-86 3/8"-16, HC 108-340 1/2"-13) in the top for unit suspension. Piping support hangers or clamps are recommended and should be placed as close to the unit heater as possible. For other models, independent suspension can be made with threaded rods, pipes, or ceiling hanger brackets. See Figure 5.1.

Vertical delivery units. Vertical delivery Models V/VN-42 through V/VN-279 have four tapped holes (1/2"-13) in the top cover for unit suspension. Unit suspension for these models can be made with threaded rods, pipes or ceiling hanger brackets. Models V/VN-333 through V/VN-952 are equipped with an angle-iron mounting bracket that has eight 5/8-inch diameter hanger holes permitting hook-hoisting and suspension with cables, if desired. A 1/2-inch U-bolt, 3-inch center can be inserted in the two holes at each end of the bracket to accommodate suspension with four threaded rods, pipes or hanger brackets.

Power-Throw horizontal delivery units. "Power-Throw" units are designed for horizontal air delivery and are equipped with hanger brackets for suspension. Three hanger brackets are supplied for Model PT/PTN-279, one on the front, and two on the rear panel for three-point suspension. Only two hanger brackets are furnished on the front panel of Models PT/PTN-333 through PT/PTN-952 (for required four-point suspension use the two hanger brackets on the front panel and the two holes on the ends of the upper angle supports at the rear of the unit). Each hanger bracket has a 5/8-inch diameter mounting hole for hook-hoisting and suspension with threaded rods, pipes, or cables.

Note: A pipe hanger adapter kit as illustrated in Figure 5.1 is available as an accessory from Modine. The kit consists of two drilled 3/4-inch I.P.S. pipe caps and two capscrews to facilitate threaded-pipe suspension. One kit will mount a Model HSB 33-340 or HC 108-340 horizontal delivery unit. Two kits are required to mount a Model V/VN vertical delivery unit.

Figure 5.1
Unit Suspension



Piping - See Figure 6.1

1. Branch piping to and from unit heater should include swing joints to allow for expansion and contraction of the piping without placing a strain on the unit heater element. On steam systems, the branch piping should be taken off and returned above the centerline of the supply and return lines.
2. Install pipe unions and shut-off valves in lines to and from each unit heater to allow maintenance or replacement of unit without shutting down and draining entire system. For hot water systems, include a balancing valve in return line for water flow regulation. A drain valve should also be provided below each unit heater to allow removal of water from the heating coil if located in an area subject to freezing.
3. In steam or hot water systems, rapid air removal is required because entrained air is a cause of corrosion. Hot water systems should be equipped with suitable air vent valves for rapid and complete removal of air at the high points and ends of both supply and return mains. Proper air venting for steam systems can be achieved by use of a steam trap with an internal air vent.
4. Traps must be located below the outlet of the unit. Consult trap manufacturer for specific recommendations. Each steam unit heater should be provided with a trap of sufficient size and capacity to pass a minimum of two times the normal condensate released by the unit at the minimum differential pressure in the system. Trap capacity is based on the pressure differential between supply and return mains. Steam systems should be equipped with a float and thermostatic trap or an inverted bucket trap with an air bypass.
5. It is advisable to use a pipe line strainer before each steam trap draining a unit heater. This protection will reduce the maintenance of the steam trap. When strainers are used they should be installed between the unit heater and the trap and be the same size as the trap tapping. In order to catch dirt and scale, the strainer should have a screen perforation size smaller than the trap orifices.
6. On systems where the steam supply to the unit heater is modulated or controlled by a motorized valve, a vacuum breaker should be installed between unit outlet and the trap. If a vacuum breaker is used, it should be in conjunction with a float and thermostatic trap.
7. Install a scale pocket at bottom of unit heater to collect dirt and scale as shown in illustrations. Pipe diameter must be the same size as unit connections and about six inches long.
8. Provide adequate pipe hangers, supports, or anchors to secure the piping system independently of the unit heater.

Electrical Connections

⚠ WARNING

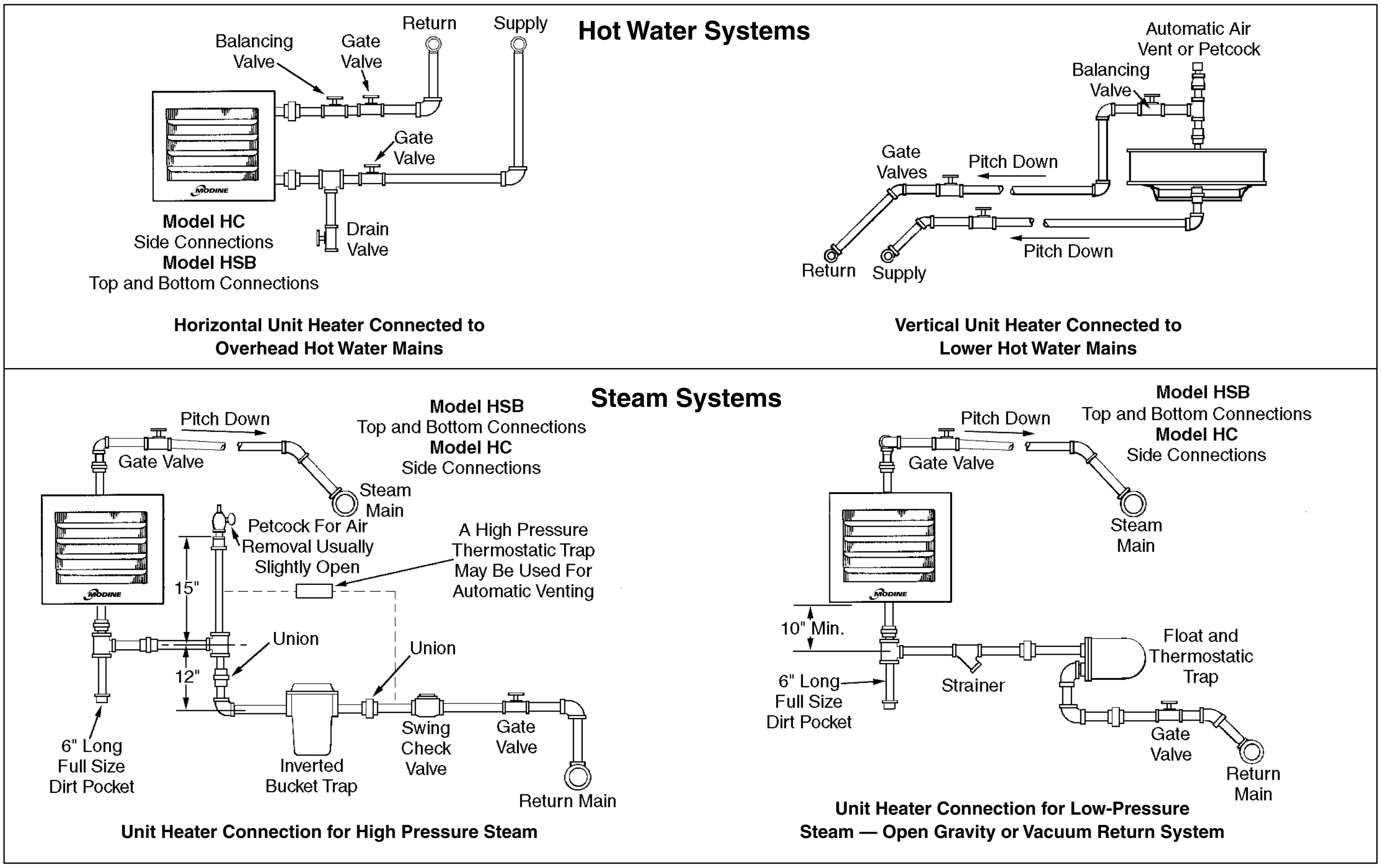
1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance as indicated on the serial plate is not 5% greater than the rated voltage.

⚠ CAUTION

1. Do not install units below 8 feet measured from the bottom of the unit to the floor.
2. Do not reuse any electrical component which has been wet. Such component must be replaced.
3. Ensure that the supply voltage to the appliance, as indicated on the serial plate is not 5% less than the rated voltage.

1. Installation of wiring must conform with local building codes, or in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Electrical Code.

Figure 6.1 - Suggested Piping Arrangements



Horizontal Unit Heater Connected to Overhead Hot Water Mains

Vertical Unit Heater Connected to Lower Hot Water Mains

Unit Heater Connection for High Pressure Steam

Unit Heater Connection for Low-Pressure Steam — Open Gravity or Vacuum Return System

Electrical Connections (Cont.)

2. Electric wiring must be sized to carry the full load amp draw of the motor, starter, and any controls that are used with the unit heater. All units with power codes 04, 05, 09, or 10 (polyphase motors) must be provided with suitable overcurrent protection in circuit supplying heater at installation. Overcurrent protectors should be sized based on motor current rating shown on the unit serial plate, and applicable national electric code procedures.

   All units are provided with an electrical junction box. Junction boxes are either integral to the motor or attached to the unit casing. Units with explosion-proof motors have an explosion-proof junction box attached to the motor.

   Any damage to or failure of Modine units caused by incorrect wiring of the units is not covered by Modine's standard warranty.
3. Location of room thermostat, when supplied, should be in the natural circulating path of room air. Mount thermostat about five feet above floor level where it will not be affected by heat from the unit or other sources of drafts that would prevent it from properly controlling room temperature. See instructions packed with the thermostat.
4. Speed controllers furnished with specified unit heater fan motors, are packed separately and must be connected according to wiring diagram with each controller.

OPERATION

Prior to Operation

1. Make sure fuses are installed in fused disconnect switches.
2. Check all electrical connections to assure they are secure.
3. Check rigidity of unit mounting. Tighten all fasteners, if necessary.
4. Inspect piping, strainers, traps, fittings, etc.

Initial Start-Up

1. Set thermostat to lowest position.
2. Turn on power supply to unit.
3. Open return gate valve, and then open supply gate valve to unit.
4. Raise thermostat setting to desired position.
5. Adjust louvers (if provided) for desired heat distribution.
6. To insure proper sequence of operation, cycle unit on and off a few times by raising and lowering thermostat setting.
7. Check for proper rotation of fan. All fans must rotate in a counterclockwise direction when viewed from the back (HSB/HC, PT/PTN) or top (V/VN) of the unit heater.

Automatic Control Operations

Install one of the following operating systems for continuous automatic control.

Intermittent Fan Operation — Hot Coil

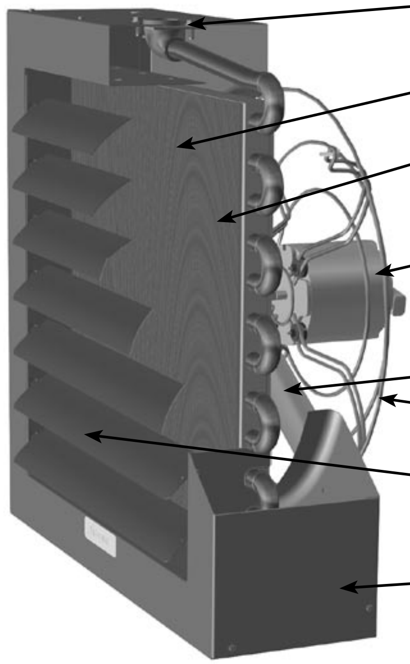
A room thermostat starts and stops the fan motor. An aquastat is sometimes strapped to the return piping to prevent fan operation when heat is not being supplied to the unit heater.

Continuous Fan Operation — Intermittent Hot/Cold Coil

A room thermostat controls a valve which opens to allow steam or hot water to supply the unit and closes to shut off the supply when the thermostat is satisfied.

OPERATION

Figure 7.1
Horizontal Delivery Unit Cutaway



Connections — Female-type permits direct connection of unit heater to the piping. HC models have copper connectors at side of the unit.

Vertical fins — Less opportunity for dust and dirt to collect. Reduces cleaning. Fins die-formed for added strength and heat transfer.

Coil — All air passes through coil. Heating is uniform. Design assures maximum control over air delivery and temperature of air leaving the heater. Aluminum fins die-formed for added strength — increased heat transfer. Fins mechanically bonded to serpentine copper tube.

Motor — All motors are totally enclosed. Single phase types include built-in thermal overload protection. Built by reputable manufacturers to NEMA standards. Selected and tested for operation on specific unit heater models. All motor wiring is terminated in an electrical junction box either supplied on the unit heater or as an integral part of the motor.

Fan — Lightweight. Blades accurately balanced and pitched to move air quietly and positively — with minimum power requirement.

Safety fan guard — Standard equipment. Bolted steel rod fan guard completely surrounds the fan offering constant protection.

Deflector blades — Adjustable horizontal air-deflector blades are standard — vertical blades are standard on Models HSB-258, HSB-290 and HSB-340 and are optional on other horizontal models.

Casings — Baked-on gray-green high solids paint is applied over rust- and corrosion-treated steel for long life.

Figure 7.2
Typical Horizontal Unit with Standard Junction Box

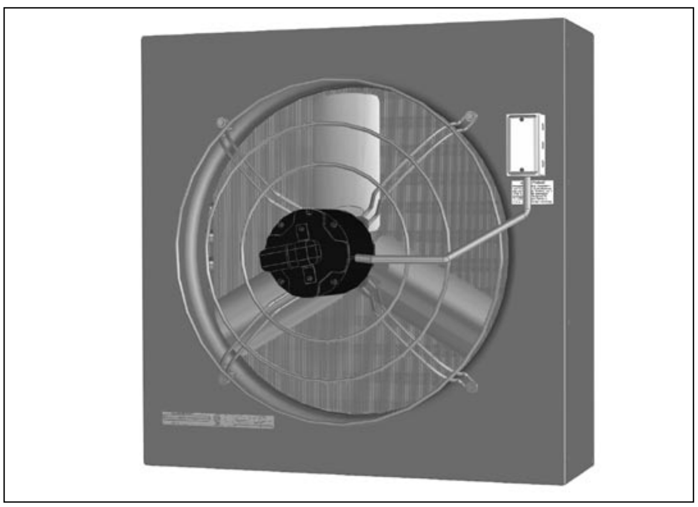


Figure 7.3
Horizontal Unit with Optional Fingerproof Fan Guard

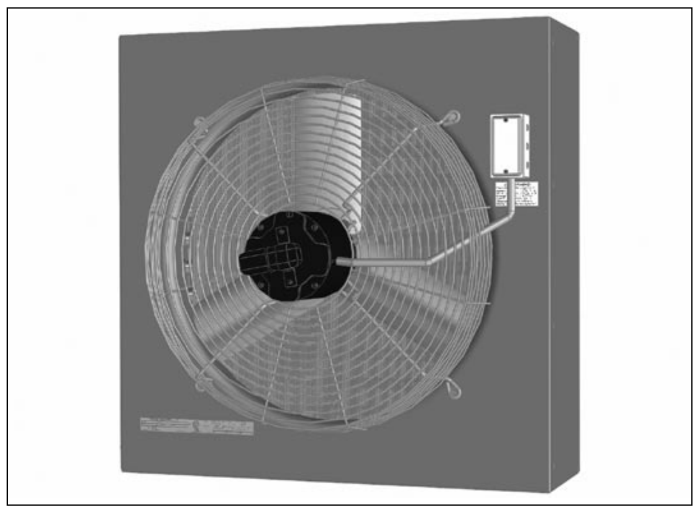
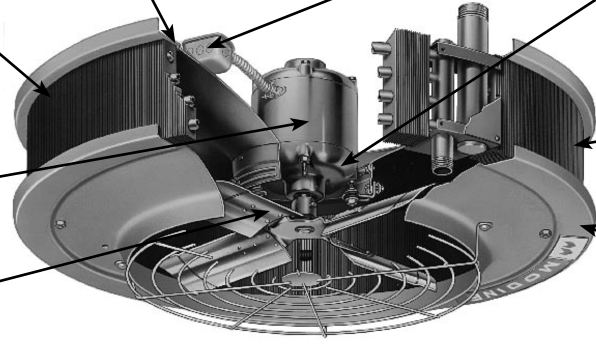


Figure 7.4
Vertical Delivery Unit Cutaway



Motor-Cooling Cone — Shields motor from coil heat — prolongs life of insulation, windings, and lubricant. Prolongs motor life.

Coil — Aluminum fins mechanically bonded to tubes for maximum heat transfer. All steam- and water-carrying passages between heavy steel pipe connections are copper, or cupronickel.

Motor — All motors are totally enclosed. Single phase types include built-in thermal overload protection. Motors selected and tested for operation on each specific model.

Fan — Accurately balanced to operate quietly and at lowest possible power consumption.

Junction Box — Easier installation with single point electrical connection.

Motor easily removable — Modine design permits motor to be removed through opening below the unit — especially important where heaters are installed close to ceiling.

Vertical fins — Less opportunity for dust and dirt to collect. Exposed for easy cleaning with air hose and brush.

Casings — Baked-on gray-green high solids paint applied over rust- and corrosion-treated steel lasts longer.

2 lbs. STEAM
60° ENT. AIR

Steam Performance Data – Standard Models

Table 8.1
Performance Data for Standard Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air High Motor Speed

Type	Model No.	Btu/hr	Sq. Ft. EDR	Air Data: Sound Class ④	Air Data: Maximum Mounting Height (ft.) ①	Air Data: Heat Throw or Spread @ Max. Height ①	Air Data: Cfm ②	Air Data: Outlet Velocity (Fpm)	Air Data: Final Air Temp. (°F)	Air Data: Condensate lb/hr	Motor Data: Hp	Motor Data: Approx. RPM
Horizontal Delivery	HSB/HC-18	18,000	75	II	8	17	340	625	107	19	1/60	1550
	HSB/HC-24	24,000	100	II	9	18	370	695	119	25	1/25	1550
	HSB/HC-33	33,000	138	II	10	21	630	690	108	34	1/25	1550
	HSB/HC-47	47,000	196	III	12	28	730	810	119	49	1/12	1550
	HSB/HC-63	63,000	263	III	14	29	1120	690	111	65	1/12	1550
	HSB/HC-86	86,000	358	III	15	31	1340	835	118	89	1/8	1625
	HSB/HC-108	108,000	450	III	17	31	2010	790	109	112	1/8	1625
	HSB/HC-121	121,000	504	III	16	25	1775	715	122	125	1/5	1075
	HSB/HC-165	165,000	688	IV	19	40	3240	880	106	171	1/3	1075
	HSB/HC-193	193,000	804	IV	18	38	2900	810	121	200	1/3	1075
	HSB/HC-258	258,000	1075	V	19	44	4560	750	111	267	1/2	1075
	HSB/HC-290	290,000	1208	V	20	46	4590	765	117	300	1/2	1075
	HSB/HC-340	340,000	1417	V	20	46	5130	735	120	352	1/2	1075
Power Throw™ ③	PT/PTN-279	279,000	1163	V	16	100	5460	2165	111	289	1/2	1075
	PT/PTN-333	333,000	1388	VI	17	110	5980	2165	116	345	3/4	1140
	PT/PTN-385	385,000	1604	VI	17	115	7680	1860	110	398	1	1140
	PT/PTN-500	500,000	2083	VI	18	130	10,390	2520	108	517	1-1/2	1140
	PT/PTN-610	610,000	2542	VI	20	140	11,750	2315	112	631	1-1/2	1140
	PT-952	952,000	3967	VI	21	145	12,170	2321	139	985	2	1140
Vertical Delivery ③	V/VN-42	42,000	175	II	11 **15**	17 **11**	950	825	103	43	1/30	1050
	V/VN-59	59,000	246	II	14 **19**	21 **14**	1155	1005	111	61	1/30	1050
	V/VN-78	78,000	325	II	15 **20**	23 **15**	1590	1065	109	81	1/15	1050
	V/VN-95	95,000	396	II	15 **20**	23 **15**	1665	1120	118	98	1/15	1050
	V/VN-139	139,000	579	III	18 **24**	27 **18**	2660	1285	112	144	1/6	1075
	V/VN-161	161,000	671	IV	20 **27**	30 **20**	2945	1420	115	167	1/3	1075
	V/VN-193	193,000	804	IV	22 **30**	33 **22**	3500	1690	116	200	1/3	1075
	V/VN-212	212,000	883	IV	22 **30**	33 **22**	3610	1740	120	219	1/3	1075
	V/VN-247	247,000	1029	V	26 **34**	39 **26**	4820	1910	111	256	1/2	1075
	V/VN-279	279,000	1163	V	30 **37**	45 **30**	5460	2165	111	289	1 /2	1075
	V/VN-333	333,000	1388	V	30 **37**	45 **30**	5980	2165	116	345	3/4	1140
	V/VN-385	385,000	1604	VI	30 **36**	45 **30**	7680	1860	110	398	1	1140
	V/VN-500	500,000	2083	VI	37 **44**	56 **37**	10,390	2520	108	517	1-1/2	1140
	V/VN-610	610,000	2542	VI	36 **43**	54 **36**	11,750	2315	112	631	1-1/2	1140
	V-952	952,000	3967	VI	37 **45**	56 **56**	12,170	2321	139	985	2	1140

Table 8.2
Performance Data for Standard Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air Reduced Motor Speed ④

Type	Model No.	Btu/hr	Sq. Ft. EDR	Air Data: Sound Class ④	Air Data: Maximum Mounting Height (ft.) ①	Air Data: Heat Throw @ Max. Height ①	Air Data: Cfm ②	Air Data: Outlet Velocity (Fpm)	Air Data: Final Air Temp. (°F)	Air Data: Condensate lb/hr	Motor Data: Hp	Motor Data: Approx. RPM
Horizontal Delivery	HSB/HC-18	14,000	58	I	8	10	220	415	118	14	1/60	1000
	HSB/HC-24	18,000	75	I	9	11	230	440	131	19	1/25	1000
	HSB/HC-33	25,000	104	I	10	13	395	440	118	26	1/25	1000
	HSB/HC-47	38,000	158	II	12	17	450	515	137	39	1/12	1000
	HSB/HC-63	47,000	195	II	14	17	685	430	122	49	1/12	1000
	HSB/HC-86	64,000	265	II	15	19	825	525	131	66	1/8	1000
	HSB/HC-108	81,000	340	II	17	19	1255	500	119	84	1/8	1000

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

Steam Performance Data – Low Outlet Temperature Models

Table 9.1
Performance Data for Low Outlet Temperature Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air High Motor Speed

Type	Model No.	Btu/hr	Sq. Ft. EDR	Air Data: Sound Class ④	Maximum Mounting Height (ft.) ①		Heat Throw or Spread @ Max. Height ①		Cfm ②	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Condensate lb/hr	Motor Data: Hp	Approx. RPM
Horizontal Delivery ③	HSB/HC-18L	15,900	66	II	9		20		364	655	100	16	1/60	1550
	HSB/HC-24L	19,300	80	II	11		21		435	795	100	20	1/25	1550
	HSB/HC-33L	29,500	123	II	12		24		695	745	99	31	1/25	1550
	HSB/HC-47L	32,000	133	III	14		32		855	910	94	33	1/12	1550
	HSB/HC-63L	52,500	219	III	16		33		1170	710	101	54	1/12	1550
	HSB/HC-86L	61,500	256	III	17		36		1510	910	97	64	1/8	1625
	HSB/HC-108L	86,500	360	III	19		36		2150	825	97	90	1/8	1625
	HSB/HC-121L	88,000	367	III	18		29		2070	800	98	91	1/5	1075
	HSB/HC-165L	143,000	596	IV	21		45		3480	930	97	148	1/3	1075
	HSB/HC-258L	190,000	792	V	22		51		4655	750	98	197	1/2	1075
	HSB/HC-290L	207,000	863	V	23		53		5040	805	94	214	1/2	1075
	HSB/HC-340L	255,000	1063	V	23		53		5575	775	102	264	1/2	1075
Power Throw™ ③	PT/PTN-610L	470,000	1958	VI	22		154		2400	2445	97	486	1-1/2	1140
Vertical Delivery ③	V/VN-42L	33,000	138	II	13	**17**	20	**13**	960	835	94	34	1/30	1050
	V/VN-59L	44,000	183	II	16	**22**	24	**16**	1190	1035	96	45	1/30	1050
	V/VN-78L	62,000	258	II	19	**26**	29	**19**	1740	1070	95	65	1/15	1050
	V/VN-95L	71,000	296	II	19	**26**	29	**19**	1760	1180	99	73	1/15	1050
	V/VN-139L	103,000	429	III	23	**31**	35	**23**	2860	1380	95	106	1/6	1075
	V/VN-161L	127,000	529	IV	26	**35**	39	**26**	3400	1640	96	132	1/3	1075
	V/VN-193L	149,000	621	IV	27	**36**	41	**27**	3710	1790	99	154	1/3	1075
	V/VN-212L	163,000	679	IV	27	**36**	41	**27**	3830	1845	102	169	1/3	1075
	V/VN-247L	190,000	792	V	32	**42**	48	**32**	5110	2030	96	197	1/2	1075
	V/VN-279L	215,000	896	V	36	**45**	54	**36**	5790	2300	96	222	1/2	1075
	V/VN-333L	256,000	1067	V	36	**45**	54	**36**	6340	2300	100	265	3/4	1140
	V/VN-385L	296,000	1233	VI	36	**43**	54	**36**	8140	1970	95	307	1	1140
	V/VN-500L	385,000	1604	VI	45	**54**	68	**45**	11,000	2670	94	400	1-1/2	1140
	V/VN-610L	470,000	1958	VI	44	**52**	66	**44**	12,400	2445	97	485	1-1/2	1140
	V-952L	733,000	3055	VI	45	**61**	68	**68**	12,940	2450	115	759	2	1140

Table 9.2
Performance Data for Low Outlet Temperature Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air Reduced Motor Speed ④

Type	Model No.	Btu/hr	Sq. Ft. EDR	Air Data: Sound Class ④	Maximum Mounting Height (ft.) ①	Heat Throw @ Max. Height ①	Cfm ②	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Condensate lb/hr	Motor Data: Hp	Approx. RPM
Horizontal Delivery	HSB/HC-18L	12,000	51	I	9	12	230	425	108	12	1/60	1000
	HSB/HC-24L	14,400	60	1	11	13	265	490	109	15	1/25	1000
	HSB/HC-33L	22,000	92	I	12	14	430	470	107	23	1/25	1000
	HSB/HC-47L	24,300	101	II	14	19	540	580	101	25	1/12	1000
	HSB/HC-63L	39,500	164	II	16	20	725	445	109	41	1/12	1000
	HSB/HC-86L	46,000	192	II	17	22	925	565	105	48	1/8	1000
	HSB/HC-108L	65,000	270	II	19	22	1330	520	104	67	1/8	1000

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

HOT WATER PERFORMANCE DATA

200°F ENTERING WATER
60°F ENTERING AIR

20°F WATER TEMPERATURE DROP

Hot Water Performance Data – Standard Models

Table 10.1
Performance Data for Standard Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air High Motor Speed

Type	Model No.	Btu/hr.	Water Data: GPM	Water Data: Pressure Drop (Ft. of Water)	Water Data: Min/Max GPM	Air Data: Sound Class ④	Air Data: Maximum Mounting Height (ft.) ①	Air Data: Heat Throw or Spread @ Max. Height ①	Air Data: Cfm ②	Air Data: Outlet Velocity (Fpm)	Air Data: Final Air Temp. (°F)	Motor Data: Hp	Motor Data: Approx. RPM
Horizontal Delivery	HSB/HC-18	12,600	1.3	0.5	0.3 / 5.0	II	9	18	340	615	93	1/60	1550
	HSB/HC-24	16,200	1.7	0.8	0.3 / 5.0	II	10	19	370	675	100	1/25	1550
	HSB/HC-33	21,700	2.3	0.2	0.4 / 10.0	II	11	23	630	675	91	1/25	1550
	HSB/HC-47	30,900	3.2	0.4	0.4 / 10.0	III	13	30	730	785	98	1/12	1550
	HSB/HC-63	45,600	4.7	0.6	0.5 / 20.0	III	15	31	1120	680	97	1/12	1550
	HSB/HC-86	60,200	6.3	1.0	0.5 / 20.0	III	16	33	1340	820	101	1/8	1625
	HSB/HC-108	83,700	8.7	2.8	0.5 / 30.0	III	18	33	2010	775	98	1/8	1625
	HSB/HC-121	93,000	9.7	3.3	0.7 / 30.0	III	17	27	1775	700	107	1/5	1075
	HSB/HC-165	130,900	13.6	8.6	2.0 / 30.0	IV	20	43	3240	870	96	1/3	1075
	HSB/HC-193	143,000	14.9	1.4	2.0 / 50.0	IV	19	41	2900	790	105	1/3	1075
	HSB/HC-258	201,900	21.0	5.7	2.5 / 70.0	V	20	47	4560	740	100	1/2	1075
	HSB/HC-290	228,600	23.8	7.1	2.5 / 70.0	V	22	50	4590	750	105	1/2	1075
	HSB/HC-340	271,100	28.2	11.3	2.8 / 70.0	V	22	50	5130	720	108	1/2	1075
Power Throw™ ③	PT/PTN-279	192,300	20.0	0.2	4.5 / 60.0	V	17	108	5460	2165	94	1/2	1075
	PT/PTN-333	238,500	24.8	0.4	4.5 / 100.0	VI	18	117	5980	2165	99	3/4	1140
	PT/PTN-385	276,100	28.8	0.6	4.5 / 100.0	VI	18	124	7680	1860	95	1	1140
	PT/PTN-500	358,000	37.3	0.5	6.0 / 100.0	VI	19	138	10,390	2520	93	1-1/2	1140
	PT/PTN-610	450,400	46.9	1.0	6.0 / 100.0	VI	22	151	11,750	2315	97	1-1/2	1140
	PT-952	721,600	75.2	1.1	14.0 / 200.0	VI	23	150	12,166	2321	120	2	1140
Vertical Delivery ③	V/VN-42	30,100	3.1	0.6	0.5 / 10.0	II	12 **16**	18 **12**	950	825	90	1/30	1050
	V/VN-59	42,600	4.4	0.5	0.8 / 15.0	II	15 **20**	22 **15**	1155	1005	96	1/30	1050
	V/VN-78	57,000	5.9	0.5	1.0 / 20.0	II	16 **22**	24 **16**	1590	1065	95	1/15	1050
	V/VN-95	69,300	7.2	0.5	1.3 / 25.0	II	16 **22**	24 **16**	1665	1120	101	1/15	1050
	V/VN-139	106,600	11.1	2.6	1.0 / 30.0	III	19 **26**	29 **19**	2660	1285	99	1/6	1075
	V/VN-161	123,200	12.8	2.2	1.3 / 40.0	IV	21 **29**	32 **22**	2945	1420	101	1/3	1075
	V/VN-193	147,200	15.3	2.2	1.5 / 50.0	IV	23 **32**	35 **24**	3500	1690	101	1/3	1075
	V/VN-212	161,700	16.8	1.5	2.0 / 60.0	IV	23 **32**	35 **24**	3610	1740	104	1/3	1075
	V/VN-247	188,700	19.7	2.1	2.0 / 60.0	V	28 **37**	41 **28**	4820	1910	98	1/2	1075
	V/VN-279	212,600	22.2	2.1	2.3 / 75.0	V	32 **40**	48 **32**	5460	2165	98	1/2	1075
	V/VN-333	260,100	27.1	3.8	2.8 / 75.0	V	32 **40**	48 **32**	5980	2165	102	3/4	1140
	V/VN-385	302,100	31.5	5.0	3.3 / 75.0	VI	32 **39**	48 **32**	7680	1860	98	1	1140
	V/VN-500	391,700	40.8	4.8	3.0 / 100.0	VI	39 **47**	59 **40**	10,390	2520	96	1-1/2	1140
	V/VN-610	450,400	46.9	1.0	6.0 / 100.0	VI	38 **46**	57 **39**	11,750	2315	97	1-1/2	1140
	V-952	721,600	75.2	1.1	14.0 / 200.0	VI	39 **63**	59 **70**	12,166	2321	120	2	1140

Table 10.2
Performance Data for Standard Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air Reduced Motor Speeds ④

Type	Model No.	Btu/hr.	Water Data: GPM	Water Data: Pressure Drop (Ft. of Water)	Air Data: Sound Class ④	Air Data: Maximum Mounting Height (ft.) ①	Air Data: Heat Throw @ Max. Height ①	Air Data: Cfm ②	Air Data: Outlet Velocity (Fpm)	Air Data: Final Air Temp. (°F)	Motor Data: Hp	Motor Data: Approx. RPM
Horizontal Delivery	HSB/HC-18	9900	1.3	0.5	I	9	11	220	400	101	1/60	1000
	HSB/HC-24	12,400	1.7	0.8	I	10	12	230	425	109	1/25	1000
	HSB/HC-33	16,700	2.3	0.2	I	11	14	395	430	98	1/25	1000
	HSB/HC-47	23,600	3.2	0.4	II	13	18	450	490	107	1/12	1000
	HSB/HC-63	34,600	4.7	0.6	II	15	18	685	420	106	1/12	1000
	HSB/HC-86	45,900	6.3	1.0	II	16	20	825	515	110	1/8	1000
	HSB/HC-108	64,300	8.7	2.8	II	18	20	1255	490	106	1/8	1000

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Non-bolded mounting height/spread data is for units without deflectors.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

HOT WATER PERFORMANCE DATA

200°F ENTERING WATER
60°F ENTERING AIR

20°F WATER TEMPERATURE DROP

Hot Water Performance Data – Low Outlet Temperature Models

Table 11.1

Performance Data for Low Outlet Temperature Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air – High Motor Speed

			Water Data			Air Data						Motor Data	
Type	Model No.	Btu/hr.	GPM	Pressure Drop (Ft. of Water)	Min/Max GPM	Sound Class ④	Maximum Mounting Height (ft.) ①	Heat Throw or Spread @ Max. Height ①	Cfm ②	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Hp	Approx. RPM
Horizontal Delivery	HSB/HC-18L	11,300	1.2	0.4	0.3 / 5.0	II	10	21	364	650	88	1/60	1550
	HSB/HC-24L	13,700	1.4	0.6	0.3 / 5.0	II	12	22	435	775	88	1/25	1550
	HSB/HC-33L	19,300	2.0	0.2	0.4 / 10.0	II	13	26	695	730	85	1/25	1550
	HSB/HC-47L	21,100	2.2	0.2	0.4 / 10.0	III	15	34	855	890	82	1/12	1550
	HSB/HC-63L	37,900	4.0	0.4	0.5 / 20.0	III	17	35	1170	695	89	1/12	1550
	HSB/HC-86L	44,600	4.6	0.6	0.5 / 20.0	III	18	38	1510	890	87	1/8	1625
	HSB/HC-108L	66,100	6.9	1.8	0.8 / 30.0	III	20	38	2150	815	88	1/8	1625
	HSB/HC-121L	66,700	6.9	1.9	0.8 / 30.0	III	19	31	2070	785	89	1/5	1075
	HSB/HC-165L	113,200	11.8	6.6	2.0 / 30.0	IV	23	48	3480	920	89	1/3	1075
	HSB/HC-258L	147,400	15.4	3.2	2.5 / 70.0	V	23	54	4655	735	89	1/2	1075
	HSB/HC-290L	161,100	16.8	3.7	2.5 / 70.0	V	25	57	5040	800	89	1/2	1075
	HSB/HC-340L	200,900	20.9	6.6	2.5 / 70.0	V	25	57	5575	760	93	1/2	1075
Power Throw™ ③	PT/PTN-610L	344,900	35.9	0.6	6.0 / 100.0	VI	24	158	12,400	2445	86	1-1/2	1140
Vertical Delivery ③	V/VN-42L	23,000	2.4	0.4	0.5 / 10.0	II	14 **18**	21 **14**	960	835	83	1/30	1050
	V/VN-59L	32,600	3.4	0.3	0.8 / 15.0	II	17 **23**	25 **17**	1190	1035	86	1/30	1050
	V/VN-78L	43,600	4.5	0.3	1.0 / 20.0	II	20 **28**	31 **21**	1740	1170	84	1/15	1050
	V/VN-95L	53,100	5.5	0.3	1.3 / 25.0	II	20 **28**	31 **21**	1760	1180	89	1/15	1050
	V/VN-139L	81,200	8.5	1.6	1.0 / 30.0	III	24 **33**	37 **25**	2860	1380	87	1/6	1075
	V/VN-161L	93,900	9.8	1.3	1.3 / 40.0	IV	28 **37**	41 **28**	3400	1640	86	1/3	1075
	V/VN-193L	112,500	11.7	1.3	1.5 / 50.0	IV	29 **38**	43 **29**	3710	1790	89	1/3	1075
	V/VN-212L	123,400	12.9	0.9	2.0 / 60.0	IV	29 **38**	43 **29**	3,830	1845	91	1/3	1075
	V/VN-247L	143,600	15.0	1.2	2.0 / 60.0	V	34 **45**	51 **35**	5110	2030	87	1/2	1075
	V/VN-279L	162,200	16.9	1.2	2.3 / 75.0	V	38 **48**	57 **39**	5790	2300	87	1/2	1075
	V/VN-333L	198,300	20.7	2.3	2.3 / 75.0	V	38 **48**	57 **39**	6340	2300	90	3/4	1140
	V/VN-385L	229,100	23.9	3.0	2.3 / 75.0	VI	38 **46**	57 **49**	8140	1970	87	1	1140
	V/VN-500L	295,000	30.7	2.8	3.0 / 100.0	VI	48 **57**	72 **49**	11,000	2670	85	1-1/2	1140
	V/VN-610L	344,900	35.9	0.6	6.0 / 100.0	VI	47 **55**	70 **48**	12,400	2445	86	1-1/2	1140
	V-952L	546,700	56.9	0.7	14.0 / 100.0	VI	48 **61**	72 **68**	12,800	2440	102	2	1140

Table 11.2

Performance Data for Low Outlet Temperature Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air – Reduced Motor Speeds ④

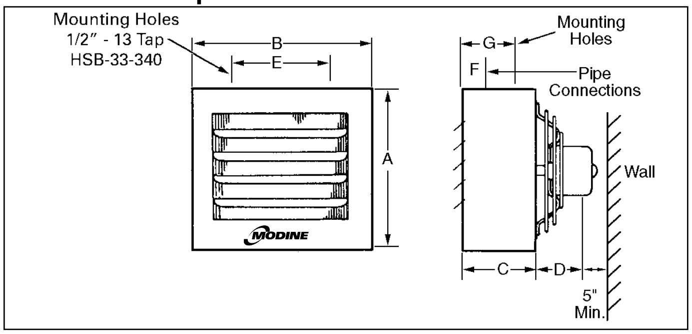
			Water Data		Air Data						Motor Data	
Type	Model No.	Btu/hr.	GPM	Pressure Drop (Ft. of Water)	Sound Class ④	Maximum Mounting Height (ft.) ①	Heat Throw @ Max. Height ①	Cfm ②	Outlet Velocity (Fpm)	Final Air Temp. (°F)	Hp	Approx. RPM
Horizontal Delivery	HSB/HC-18L	8700	1.2	0.4	I	10	13	230	410	94	1/60	1000
	HSB/HC-24L	10,400	1.4	0.6	I	12	14	265	475	95	1/25	1000
	HSB/HC-33L	14,700	2.0	0.2	I	13	16	430	455	91	1/25	1000
	HSB/HC-47L	16,300	2.2	0.2	II	15	21	540	570	87	1/12	1000
	HSB/HC-63L	29,000	4.0	0.4	II	17	21	725	435	96	1/12	1000
	HSB/HC-86L	33,900	4.6	0.6	II	18	23	925	550	93	1/8	1000
	HSB/HC-108L	50,500	6.9	1.8	II	20	23	1330	510	94	1/8	1000

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Non-bolded mounting height/spread data is for units without deflectors.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

DIMENSIONAL / MOTOR DATA

Horizontal Air Delivery Models — Two Styles

Model HSB - Top/Bottom — Inlet/Outlet



Model HC - Side Inlet/Outlet

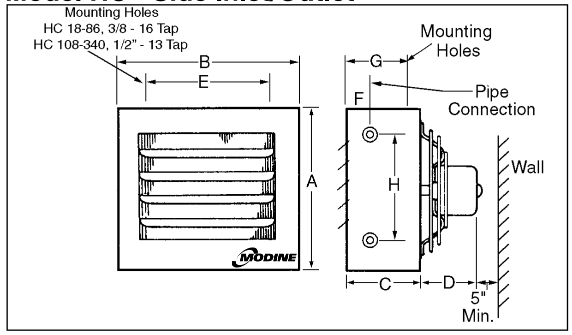


Table 12.1 - Model HSB and HC Dimensions ① ②

Model Number	A	B	C	D 115 Std. Motor	D 115V Exp. Motor	E	F	G	H	Female Connections NPT	Fan Diameter	Approx. Shipping Wt. lb.
HSB-18	12-3/8	13	6	5	12	-	3	-	-	3/4	9	16
HSB-24	12-3/8	13	6	6-1/2	12	-	3	-	-	3/4	9	20
HSB-33	16-3/8	17-1/2	8-3/4	6-1/2	12-1/4	11	3-5/8	6	-	1-1/4	12	34
HSB-47	16-3/8	17-1/2	8-3/4	8	12-1/4	11	3-5/8	6	-	1-1/4	12	36
HSB-63	20-7/16	21-1/2	8-3/4	8	12-3/4	15	3-5/8	6	-	1-1/4	14	48
HSB-86	20-7/16	21-1/2	8-3/4	9	12-3/4	15	3-5/8	6	-	1-1/4	14	52
HSB-108	24-7/16	25-1/2	9-1/2	8	11-1/2	18	3-3/4	6-3/8	-	1-1/4	18	74
HSB-121	24-7/16	25-1/2	9-1/2	7-1/2	11	18	3-3/4	6-3/8	-	1-1/4	18	76
HSB-165	30-1/2	30-1/2	9-1/4	9-1/2	14	21-1/4	3-3/4	6-3/8	-	1-1/4	22	92
HSB-193	30-1/2	30-1/2	9-1/4	9-1/2	14	21-1/4	3-3/4	6-3/8	-	1-1/4	22	98
HSB-258	38-1/2	38-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	7-7/8	-	1-1/4	22	162
HSB-290	38-1/2	38-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	7-7/8	-	1-1/4	24	168
HSB-340	38-1/2	44-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	7-7/8	-	1-1/4	24	176
HC-18	11-1/2	12-3/4	6	5	12	5-5/8	2-1/4	4-1/8	7-1/2	1/2	9	16
HC-24	11-1/2	12-3/4	6	6-1/2	12	5-5/8	2-1/4	4-1/8	7-1/2	1/2	9	20
HC-33	15	17-1/2	8-3/4	6-1/2	12-1/4	11	3-5/8	6	10	3/4	12	34
HC-47	15	17-1/2	8-3/4	8	12-1/4	11	3-5/8	6	10	3/4	12	35
HC-63	18-1/2	21-1/2	8-3/4	8	12-3/4	15	3-5/8	6	14	3/4	12	48
HC-86	18-1/2	21-1/2	8-3/4	9	12-3/4	15	3-5/8	6	14	3/4	14	52
HC-108	22-1/2	25-1/2	9-1/2	8	11-1/2	18	3-5/8	6-3/8	18	3/4	18	74
HC-121	22-1/2	25-1/2	9-1/2	7-1/2	11	18	3-5/8	6-3/8	18	3/4	18	76
HC-165	26-1/2	29-1/2	9-1/4	9-1/2	14	21-1/4	3-5/8	6-3/8	22	3/4	22	92
HC-193	30-1/2	32-1/2	9-1/4	9-1/2	14	21-1/4	3-5/8	4-3/4	26	1-1/4	22	98
HC-258	38-1/2	38-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	8	34	1-1/4	22	163
HC-290	38-1/2	38-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	8	34	1-1/4	24	168
HC-340	38-1/2	44-1/2	12-1/2	10-1/2	14	18-1/2	3-5/8	8	34	1-1/4	24	176

① All dimensions in inches. ② Dimensions shown are for Standard and Low Outlet Temperature Models.

Table 12.2 - Models HSB and HC Motor Ampere Ratings

Model Number	Motor HP ①	Totally Enclosed w/Thermal Overload 115/60/1 01 Amps	Totally Enclosed w/Thermal Overload 200/60/1 N/A Amps	Totally Enclosed w/Thermal Overload 230/60/1 02 Amps	Totally Enclosed w/Thermal Overload 200-208/60/3 04 Amps	Totally Enclosed w/Thermal Overload 230/460/3 05 Amps	Totally Enclosed w/Thermal Overload 575/60/3 10 Amps	Explosion Proof w/ Thermal Overload 115/60/1 06 Amps	Explosion Proof w/ Thermal Overload 230/460/60/3 09 Amps
HSB/HC-18	1/60	0.8	②	0.44	②	②	②	3.1	-
HSB/HC-24	1/25	1.6	②	0.44	②	②	②	3.1	-
HSB/HC-33	1/25	1.6	②	1	②	②	②	3.1	-
HSB/HC-47	1/12	2.2	②	1	②	②	②	3.1	-
HSB/HC-63	1/12	2.2	②	1	②	②	②	3.1	-
HSB/HC-86	1/8	2.3	②	1	②	②	②	3.1	-
HSB/HC-108	1/8	2.3	②	1	②	②	②	3.1	-
HSB/HC-121	1/5	2.8	②	1.5	②	②	②	4.1	1.5/0.75
HSB/HC-165	1/3	5.4	②	2.23	②	②	②	6.1	1.5/0.75
HSB/HC-193	1/3	5.4	②	2.23	②	②	②	6.1	1.5/0.75
HSB/HC-258	1/2	7.5	②	3.5	②	②	②	5.8	2.0/1.0
HSB/HC-290	1/2	7.5	②	3.5	②	②	②	5.8	2.0/1.0
HSB/HC-340	1/2	7.5	②	3.5	②	②	②	5.8	2.0/1.0

① All HSB/HC units motor HP listed for power code 01.

② For supply voltages of 200V/60Hz/1ph and all non-explosion proof 3 phase voltages of 200, 230, 460 and 575, Model Numbers indicated with Note ②, require that a 115V/60Hz/1 phase Power Code 01 unit heater be used with a shipped loose accessory transformer. See literature #1-556 for additional information.

DIMENSIONAL / MOTOR DATA

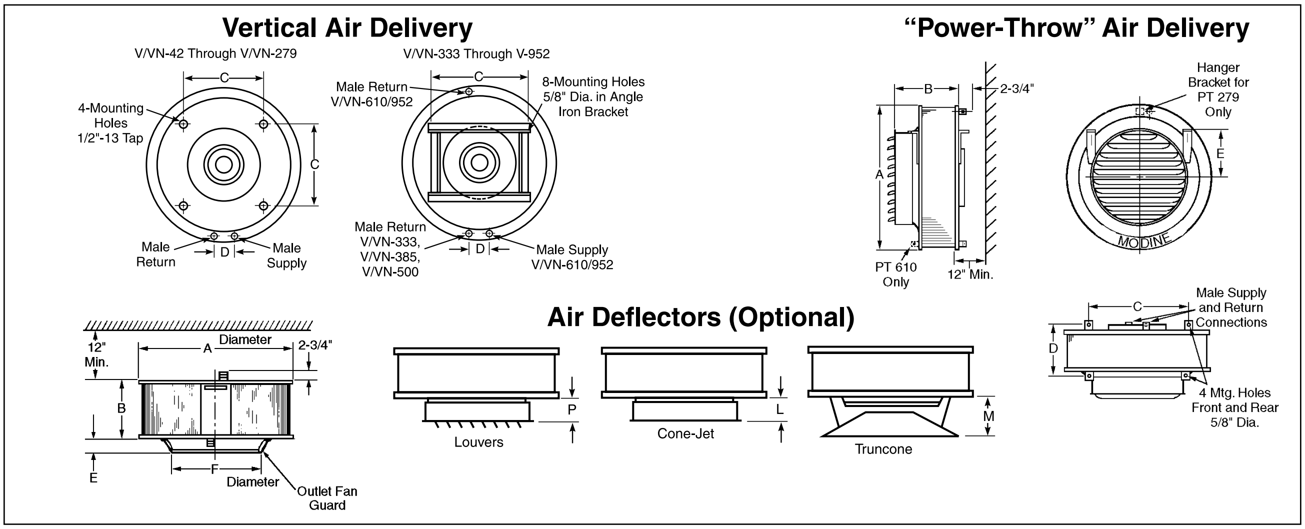


Table 13.1 - Models V/VN and PT/PTN Dimensions ①②

Model Number	A	B	C	D	E	F	L	M	N	P	Fan Dia.	Male Conn. NPT Top	Male Conn. NPT Bottom	Approx. Shipping Wt. Lbs.
V/VN-42	24-3/4	3-5/8	11-3/8	2-1/8	4-3/8	14-1/2	6-1/2	12	10-1/4	6-1/2	14	1-1/4	1-1/4	36
V/VN-59	24-3/4	5-1/8	11-3/8	2-1/8	4-3/8	14-1/2	6-1/2	12	10-1/4	6-1/2	14	1-1/4	1-1/4	42
V/VN-78	24-3/4	6-5/8	11-3/8	2-1/8	2-5/8	16-1/2	6-1/2	12	13	6-1/2	16	1-1/4	1-1/4	46
V/VN-95	24-3/4	8-1/8	11-3/8	2-1/8	2-5/8	16-1/2	6-1/2	12	13	6-1/2	16	1-1/4	1-1/4	48
V/VN-139	34-3/4	6-7/8	18-3/8	2-1/8	3	19-1/2	7-1/2	13	11-1/4	7-1/2	19	1-1/2	1	70
V/VN-161	34-3/4	8-3/8	18-3/8	2-1/8	3	19-1/2	7-1/2	13	11-1/4	7-1/2	19	1-1/2	1	80
V/VN-193	34-3/4	9-7/8	18-3/8	2-1/8	3	19-1/2	7-1/2	13	11-1/4	7-1/2	19	1-1/2	1	86
V/VN-212	34-3/4	12-7/8	18-3/8	2-1/2	3	19-1/2	7-1/2	13	11-1/4	7-1/2	19	2	1-1/4	94
V/VN-247	34-3/4	12-7/8	18-3/8	2-1/2	3	21-1/2	8	16	12-3/4	8	21	2	1-1/4	108
V/VN-279	34-3/4	14-3/8	18-3/8	2-1/2	3	21-1/2	8	16	12-3/4	8	21	2	1-1/4	112
V/VN-333	43-1/4	14-5/8	24	2-7/8	3-1/8	22-1/2	8-1/2	16	12	8-1/2	22	2-1/2	1-1/2	166
V/VN-385	43-1/4	14-1/2	24	2-7/8	3-1/2	27-1/2	10	21	14	10	27	2-1/2	1-1/2	168
V/VN-500	43-1/4	19	24	2-7/8	3-1/2	27-1/2	10	21	14	10	27	2-1/2	1-1/2	360
V/VN-610	51-1/2	19-1/8	29-7/8	—	3-3/4	30-1/2	10-1/2	21	—	10-1/2	30	2-1/2	1-1/2	450
V-952	53-3/4	21-1/8	30	—	3-1/2	31	—	22	—	18-3/4	30	3	3	487
PT/PTN-279	34-3/4	22-5/8	25-1/4	16-3/4	9-7/8	—	—	—	—	—	21	2	1-1/4	122
PT/PTN-333	43-1/4	22-7/8	30	15-3/4	14-3/8	—	—	—	—	—	22	2-1/2	1-1/2	176
PT/PTN-385	43-1/4	23-3/4	30	15-3/4	14-3/8	—	—	—	—	—	27	2-1/2	1-1/2	184
PT/PTN-500	43-1/4	29	30	20-1/4	14-3/8	—	—	—	—	—	27	2-1/2	1-1/2	376
PT/PTN-610	51-1/2	29-5/8	30	20-3/8	21	—	—	—	—	—	30	2-1/2	1-1/2	472
PT-952	53-3/4	26-3/8	30	23-1/8	26-7/8	—	—	—	—	—	30	3	3	487

① All dimensions in inches.
② Dimensions shown are for Standard and Low Outlet Temperature Models.

Table 13.2 - Models V/VN and PT/PTN Motor Ampere Rating

		Motor Type, Voltage and Power Code							
		Totally Enclosed w/Thermal Overload ②						Explosion Proof w/ Thermal Overload	
Model Number	Motor HP ①	115/60/1 01 Amps	200/60/1 N/A Amps	230/60/1 02 Amps	200-208/60/3 04 Amps	230/460/3 05 Amps	575/60/3 10 Amps	115/60/1 06 Amps	230/460/60/3 09 Amps
V/VN-42	1/30	1.9	③	1.28	③	③	③	4.1	-
V/VN-59	1/30	1.9	③	1.28	③	③	③	4.1	-
V/VN-78	1/15	2.4	③	1.28	③	③	③	4.1	-
V/VN-95	1/15	2.4	③	1.28	③	③	③	4.1	-
V/VN-139	1/5	2.8	③	1.5	③	③	③	4.1	1.5/.75
V/VN-161	1/3	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-193	1/3	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-212	1/3	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-247	1/2	7.5	③	3.5	③	③	③	5.8	2.0/1.0
V/VN, PT/PTN-279	1/2	7.5	③	3.5	③	③	③	5.8	2.0/1.0
V/VN, PT/PTN-333	3/4	8.8	③	4.4	③	③	③	-	-
V/VN, PT/PTN-385	1	-	-	-	4	4.0/2.0	4.6	-	3.5/1.75
V/VN, PT/PTN-500	1-1/2	-	-	-	5.8	5.2/2.6	2	-	5.8/2.9
V/VN, PT/PTN-610	1-1/2	-	-	-	5.8	5.2/2.6	2	-	5.8/2.9
V, PT-952	2	-	-	-	-	6.8/3.4	-	-	6.2/3.1

① V/VN-42 thru V/VN,PT/PTN-333 motor HP listed for power code 01. V/VN,PT/PTN333 thru V/VN,PT/PTN610 motor HP listed for power code 04 and V/PT-952 motor HP listed for power code 05.

② For model sizes V/VN/PT/PTN385 and above, motors for Power Codes 04, 05, and 10 do not have thermal overload protection.

③ For supply voltages of 200V/60Hz/1ph and all non-explosion proof 3 phase voltages of 200, 230, 460 and 575, Model Numbers indicated with Note ③, require that a 115V/60Hz/1 phase Power Code 01 unit heater be used with a shipped loose accessory transformer. See literature #1-556 for additional information.

MAINTENANCE / SERVICE

All heating equipment should be serviced before each heating season to assure proper operations. The following items may be required to have more frequent service scheduled based on the environment in which the unit is installed, and the frequency of the equipment operation.

Motors

A. Cleaning

Remove grease and dirt on motor during each inspection or lubrication. Open frame motors should be blown clean every heating season, or whenever condensers are cleaned, whichever is sooner.

B. Lubrication

1. Lubricate motor according to manufacturer's instructions located on the motor.
2. When no motor oiling instructions are on the motor, oil the motor every two thousand hours of operation with SAE20 motor oil for units in normal applications. Adjust oiling according to usage and atmosphere.
3. Some motors do not have oil fittings. These motors are lubricated for long life and do not require further lubrication.

C. Overload Protection

A change in line voltage higher or lower than motor nameplate rating may cause overheating and serious motor damage. Check plant voltage conditions. A separate manual starter with thermal overload protection device is recommended for those units that do not have motors with built-in overload protection.

Condensers

A. Cleaning

Clean condenser at least once a year; more often under unfavorable conditions. Unless condenser is kept reasonably free of dirt, lint and grease, its original heating capacity will be reduced — possibly to a serious degree, and motor damage may result.

Two commonly used cleaning methods are:

1. Loosen dirt by brushing fins on side where air enters condenser and then turn on fan to blow dirt from unit.
2. Use high pressure air hose to loosen dirt by blowing from side where air leaves condenser (side adjacent to louvers on blow-through units; side adjacent to fan on draw-through units).

For thorough cleaning of condenser, remove motor and fan and spray a mild alkaline cleaning solution over the condenser. After a few minutes, follow by a hot water rinse. (A steam gun can be used for spraying cleaning solution and hot water.)

Condensers subjected to corrosive fumes should be checked and cleaned frequently.

B. Internal Corrosion Safeguards

1. Provide controlled water treatment — don't use excess of boiler compounds. Contact your boiler compound supplier for proper usage or the services of a water treatment laboratory.
2. Periodic internal flushing of the coils is recommended in areas where water supply is suspected of causing scale. Use an alkaline-chelant solution and introduce it at the main pump of the hydronic system. Flush thoroughly.

WARNING: USING INORGANIC OR MINERAL ACIDS SUCH AS MURIATIC (HYDROCHLORIC) ACID, EVEN THOUGH INHIBITED, AMY LEAD TO SEVERE DAMAGE, INCLUDING CORROSION AND LEAKAGE.

3. De-aerate boiler feed-water (particularly if large amount of new water is used).
4. Insure rapid continuous and adequate condensate drainage by properly sized and installed traps and piping. Check traps for sticking. Clean strainers ahead of traps. (When traps don't work, condensate accumulates in unit heater coil; water hammer results.)

5.Adequately vent each unit.

6.Use low pressure steam when possible.

Casings

A. Cleaning

Periodic cleaning of casings is recommended to remove dirt, grease and corrosive substances that may injure finish. Rusted or corroded spots should be cleaned and repainted.

B. General Inspection

Tighten fan guard and motor bracket. Check fan for proper clearance, free rotation and firm connection to shaft.

When servicing is complete, tag unit to indicate date of inspection, lubrication and cleaning.

SERVICE

If a qualified service person cannot solve the problem, consult your local gas company of local Modine reppresentative.

When servicing, repairing or replacing parts on these units always give the complete Model Number and Serial Number from the unit identification plate. (See Figure 14.1)

Replacement Parts

When requesting parts please contact your local representative. Please have full model and serial number available.

Figure 14.1
Model Identification Plate

HYDRONIC UNIT HEATER

Model No.		Serial No.
HSB 108S01		05011298-0007
Motor HP	**Volts/Hertz/Phase**	**Amps**
1/8	115/60/1	2.3
Location Designation		**CSA File No.**
Ordinary Location		0307470000

Modine Manufacturing Company
604 Liberty Lane, P.O. Box 308
West Kingston, Rhode Island 02893

5H73739B Rev G
BTL

COMMON PARTS

Motor	Fan	Coil
9F30212A	5H58108C4	3H32251C2

Units with Hazardous Location Designation are suitable for Class I Group D, Class II Groups F and G and Class III locations, and may be operated with maximum fluid pressure of 87 psig, per temperature code T3B.

WARNING: INSTALL UNIT AT LEAST 8 FT. ABOVE THE FLOOR AND OUT OF REACH.
ATTENTION: INSTALLER A 2.45M MINIMUM AU DESSUS DU SOL ET HORS D'ATTEINTE.

Made in U.S.A.

⚠ WARNING

When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete unit substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

Do not reuse any electrical component which has been wet. Such component must be replaced.

IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Table 15.1, refer to the applicable sections of the manual.

Table 15.1
Troubleshooting

Fails to Maintain Temperature

1. Undersized unit heater, boiler, pump or piping.
2. Excessive exhaust air (exhaust fans may have been added since heating installed).
3. Unit heater operating at lower speed when sized to operate at high speed.
4. Unit heater mounted too high — heated air not delivered to floor level.
5. Thermostat — improper location or setting, or not functioning.
6. Dirty or clogged condenser.

Unit Blows Cold Air

1. Manual shut-off valve closed.
2. Insufficient steam pressure of lack of hot water.
3. Aquastat not functioning.
4. Improper venting.
5. Steam trap not functioning.
6. Drip leg too short (steam system).
7. Return line plugged (steam system).
8. Pump undersized or not operating (hot water system).

Does Not Operate When Heat Needed

1. Defective motor or electrical connections.
2. Thermostat, aquastat or pressure limit control not functioning.

Fails to Deliver Heat to Floor

1. Units mounted too high.
2. Operating on low speed.
3. Final air temperature too high.
4. Louvers not adjusted properly.
5. Wrong type of diffuser (on verticals).
6. Undersized unit heater (insufficient air delivery).
7. Wrong type of unit (may require vertical delivery).
8. Cross ventilation or drafts.
9. Obstructions to air flow.

Noisy Unit

1. Loose bolts or screws.
2. Fan blade bent, out of balance.
3. Dirt accumulation on fan blades.
4. Fan hub or blade rivets loose.
5. Motor shaft thrust bearing worn.
6. Motor mounting bent, fan not positioned properly in venturi.
7. Unit mounted too rigidly, transmits vibration noise.
8. Conduit too rigid, transmits vibration noise.
9. BX cable touching unit heater, chatters as casing vibrates.

Unit Leaks

1. Loose connection.
2. Internal corrosion.

Employees Complain of Hot Blast

1. Air stream aimed directly at employees.
2. Louvers not adjusted properly.
3. Wrong type of diffuser (on verticals).
4. Excessive final air temperature.

Unit Operates Too Long

1. Thermostat installed on cold wall or otherwise improperly located.
2. Heavy exhaust fan load. (May have been increased since heating system was laid out).
3. Aquastat or pressure limit control not functioning properly.
4. Unit is undersized.

Frequent Motor Failure

1. Voltage fluctuations too high or too low.
2. Excessive or insufficient lubrication.
3. Wiring to motor undersized.
4. Improper electrical connections.
5. Motor operating in too high air temperature.
6. Restricted air flow through unit due to clogged condenser, closed louvers, too much duct work connected to unit.
7. Fan out of balance.
8. Unbalanced voltage on 3ϕ power.

Premature Failure

1. Severe internal corrosion due to condition of boiler water.

Condenser Failure

1. Severe internal corrosion from feedwater.
2. Type of boiler treatment.
3. Entrained air causing water hammer.
4. Too much outdoor air portion in freezing temperatures.
5. Continuous operation above 150 PSI (375°F)(steam systems).

WARRANTY

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

Heat Exchangers

For Seller's <u>non-separated combustion</u> Gas-Fired Unit Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Low Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 66 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

Heat Exchanger (Condensers) for all Seller's products except <u>non-separated combustion</u> Gas-Fired Unit Heaters and Infrared Heaters, all Burners except Infrared Heaters, and Sheet Metal for all Seller's products

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER (CONDENSER) OR BURNER WHICH SHALL, WITHIN ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

Burners

For Seller's Low Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 30 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

For Seller's High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY BURNER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 126 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

All Other Components Excluding Heat Exchanger (Condenser), Burner, and Sheet Metal

For all Seller's products except Direct-Fired Heaters and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY PART OR PARTS WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Direct-Fired Heaters and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW IS LIMITED TO REPAIR OR REPLACEMENT AT THE SELLER'S OPTION ANY PART OR PARTS WHICH SHALL WITHIN A PERIOD OF ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 18 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF THE SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

Modine Manufacturing Company has a continuous product improvement program; it reserves the right to change design and specifications without notice.

Commercial HVAC&R Division

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Phone: 1.800.828.4328
www.modine.com

1-550.25
5H70718A Rev. O

Septembre 2005

MANUEL D'INSTALLATION ET D'ENTRETIEN
Appareils de chauffage à la vapeur et à l'eau chaude

Modèle HSB
Débit horizontal
Entrée et sortie en haut et en bas

Modèle HC
Débit horizontal
Entrée et sortie sur le côté

Modèles V/VN
Débit vertical

Modèles PT/PTN
« Power-throw »

IMPORTANT

Ce manuel est spécifiquement destiné au personnel d'une entreprise qualifiée d'installation et d'entretien.
Toutes les opérations d'installation et d'entretien doivent être confiées à une entreprise qualifiée.

Inspection à la réception

1. L'appareil doit être inspecté à la livraison. Signaler immédiatement tout dommage au transporteur et aviser le représentant de votre distributeur local.
2. Vérifier la plaque signalétique pour déterminer si les caractéristiques de l'appareil correspondent à l'alimentation électrique disponible au point d'installation.
3. Inspecter l'appareil reçu pour vérifier qu'il est conforme à la description du produit commandé (y compris aux spécifications, s'il y a lieu).

Renseignements généraux

Les instructions d'installation et d'entretien contenues dans ce manuel s'appliquent à trois types d'appareils de chauffage à la vapeur ou à l'eau chaude qui devraient être installés selon leurs applications spécifiques de chauffage au plafond de façon à assurer le meilleur rendement possible.

Les échangeurs de cuivre sont garantis pour des pressions de vapeur et d'eau de 1033,50 kPa et/ou des températures de 190,56 °C; les tubes en cupronickel sont garantis pour des pressions de vapeur et d'eau de 1722,50 kPa et/ou des températures de 204,44°C. L'Association canadienne de normalisation (CSA) exige que les unités antidéflagrantes ne soient pas utilisées à des températures du fluide dépassant 165°C pour conserver leur homologation au sens du Code national de l'électricité, exigence T3B limitant la température en présence de poussière de céréales.

Les moteurs sont calculés pour un service continu. Ils peuvent tourner ainsi jusqu'à une température ambiante maximum de 104°F (40°C).

Les unités de chauffage sont homologuées par l'Association canadienne de normalisation et les échangeurs de chaleur le sont aussi sous le numéro CRN OH 9234.5.

⚠ ATTENTION

Sur les appareils de type vertical, il ne faut pas retirer la grille de protection du ventilateur.

Les unités de chauffage à vapeur à débit horizontal ou vertical sont disponibles en version standard et à basse température de sortie (B.T.S.). Les modèles à basse température de sortie sont surtout recommandés pour les installations de chauffage qui utilisent une pression de vapeur de 270 à 1033,50 kPa. À ces pressions de vapeur, ces modèles ont une température plus basse de l'air chaud avec une meilleure portée horizontale; de plus, comme les ailettes sont plus espacées, les échangeurs auront moins tendance à s'encrasser en atmosphère poussiéreuse.

Le numéro de modèle de chaque unité indique sa capacité nominale en milliers de KW pour une pression de vapeur de 13,78 kPa et une température d'entrée de l'air de 15,56°C. Par exemple, le modèle HSB-63 a une capacité de 18,46 KW pour de la vapeur à 13,78 kPa et de l'air froid à 15,56°C.

CE MANUEL DOIT ÊTRE REMIS AU PROPRIÉTAIRE DE L'INSTALLATION.
N'OUBLIEZ PAS DE LE LAISSER AU PROPRIÉTAIRE EN QUITTANT LE CHANTIER.

PRÉCAUTIONS PARTICULIÈRES / TABLE DES MATIÈRES / FACTEURS DE CONVERSION SI (MÉTRIQUES)

PRÉCAUTIONS PARTICULIÈRES

LES INSTRUCTIONS D'INSTALLATION ET D'ENTRETIEN DE CE MANUEL DOIVENT ÊTRE OBSERVÉES POUR ASSURER UN FONCTIONNEMENT SÉCURITAIRE, EFFICACE ET FIABLE. DE PLUS, LES PRÉCAUTIONS PARTICULIÈRES CI-APRÈS DOIVENT ÊTRE RIGOUREUSEMENT RESPECTÉES. LE NON-RESPECT DE CES ASPECTS CRITIQUES PEUT CAUSER DES DOMMAGES MATÉRIELS, DES BLESSURES OU LA MORT. CES INSTRUCTIONS SONT SUBORDONNÉES À DES DISPOSITIONS PLUS RESTRICTIVES DES CODES PROVINCIAL OU NATIONAL.

HIÉRARCHIE DES NIVEAUX DE RISQUES

1. **DANGER :** Indique une situation qui, si elle se matérialise, ENTRAÎNERA INÉVITABLEMENT des accidents de personnes graves ou mortels.
2. **AVERTISSEMENT :** Indique une situation qui, si elle se matérialise, POURRAIT ENTRAÎNER des accidents de personnes graves ou mortels.
3. **ATTENTION :** Indique une situation qui, si elle se matérialise, POURRAIT ENTRAÎNER des accidents de personnes mineurs ou modérément graves.
4. **IMPORTANT :** Indique une situation qui, si elle se matérialise, POURRAIT ENTRAÎNER des risques pour la sécurité des personnes.

⚠ DANGER

Les appareils portant les codes de puissance 01, 02, 04, 05 et 10 doivent être installés de façon à ne pas être exposés à des atmosphères potentiellement explosives ou inflammables.

⚠ AVERTISSEMENT

1. Débrancher l'alimentation électrique avant de faire les connexions pour éviter les chocs électriques et les dommages à l'équipement.
2. Tous les branchements et câblages doivent être faits en stricte conformité avec le schéma fourni avec l'appareil. Tout câblage différent de celui du schéma peut créer des risques de dommages matériels ou de blessures.
3. Si un câblage d'origine doit être remplacé, il est impératif de le faire avec du fil ou du câble ayant une température nominale de 105°C ou plus.
4. Vérifier que la tension d'alimentation n'est pas supérieure de plus de 5% à la tension nominale inscrite sur la plaque de l'appareil.
5. Pour l'entretien et les réparations de cet appareil, n'utiliser que des pièces d'origine certifiées. Pour la liste complète des pièces de rechange, consulter Modine Manufacturing Company. Le numéro de modèle complet, le numéro de série et l'adresse du fabricant figurent sur la plaque signalétique fixée à l'appareil. Toute substitution de pièce ou d'organe de commande non approuvé par le fabricant engage la responsabilité du propriétaire.

⚠ ATTENTION

1. Sur les appareils de type vertical, il ne faut pas retirer la grille de protection du ventilateur.
2. Ne pas installer l'appareil à moins de 2,44 m de hauteur, mesuré entre le bas de l'appareil et le plancher.
3. Ne jamais réutiliser un composant électrique qui a été atteint par l'eau. Ces composants doivent être remplacés.
4. Vérifier que la tension d'alimentation n'est pas inférieure de plus de 5 % à la tension nominale inscrite sur la plaque de l'appareil.

IMPORTANT

1. Les procédures de mise en service et de réglage initial devraient être confiées à une entreprise qualifiée pour l'entretien de ces appareils.
2. Pour essayer la plupart des Solutions possibles suggérées dans le tableau de dépannage 15.1, reportez-vous aux sections correspondantes du manuel.

Table des matières

FACTEURS DE CONVERSION SI (SYSTÈME MÉTRIQUE) Tableau 2.1

Pour convertir	Multiplier par	Pour obtenir
po d'eau.	0.249	kPa
°F	(°F-32) x 5/9	°C
BTU	1.06	kJ
BTU/pi^3	37.3	kJ/m^3
BTU/h	0.000293	kW
CFH (pi^3/h)	0.000472	m^3/min
CFH (pi^3/h)	0.00000787	m^3/s
CFM (pi^3/min)	0.0283	m^3/min
CFM (pi^3/min)	0.000472	m^3/s

Pour convertir	Multiplier par	Pour obtenir
pieds	0.305	m
Gal/h	0.00379	m^3/h
Gal/h	3.79	L/h
gallons	3.79	L
Puissance HP	746	W
pouces	25.4	mm
livres	0.454	kg
psig	6.89	kPa
psig	27.7	po d'eau.

EMPLACEMENT D'INSTALLATION / MONTAGE DE L'APPAREIL

EMPLACEMENT D'INSTALLATION

⚠ DANGER

Les appareils portant les codes de puissance 01, 02, 04, 05 et 10 doivent être installés de façon à ne pas être exposés à des atmosphères potentiellement explosives ou inflammables.

1. Ne pas installer les appareils dans des atmosphères où il y a des vapeurs ou des projections de substances corrosives.
2. Vérifier qu'il n'y a pas d'obstacles devant la prise d'air ou la sortie d'air chaud.
3. Les appareils à débit horizontal doivent être montés de façon que les flux d'air chaud balaient les parois exposées du local parallèlement ou obliquement, mais pas perpendiculairement. Les appareils doivent être espacés pour que leurs flux d'air chaud se renforcent les uns les autres. Voir la figure 3.1
4. Les piliers, machines et autres obstacles ne devraient pas perturber les flux d'air des appareils.
5. Dans les bâtiments exposés à un vent dominant, les appareils devraient être installé de façon à diriger la majeure partie du flux d'air chaud vers le mur situé au vent.
6. Les grandes étendues de vitrages ou les grandes portes qui sont fréquemment ouvertes devraient être couvertes par des appareils à « longue portée », tels que des « Power-Throw » qui créent un fort débit d'air horizontal.
7. Les appareils à débit vertical devraient généralement être installés au-dessus de la partie centrale de la zone à chauffer. Installer les appareils à débit horizontal le long des murs du même bâtiment, là où les pertes de chaleur sont les plus grandes. Voir la figure 3.3
8. Les appareils à débit horizontal ne devraient pas souffler directement vers les occupants. Les flux d'air de ces appareils devraient être dirigés le long des couloirs, vers le plancher dans les zones ouvertes ou le long des murs extérieurs.
9. S'il n'y a que des appareils à débit vertical, ils devraient être installés de façon que leurs flux forment un rideau isolant le long des murs. Voir la figure 3.2

Figure 3.1 - Disposition pour distribution horizontale

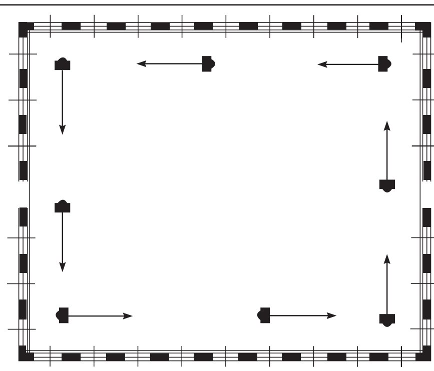


Figure 3.2 - Disposition des appareils verticaux pour chauffer un local étroit

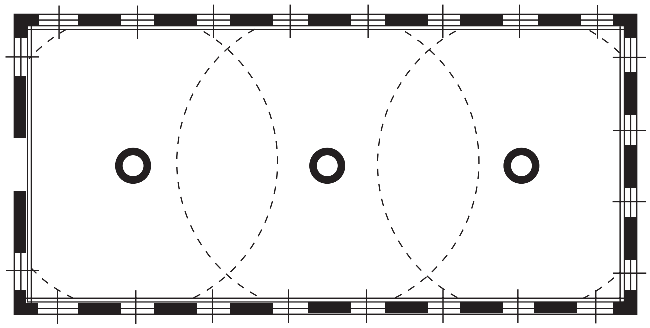
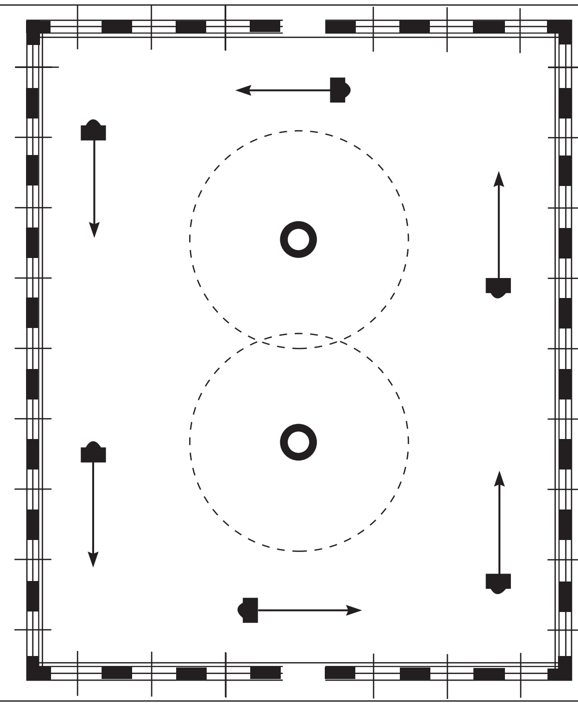


Figure 3.3
Combinaison d'appareils à débit horizontal et à débit vertical



MONTAGE DE L'APPAREIL

⚠ ATTENTION

Les appareils ne doivent pas être installés à une hauteur de moins de 8 pieds, mesurée entre le dessous et le plancher.

Ne pas installer l'appareil plus haut que les hauteurs maximum recommandées. La hauteur de montage de l'appareil est un aspect critique. Les hauteurs maximum de montage sont indiquées pour les divers modèles dans le Tableau 4.1 et les dimensions correspondantes sont données sur les Figures 4.3 à 4.7. Pour les modèles verticaux, les hauteurs maximum de montage sont données avec et sans les déflecteurs d'air en option. Les données du Tableau 4.1 sont basées sur les conditions de fonctionnement normales suivantes : vapeur à 13,78 kPa ou eau à 104,44°C et air froid à 15,56°C. Pour des conditions différentes, il faut appliquer un facteur de correction de hauteur maximum qui est donné à la Figure 4.2. Pour calculer la hauteur maximum de montage dans les conditions réelles, multiplier la hauteur donnée au Tableau 4.1 par le facteur de la Figure 4.2. La hauteur de montage maximale est le niveau pour lequel l'air chaud de l'appareil n'atteint plus le plancher dans les conditions normales d'utilisation.

Montage du déflecteur

Si un déflecteur en option est commandé pour un appareil vertical, il sera toujours livré séparément et devra être fixé à l'appareil avant sa suspension. Les registres à volets verticaux pour appareils horizontaux et les registres à volets horizontaux pour appareils « Power-Throw » doivent également être montés et réglés avant l'installation. Les déflecteurs à jet conique et à volets doivent être fixés au moyen de cornières et de vis mécaniques au carter inférieur de l'appareil. Consulter les instructions de montage fournies avec chaque déflecteur.

Selon la disposition des tuyauteries d'alimentation et de retour, il est possible que les tuyaux touchent certains déflecteurs d'air « Anemostat » sur les appareils à débit vertical. Vérifier les dimensions.

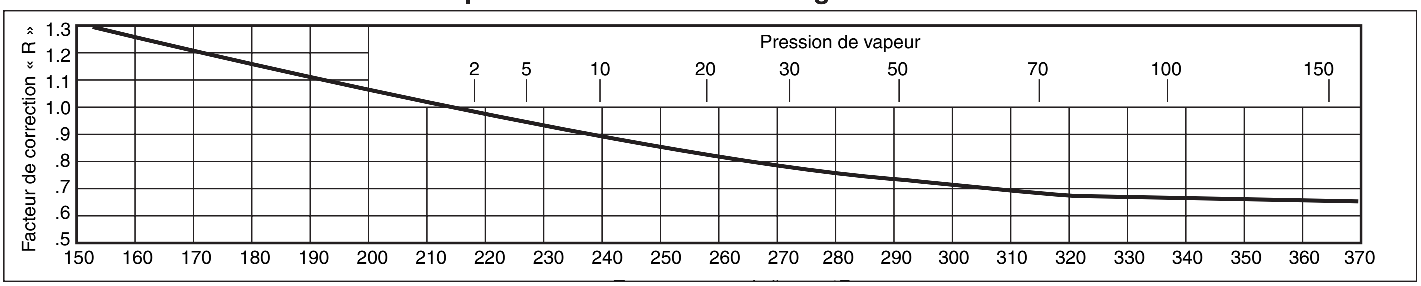
MONTAGE DE L'APPAREIL

Tableau 4.1 - Hauteurs de montage maximum

Type horizontal ①			« Power-Throw » Type ②			Type vertical avec déflecteurs ② — Sans déflecteur			Jet conique		Diffuseur tronconique		Volets	
Modèle N°	Hauteur (m) Std.	B.T.S.	Modèle N°	Hauteur (m) Std.	B.T.S.	Modèle N°	Hauteur (m) Std.	B.T.S.	Hauteur (m) Std.	B.T.S.	Hauteur (m) Std.	B.T.S.	Hauteur (m) Std.	B.T.A.
HSB/HC-18	2,44	2,75	—	—	—	V/VN-42 ②	3,36	3,97	4,58	5,19	2,44	2,75	3,97	4,58
HSB/HC-24	2,75	3,36	—	—	—	V/VN-59 ②	4,27	4,88	5,80	6,71	2,75	3,36	4,88	5,49
HSB/HC-33	3,05	3,66	—	—	—	V/VN-78 ②	4,58	5,80	6,10	7,93	3,36	4,27	5,19	6,71
HSB/HC-47	3,66	4,27	—	—	—	V/VN-95 ②	4,58	5,80	6,10	7,93	3,36	4,27	5,19	6,71
HSB/HC-63	4,27	4,88	—	—	—	V/VN-139 ②	5,49	7,02	7,32	9,46	3,97	5,19	6,41	7,93
HSB/HC-86	4,58	5,19	—	—	—	V/VN-161 ②	6,10	7,93	8,24	10,68	4,27	5,49	7,02	9,15
HSB/HC-108	5,19	5,80	—	—	—	V/VN-193 ②	6,71	8,24	9,15	10,98	4,88	5,80	7,63	9,46
HSB/HC-121	4,88	5,49	—	—	—	V/VN-212 ②	6,71	8,24	9,15	10,98	4,88	5,80	7,63	9,46
HSB/HC-165	5,80	6,41	—	—	—	V/VN-247 ②	7,93	9,76	10,37	12,81	5,19	6,41	9,15	11,29
HSB/HC-193	5,49	—	PT/PTN-279 ②	4,88	—	V/VN-279 ②	9,15	10,98	11,29	13,73	5,49	6,71	10,68	12,51
HSB/HC-258	5,80	6,71	PT/PTN-333 ②	5,19	—	V/VN-333 ②	9,15	10,98	11,29	13,73	5,19	6,10	10,68	12,51
HSB/HC-290	6,10	7,02	PT/PTN-385 ②	5,19	—	V/VN-385 ②	9,15	10,98	10,98	13,12	5,19	6,10	10,68	12,51
HSB/HC-340	6,10	7,02	PT/PTN-500 ②	5,49	—	V/VN-500 ②	11,29	13,73	13,42	16,47	5,80	7,32	12,81	15,56
—	—	—	PT/PTN-610 ②	6,10	6,71	V/VN-610 ②	10,98	13,42	13,12	15,86	5,80	7,32	12,51	15,25
—	—	—	PT-952	6,41	—	V-952 ②	11,29	13,73	13,73	18,61	13,73	16,17	—	—

① Avec volets horizontaux ouverts à 30° du plan vertical. Les modèles HSB ont leurs raccords en haut et en bas, les modèles HC ont leurs raccords sur le côté. Tous sont équipés de tubes en cuivre.
② Les modèles V et PT sont équipés de tubes en cuivre, les modèles VN et PTN de tubes en cupro-nickel.
Les hauteurs de montage indiquées sont des maximums pour des appareils fonctionnant en conditions standard (vapeur à 13,78 kPa ou eau à 104,44°C et air froid à 15,56°C). Les hauteurs indiquées pour les registres à volets ou les déflecteurs à jet conique le sont pour la position d'ouverture compète. Consulter la Figure 4.2 pour les facteurs de correction de hauteur si les conditions sont différentes. Les hauteurs de montage indiquées doivent être réduites si la temperature de l'air est supérieure à 15,56°C.

Tableau 4.2 - Facteurs de correction pour les hauteurs de montage maximum



Ces facteurs sont des multiplicateurs de correction des hauteurs de montage maximum à utiliser si la pression de vapeur est différente de 13,78 kPa ou si l'eau est à une température moyenne autre que 104,44°C.

Figure 4.3 - Appareil à débit horizontal

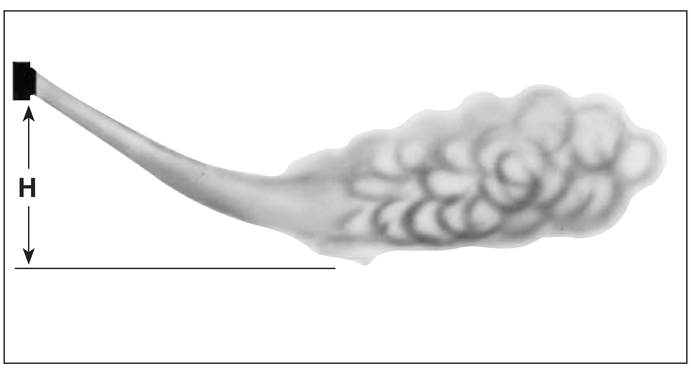


Figure 4.4 - Débit vertical orienté ou divisé par les volets

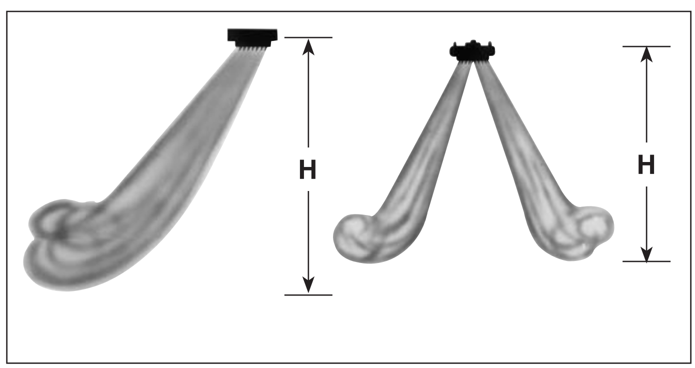


Figure 4.3 - Jet conique vertical

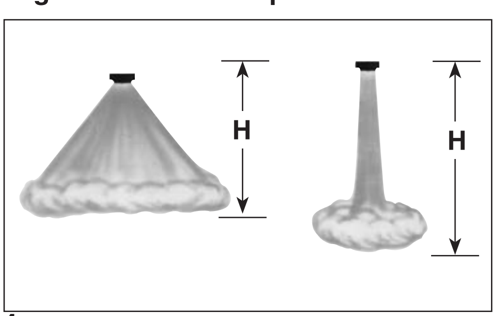
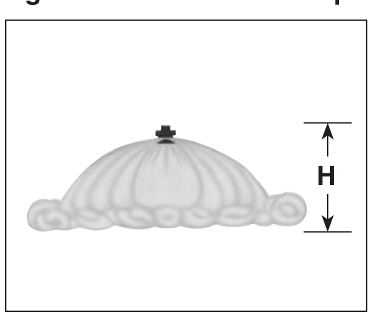


Figure 4.6 - Débit tronconique vertical



SUSPENSION ET INSTALLATION DE L'APPAREIL

SUSPENSION DE L'APPAREIL

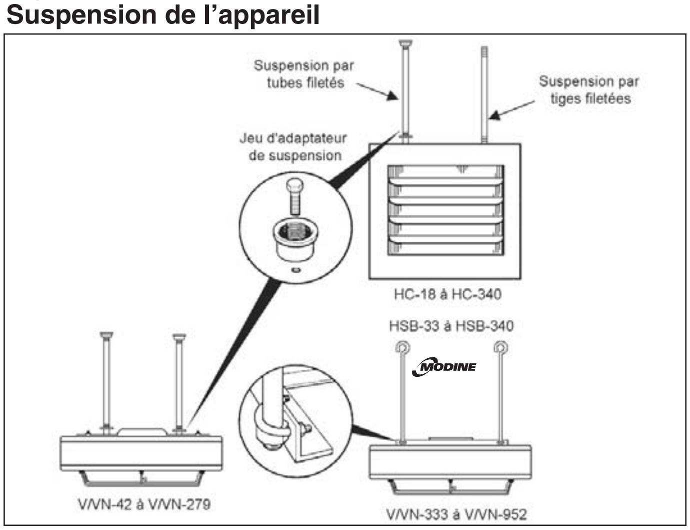
Modèles à débit horizontal, série HSB/HC. Tous les appareils à débit horizontal, sauf les modèles HSB-18 et HSB-24, comportent deux trous taraudés (1/2-13 po) sur le dessus pour leur suspension. Les modèles HSB-18 et HSB-24 n'ont pas besoin d'une suspension indépendante et peuvent être directement suspendus à leurs tuyaux d'alimentation. Les modèles HC ont deux trous taraudés (HC 18-86 3/8-16 po, HC 108-340 1/2-13 po) sur le dessus, pour la suspension. Des ferrures ou des colliers de tuyau sont recommandés et devraient être placés aussi près que possible de l'appareil de chauffage. Pour les autres modèles, la suspension indépendante peut se faire par des tiges filetées, des tuyaux ou des supports fixés au plafond. Voir la Figure 5.1.

Appareils à débit vertical. Les modèles à débit vertical V/VN-42 à V/VN-279 comportent quatre trous taraudés (1/2-13 po) sur leur couvercle supérieur pour la suspension. La suspension de ces modèles peut se faire par des tiges filetées, des tuyaux ou des supports fixés au plafond. Les modèles V/VN-333 à V/VN-952 sont équipés d'une cornière de montage ayant huit trous de 15,88 mm de diamètre permettant le levage avec des crochets et la suspension au moyen de câbles, si nécessaire. Les deux trous à chaque extrémité de la cornière sont prévus pour recevoir un étrier de 12,70 mm de diamètre, dont les branches sont écartées de 76,20 mm, pour une suspension par quatre tiges filetées, tuyaux ou supports.

Modèles Power-Throw à débit horizontal. Les modèles « Power-Throw » sont conçus pour propulser l'air horizontalement et sont équipés de ferrures de suspension. Trois supports sont fournis avec le modèle PT/PTN-279, un à l'avant et deux sur le panneau arrière, pour une suspension trois points. Sur les modèles PT/PTN-333 à PT/PTN-952, il n'y a que deux ferrures de suspension sur le panneau avant (pour une suspension quatre points, utiliser les deux ferrures du panneau avant et les deux trous des extrémités des cornières supérieures, à l'arrière de l'appareil). Chaque ferrure de suspension comporte un trou de 15,88 mm de diamètre pour le levage avec des crochets et la suspension au moyen de tiges filetées, de tubes ou de câbles.

Remarque : Les accessoires de suspension illustrés à la Figure 5.1 sont offerts en option par Modine. Cette trousse comprend deux bouchons de tuyaux percés 19,05 mm I.P.S., et deux vis machine facilitant la suspension avec des tubes filetés. Il suffit d'une trousse pour monter un modèle HSB 33-340 ou HC 108-340 à débit horizontal. Deux trousses sont nécessaires pour le montage d'un appareil modèle V/VN à débit vertical.

Figure 5.1
Suspension de l'appareil



Tuyauteries - voir Figure 6.1

1. Les tuyauteries d'alimentation et de retour de l'appareil doivent comporter des joints articulés pour permettre la dilatation et la contraction des tuyaux sans créer de contraintes excessives au niveau de l'appareil. Sur les systèmes à vapeur, les points de branchement doivent être au-dessus de l'axe du collecteur, autant pour l'alimentation que pour le retour.
2. Les tuyauteries d'alimentation et de retour doivent être munies de raccords union et de robinets-vannes pour permettre l'entretien ou le remplacement de l'appareil sans avoir à arrêter et à purger l'ensemble du système. Pour les systèmes à eau chaude, il faut ajouter un robinet d'équilibrage dans la tuyauterie de retour pour la régulation du débit d'eau. Il doit également y avoir un robinet de purge en dessous de chaque appareil pour permettre de vider l'eau du serpentin si la température du local est susceptible de descendre en dessous du point de congélation.
3. Dans les systèmes à vapeur ou à eau chaude, il est important d'avoir un moyen de purger rapidement l'air qui peut causer de la corrosion lorsqu'il est entraîné dans le circuit. Les systèmes à eau chaude devraient être équipés de purgeurs permettant d'éliminer rapidement et complètement l'air aux points hauts et aux extrémités des collecteurs d'alimentation et de retour. Sur les systèmes à vapeur, on peut obtenir le même résultat au moyen d'un purgeur à évacuation interne de l'air.
4. Un purgeur automatique doit être monté à la sortie de l'appareil. Consulter la documentation du fabricant pour des recommandations spécifiques. Chaque appareil à vapeur doit être muni d'un purgeur de section et de capacité suffisant pour laisser passer au moins deux fois le débit normal de condensat de l'appareil à la pression différentielle minimale. La capacité du purgeur est basée sur la différence de pression entre le collecteur d'alimentation et de retour. Les systèmes à vapeur doivent être équipés d'un purgeur à flotteur et thermostatique ou d'un purgeur à flotteur inversé à bypass d'air.
5. Il est recommandé de placer une crépine en amont de chaque purgeur de vapeur associé à un appareil. Cette crépine réduit la fréquence d'entretien des purgeurs. Elle doit être placée entre l'appareil et le purgeur, avec le même diamètre que le trou taraudé du purgeur. Pour retenir efficacement la saleté et le tartre, la crépine doit avoir un tamis dont les perforations sont plus petites que les orifices du purgeur.
6. Sur les systèmes dont le débit de vapeur vers les appareils est modulé ou réglé par une vanne à moteur, il faut également installer un casse-vide entre la sortie de l'appareil et le purgeur. Dans ce cas, le purgeur doit être de type thermostatique à flotteur.
7. Installer un collecteur d'impuretés au bas de l'appareil pour recueillir la saleté et le tartre, comme illustré. Le diamètre du tuyau doit être le même que celui des raccords de l'appareil, pour une longueur d'environ six pouces.
8. Le client doit fournir des tubes de suspension, des supports ou des ancrages permettant de suspendre les tuyauteries indépendamment de l'appareil.

Connexions électriques

⚠ AVERTISSEMENT

1. Débrancher l'alimentation électrique avant de faire les connexions pour éviter les chocs électriques et les dommages à l'équipement.
2. Tous les branchements et câblages doivent être faits en stricte conformité avec le schéma fourni avec l'appareil. Tout câblage différent de celui du schéma peut créer des risques de dommages matériels ou de blessures.
3. Si un câblage d'origine doit être remplacé, il est impératif de le faire avec du fil ou du câble ayant une température nominale de 105°C ou plus.
4. Vérifier que la tension d'alimentation n'est pas supérieure de plus de 5% à la tension nominale inscrite sur la plaque de l'appareil.

⚠ ATTENTION

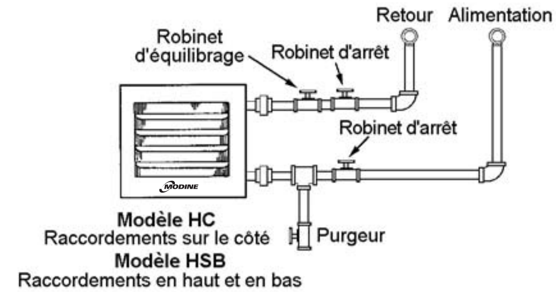
1. Les appareils ne doivent pas être installés à une hauteur de moins de 2,44 m, mesurée entre le dessous et le plancher.
2. Ne jamais réutiliser un composant électrique qui a été atteint par l'eau. Ces composants doivent être remplacés.
3. Vérifier que la tension d'alimentation n'est pas inférieure de plus de 5 % à la tension nominale inscrite sur la plaque de l'appareil.

1. L'installation doit se faire conformément aux codes locaux de la construction ou, à défaut de tels codes, conformément au National Electric Code ANSI/NFPA 70 - dernière édition. L'appareil doit être mis à la terre conformément à ce code. Au Canada, l'installation doit se faire selon le code de l'électricité CSA C22.1.

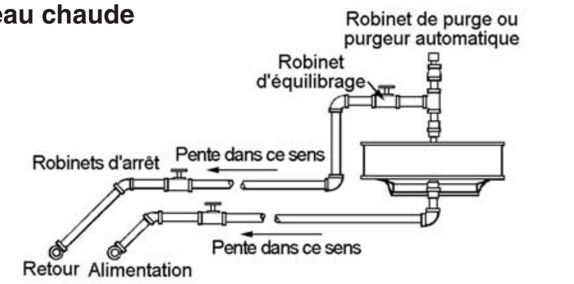
INSTALLATION ET FONCTIONNEMENT

Figure 6.1 - Disposition suggérée des tuyauteries

Systèmes à eau chaude

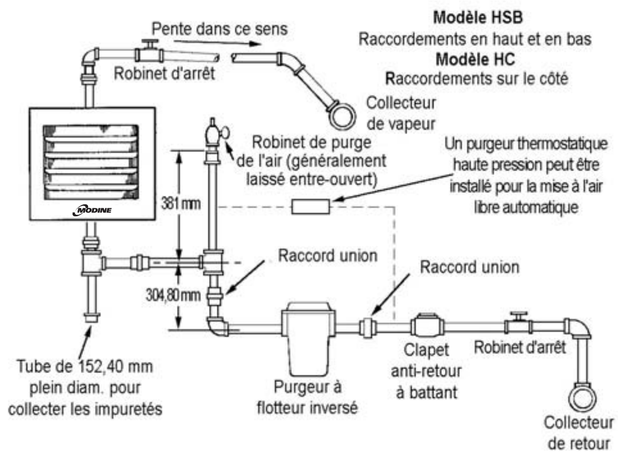


Appareil horizontal raccordé à un collecteur d'eau chaude en hauteur

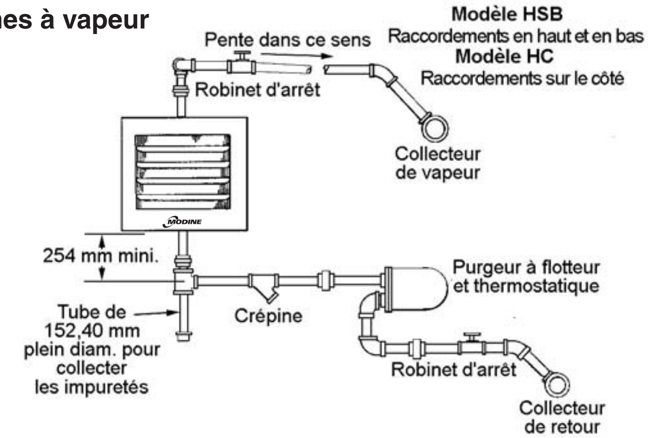


Appareil vertical raccordé à un collecteur d'eau chaude situé plus bas

Systèmes à vapeur



Raccordement de l'appareil pour un système à vapeur haute pression



Raccordement de l'appareil pour un système à vapeur basse pression — Retour ouvert par gravité ou à dépression

Connexions électriques (suite)

2. Le câblage électrique doit être dimensionné en fonction de l'ampérage maximum consommé par le moteur, le démarreur et toutes les commandes utilisées avec l'appareil de chauffage. Tous les modèles portant les codes d'alimentation 04, 05, 09 ou 10 (moteurs polyphasés) doivent être munis d'une protection contre les surintensités dans le circuit d'alimentation de l'installation. Les disjoncteurs de surintensité doivent être calculés en fonction de la charge nominale du moteur indiquée sur la plaque signalétique, selon les procédures du code de l'électricité applicable.

   Tous les appareils doivent être équipés d'une boîte de jonction. La boîte de jonction peut être intégrée au moteur ou fixée au carter de l'appareil. Les moteurs de type antidéflagrant sont munis d'une boîte de jonction de même catégorie.

   Les dommages et les défaillances des appareils Modine causés par des erreurs de branchement électrique ne sont pas couverts par la garantie standard.
3. Si un thermostat de température ambiante est fourni, il doit être installé dans un endroit où la circulation d'air est naturelle. Pour assurer une bonne régulation de température, le thermostat doit être monté à une hauteur de cinq pieds (1,5 m), en un point abrité de la chaleur de l'appareil et des autres sources de courant d'air. Suivre les instructions fournies avec le thermostat.
4. Les régulateurs de vitesse du ventilateur, fournis avec l'appareil, sont livrés séparément et doivent être branchés selon le schéma de câblage de chaque contrôleur.

FONCTIONNEMENT

Avant la mise en service

1. Vérifier que les fusibles sont en place dans tous les sectionneurs.
2. Vérifier que toutes les connexions électriques sont bien serrées.
3. Vérifier la rigidité du montage de l'appareil. Resserrer toutes les fixations, au besoin.
4. Inspecter les tuyauteries, les crépines, les purgeurs, les raccords, etc.

Mise en service

1. Régler le thermostat au minimum.
2. Mettre l'appareil sous tension.
3. Ouvrir le robinet d'arrêt du retour, puis le robinet d'alimentation.
4. Régler le thermostat à la position désirée.
5. Régler les volets (s'il y a lieu) pour obtenir la répartition désirée de la chaleur.
6. Pour vérifier la séquence de régulation, faire quelques cycles de démarrage et d'arrêt de l'appareil en augmentant et en abaissant le point de consigne du thermostat.
7. Vérifier que le ventilateur tourne librement. Le sens de la rotation est antihoraire vu de l'arrière (HSB/HC, PT/PTN), ou du dessus (V/VN) de l'appareil.

Fonctions de régulation automatique

Installer l'un des systèmes de commande suivants pour assurer une régulation automatique continue.

Ventilateur intermittent — Serpentin chaud

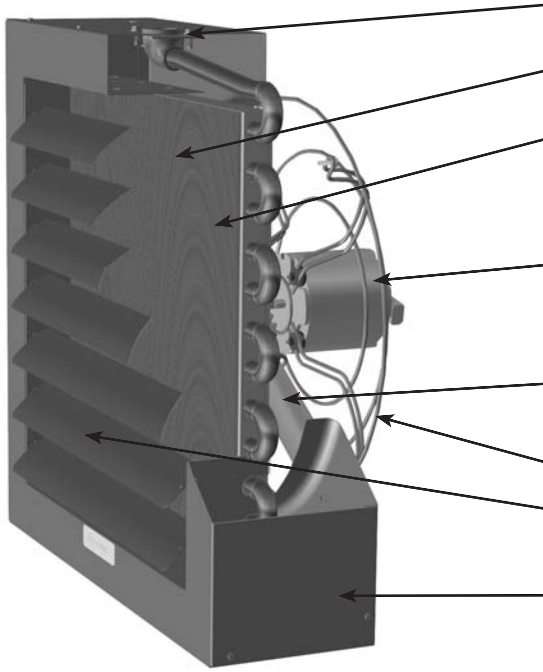
Le démarrage et l'arrêt du moteur du ventilateur sont commandés par un thermostat de température ambiante. Un aquastat est parfois fixé sur le tuyau de retour pour éviter que le ventilateur tourne quand l'appareil n'est pas alimenté en eau chaude ou en vapeur.

Fonctionnement continu du ventilateur — Régulation de la température du serpentin

Un thermostat de température ambiante commande la vanne qui ouvre l'arrivée de vapeur ou d'eau chaude au serpentin et la referme lorsque le thermostat détecte la température de consigne.

FONCTIONNEMENT

Figure 7.1
Coupe d'un appareil à débit horizontal



Raccords — de type femelle pour branchement direct de la tuyauterie. Les modèles HC ont des raccords en cuivre sur le côté de l'appareil.

Ailettes verticales — moins de risque d'accumulation de la poussière et de la saleté. Nettoyage réduit. Ailettes matricées pour améliorer leur résistance et le transfert de chaleur.

Serpentin — tout l'air passe à travers le serpentin pour un chauffage plus uniforme. La conception assure un contrôle optimal du débit d'air et de la température à la sortie de l'appareil. Ailettes en aluminium matricé pour plus de résistance et un meilleur transfert de chaleur. Les ailettes sont fixées mécaniquement au tube de cuivre du serpentin.

Moteur — tous les moteurs sont de type étanche. Les moteurs monophasés ont une protection thermique incorporée. Construction de qualité selon les normes NEMA. Les moteurs sont choisis et testés en fonction du modèle de ventilateur. Les câblages du moteur se terminent dans une boîte de jonction incorporée ou fournie avec l'appareil.

Ventilateur — hélice légère. Les pales sont équilibrées avec précision et leur pas ajusté pour brasser l'air efficacement et silencieusement — consommation minimale.

Grille de protection — équipement standard. Grille en fil d'acier boulonnée entourant complètement l'hélice.

Déflecteur à relais — les volets horizontaux sont standard — des volets verticaux sont standard sur les modèles HSB-258, HSB-290 et HSB-340, et optionnel sur les autres modèles horizontaux.

Carters — peinture robuste de couleur gris-vert, cuite au four pour une résistance optimale à la rouille et à la corrosion à long terme.

Figure 7.2
Boîte de jonction standard pour appareil à débit horizontal

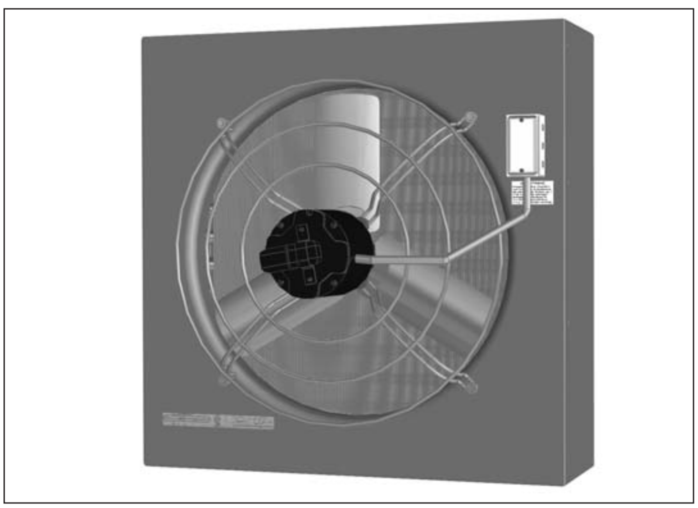


Figure 7.3
Appareil à débit horizontal avec grille de protection du ventilateur

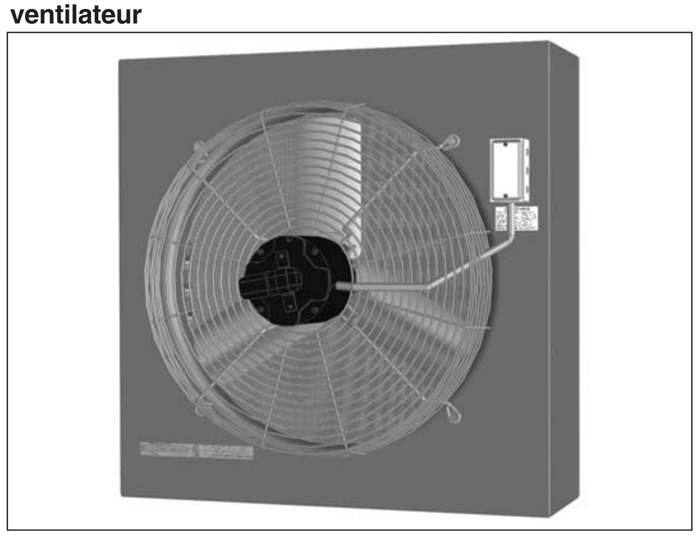
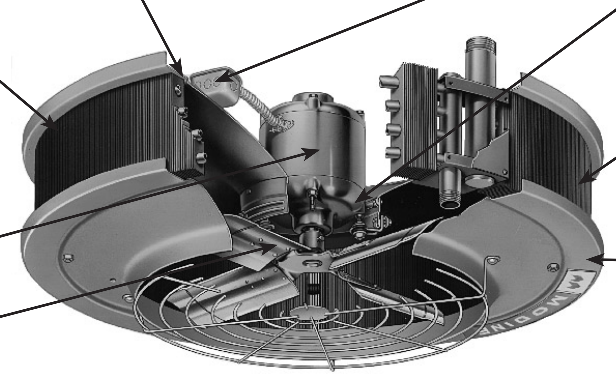


Figure 7.4
Coupe d'un appareil à débit vertical



Cône de protection du moteur — abrite le moteur de la chaleur du serpentin — prolonge la durée de vie de l'isolation, des enroulements et du lubrifiant. Prolonge la durée de vie du moteur.

Serpentin — ailettes en aluminium fixées mécaniquement sur les tubes pour un transfert de chaleur optimal. Tous les passages de vapeur ou d'eau chaude sont en tube de cuivre ou cupro-nickel avec des raccords d'acier renforcés.

Moteur — tous les moteurs sont de type étanche. Les moteurs monophasés ont une protection thermique incorporée. Les moteurs sont choisis et testés en fonction du modèle de ventilateur.

Ventilateur — équilibrage précis pour un fonctionnement silencieux et une consommation électrique minimale.

Boîte de jonction — facilite l'installation avec un point de connexion unique.

Moteur facilement démontable — le design de Modine permet de retirer le moteur par le dessous — important lorsque les appareils de chauffage sont installés près du plafond.

Ailettes verticales — moins de risque d'accumulation de la poussière et de la saleté. Surface extérieure facile à nettoyer au jet et à la brosse.

Carters — peinture robuste de couleur gris-vert, cuite au four pour une résistance optimale à la rouille et à la corrosion à long terme.

PERFORMANCES NOMINALES DES MODÈLES À VAPEUR

VAPEUR <SoftReturn>
2 PSI
AIR À 60° AIR

Performances vapeur

Tableau 8.1

**Performances des modèles standard dans les conditions normales : vapeur à 13,78 kPa et air froid à 15,56°C
Moteur à la vitesse rapide**

Type	Modèle N°	KW	EDR m^2	Données concernant l'air							Moteur	
				Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée de l'air chaud à la hauteur maxi. ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Condensat kg/h	W	Vitesse approx.
Débit horizontal	HSB/HC-18	5,27	6,97	II	2,44	17	9,62	190,50	41,67	8,63	12,43	1550
	HSB/HC-24	7,03	9,29	II	2,75	18	10,47	211,83	48,33	11,35	29,84	1550
	HSB/HC-33	9,67	12,82	II	3,05	21	17,83	210,31	42,22	15,44	29,84	1550
	HSB/HC-47	13,77	18,21	III	3,66	28	20,66	246,88	48,33	22,25	62,17	1550
	HSB/HC-63	18,46	24,43	III	4,27	29	31,70	210,31	43,89	29,51	62,17	1550
	HSB/HC-86	25,20	33,26	III	4,58	31	37,92	254,50	47,78	40,41	93,25	1625
	HSB/HC-108	31,46	41,81	III	5,19	31	55,88	240,79	42,78	50,85	93,25	1625
	HSB/HC-121	35,45	46,82	III	4,88	25	50,23	217,93	50,00	56,75	149,20	1075
	HSB/HC-165	48,35	63,92	IV	5,80	40	91,69	268,22	41,11	77,63	248,67	1075
	HSB/HC-193	56,55	74,69	IV	5,49	38	82,07	246,88	49,44	90,80	48,67	1075
	HSB/HC-258	75,59	99,87	V	5,80	44	129,05	228,60	43,89	121,22	373,00	1075
	HSB/HC-290	84,97	112,23	V	6,10	46	129,90	233,17	47,22	136,20	373,00	1075
	HSB/HC-340	99,62	131,64	V	6,10	46	145,18	224,02	48,89	159,81	373,00	1075
Power Throw™ ③	PT/PTN-279	81,75	108,05	V	4,88	100	154,52	659,89	43,89	131,21	373,00	1075
	PT/PTN-333	97,57	128,95	VI	5,19	110	169,23	659,89	46,67	156,63	559,50	1140
	PT/PTN-385	112,81	149,02	VI	5,19	115	217,34	566,92	43,33	180,69	746,00	1140
	PT/PTN-500	146,50	193,52	VI	5,49	130	294,04	768,09	42,22	234,72	1119,00	1140
	PT/PTN-610	178,73	236,16	VI	6,10	140	332,53	705,61	44,44	286,47	1119,00	1140
	PT-952	278,94	368,55	VI	6,41	145	344,41	707,44	59,44	447,19	1492,00	1140
Débit vertical ③	V/VN-42	12,31	16,26	II	3,66 **4,58**	17 **11**	26,89	251,46	39,44	19,52	24,87	1050
	V/VN-59	17,29	22,85	II	4,17 **5,80**	21 **14**	32,69	306,32	43,89	27,69	24,87	1050
	V/VN-78	22,85	30,19	II	4,58 **6,10**	23 **15**	45,00	324,61	42,78	36,77	49,73	1050
	V/VN-95	27,84	36,79	II	4,58 **6,10**	23 **15**	47,12	341,37	47,78	44,49	49,73	1050
	V/VN-139	40,73	53,79	III	5,49 **7,32**	27 **18**	75,28	391,66	44,44	65,38	124,33	1075
	V/VN-161	47,17	62,34	IV	6,10 **8,24**	30 **20**	83,34	432,81	46,11	75,82	248,67	1075
	V/VN-193	56,55	74,69	IV	6,71 **9,15**	33 **22**	99,05	515,11	46,67	90,80	248,67	1075
	V/VN-212	62,12	82,03	IV	6,71 **9,15**	33 **22**	102,16	530,35	48,89	99,43	248,67	1075
	V/VN-247	72,37	95,60	V	7,93 **10,37**	39 **26**	136,41	582,16	43,89	116,22	373,00	1075
	V/VN-279	81,75	108,05	V	9,15 **11,29**	45 **30**	154,52	659,89	43,89	131,21	373,00	1075
	V/VN-333	97,57	128,95	V	9,15 **11,29**	45 **30**	169,23	659,89	46,67	156,63	559,50	1140
	V/VN-385	112,81	149,02	VI	9,15 **10,98**	45 **30**	217,34	566,92	43,33	180,69	746,00	1140
	V/VN-500	146,50	193,52	VI	11,29 **13,42**	56 **37**	294,04	768,09	42,22	234,72	1119,00	1140
	V/VN-610	178,73	236,16	VI	10,98 **13,12**	54 **36**	332,53	705,61	44,44	286,47	1119,00	1140
	V-952	278,94	368,55	VI	11,29 **13,73**	56 **56**	344,41	707,44	59,44	447,19	1492,00	1140

Tableau 8.2

**Performances des modèles standard dans des conditions normales : vapeur à 13,78 kPa et air froid à 15,56°C
Moteur à la vitesse lente ④**

Type	Modèle N°	KW	EDR m^2	Données concernant l'air							Moteur	
				Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée à la hauteur maxi ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Condensat kg/h	W	Vitesse. approx.
Débit Horizontal	HSB/HC-18	4,10	5,39	I	2,44	10	6,23	126,49	47,78	6,36	12,43	1000
	HSB/HC-24	5,27	6,97	I	2,75	11	6,51	134,11	55,00	8,63	29,84	1000
	HSB/HC-33	7,33	9,66	I	3,05	13	11,18	134,11	47,78	11,80	29,84	1000
	HSB/HC-47	11,13	14,68	II	3,66	17	12,74	156,97	58,33	17,71	373,00	1000
	HSB/HC-63	13,77	18,12	II	4,27	17	19,39	131,06	50,00	22,25	373,00	1000
	HSB/HC-86	18,75	24,62	II	4,58	19	23,35	160,02	55,00	29,96	93,25	1000
	HSB/HC-108	23,73	31,59	II	5,19	19	35,52	152,40	48,33	38,14	93,25	1000

① Modèles horizontaux avec volets horizontaux ouverts à 30° du plan vertical. Les modèles verticaux avec déflecteur à jet conique avec volets ouverts au maximum sont indiqués en caractères gras.
② Le débit en m^3/min pour les modèles horizontaux est le DÉBIT D'ENTRÉE. Les débits en m^3/min pour les modèles verticaux et Power Throw™ sont les DÉBITS DE SORTIE.
② Les modèles V et PT sont équipés de tubes en cuivre, les modèles VN et PTN de tubes en cupro-nickel 90/10.
④ Nécessite un régulateur électronique de vitesse pour le moteur.

PERFORMANCES NOMINALES DES MODÈLES À VAPEUR

VAPEUR
<SoftReturn>
2 PSI
AIR À 60° AIR

Performances des modèles à vapeur – basse température de sortie

Tableau 9.1
Performances des modèles à basse température de sortie en conditions normales : vapeur à 13,78 kPa et air froid à 15,56°C
Moteur à la vitesse rapide

Type	Modèle N°	KW	EDR m^2	Données concernant l'air: Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée de l'air chaud à la hauteur maxi. ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Condensat kg/h	Moteur: W	Vitesse approx.
Débit horizontal ③	HSB/HC-18L	4,66	6,13	II	2,75	20	10,30	199,64	37,78	7,26	12,43	1550
	HSB/HC-24L	5,65	7,43	II	3,36	21	12,31	242,31	37,78	9,08	29,84	1550
	HSB/HC-33L	8,64	11,43	II	3,66	24	19,67	227,07	37,22	14,07	29,84	1550
	HSB/HC-47L	9,38	12,36	III	4,27	32	24,20	277,36	34,44	14,98	62,17	1550
	HSB/HC-63L	15,38	20,35	III	4,88	33	33,11	216,40	38,33	24,52	62,17	1550
	HSB/HC-86L	18,02	23,78	III	5,19	36	42,73	277,36	36,11	29,06	93,25	1625
	HSB/HC-108L	25,34	33,45	III	5,80	36	60,85	251,46	36,11	40,86	93,25	1625
	HSB/HC-121L	25,78	34,10	III	5,49	29	58,58	243,84	36,67	41,31	149,20	1075
	HSB/HC-165L	41,90	55,37	IV	6,41	45	98,48	283,46	36,11	67,19	248,67	1075
	HSB/HC-258L	55,67	73,58	V	6,71	51	131,74	228,60	36,67	89,44	373,00	1075
	HSB/HC-290L	60,65	80,18	V	7,02	53	142,63	245,36	34,44	97,16	373,00	1075
	HSB/HC-340L	74,72	98,76	V	7,02	53	157,77	236,22	38,89	119,86	373,00	1075
Power Throw™ ③	PT/PTN-610L	137,71	181,90	VI	6,71	154	67,92	745,23	36,11	220,64	1119,00	1140
Débit vertical ③	V/VN-42L	9,67	12,82	II	3,97 **5,19**	20 **13**	27,17	254,50	34,44	15,44	24,87	1050
	V/VN-59L	12,89	17,00	II	4,88 **6,71**	24 **16**	33,68	315,46	35,56	20,43	24,87	1050
	V/VN-78L	18,17	23,97	II	5,80 **7,93**	29 **19**	49,24	326,13	35,00	29,51	49,73	1050
	V/VN-95L	20,80	27,50	II	5,80 **7,93**	29 **19**	49,81	359,66	37,22	33,14	49,73	1050
	V/VN-139L	30,18	39,86	III	7,02 **9,46**	35 **23**	80,94	420,62	35,00	48,12	124,33	1075
	V/VN-161L	37,21	49,15	IV	7,93 **10,68**	39 **26**	96,22	499,87	35,56	59,93	248,67	1075
	V/VN-193L	43,66	57,69	IV	8,94 **10,98**	41 **27**	104,99	545,59	37,22	69,92	248,67	1075
	V/VN-212L	47,76	63,08	IV	8,94 **10,98**	41 **27**	108,39	562,35	38,89	76,73	248,67	1075
	V/VN-247L	55,67	73,58	V	9,76 **12,81**	48 **32**	144,61	618,74	35,56	89,44	373,00	1075
	V/VN-279L	63,00	83,24	V	10,98 **13,73**	54 **36**	163,86	701,04	35,56	100,79	373,00	1075
	V/VN-333L	75,01	99,13	V	10,98 **13,73**	54 **36**	179,42	701,04	37,78	120,31	559,50	1140
	V/VN-385L	86,13	114,55	VI	10,98 **13,12**	54 **36**	230,36	600,45	35,00	139,38	746,00	1140
	V/VN-500L	112,81	149,02	VI	13,73 **16,47**	68 **45**	311,30	813,81	34,44	181,60	1119,00	1140
	V/VN-610L	137,71	181,90	VI	13,42 **15,86**	66 **44**	350,92	745,23	36,11	220,19	1119,00	1140
	V-952L	214,77	283,82	VI	13,73 **18,61**	68 **68**	366,20	746,76	46,11	344,59	1492,00	1140

Tableau 9.2
Performances des modèles à basse température de sortie en conditions normales : vapeur à 13,78 kPa et air froid à 15,56°C
Moteur à la vitesse lente ④

Type	Modèle N°	KW	EDR m^2	Données concernant l'air: Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée à la hauteur maxi. ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Condensat kg/h	Moteur: W	Vitesse. approx.
Débit horizontal	HSB/HC-18L	3,52	4,74	I	2,75	12	6,51	129,54	42,22	5,45	12,43	1000
	HSB/HC-24L	4,22	5,57	1	3,36	13	7,50	149,35	42,78	6,81	29,84	1000
	HSB/HC-33L	6,45	8,55	I	3,66	14	12,17	143,25	41,67	10,44	29,84	1000
	HSB/HC-47L	7,12	9,38	II	4,27	19	15,28	176,78	38,33	11,35	62,17	1000
	HSB/HC-63L	11,57	15,24	II	4,88	20	20,52	135,63	42,78	18,61	62,17	1000
	HSB/HC-86L	13,48	17,84	II	5,19	22	26,18	172,21	40,56	21,79	93,25	1000
	HSB/HC-108L	19,05	25,08	II	5,80	22	37,64	158,49	40,00	30,42	93,25	1000

① Modèles horizontaux avec volets horizontaux ouverts à 30° du plan vertical. Les modèles verticaux avec déflecteur à jet conique avec volets ouverts au maximum sont indiqués en caractères gras.
② Le débit en m^3/min pour les modèles horizontaux est le DÉBIT D'ENTRÉE. Les débits en m^3/min pour les modèles verticaux et Power Throw™ sont les DÉBITS DE SORTIE.
② Les modèles V et PT sont équipés de tubes en cuivre, les modèles VN et PTN de tubes en cupro-nickel 90/10.
④ Nécessite un régulateur électronique de vitesse pour le moteur.

PERFORMANCES NOMINALES DES MODÈLES EAU CHAUDE

EAU D'ENTRÉE À 200°F ET AIR FROID À 60°F

CHUTE DE 20°F ENTRE L'ENTRÉE ET LA SORTIE

Performance eau chaude – Modèles standard

Tableau 10.1
Performances des modèles standard en conditions normales : eau d'entrée à 93,33°C, air froid à 15,56°C
Moteur tournant à la vitesse rapide

Type	Modèle N°	KW	Données eau			Données air							Moteur	
			lt/min	Perte de charge (pi colonne d'eau)	lt/min min/max	Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée de l'air chaud à la hauteur maxi. ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	W	Vitesse approx.
	HSB/HC-18	3,69	4,92	0.5	1,13 /18,92	II	2,74	18	9,62	187,45	33,89	12,43	1550
	HSB/HC-24	4,75	6,43	0.8	1,13 /18,92	II	3,05	19	10,47	205,74	37,78	29,48	1550
	HSB/HC-33	6,36	8,70	0.2	1,51 /37,85	II	3,35	23	17,82	205,74	32,78	29,48	1550
	HSB/HC-47	9,05	12,11	0.4	1,51 /37,85	III	3,96	30	20,65	239,27	36,67	62,17	1550
	HSB/HC-63	13,36	17,79	0.6	1,89/75,70	III	4,57	31	31,69	207,26	36,11	62,17	1550
Débit Horizontal	HSB/HC-86	17,64	23,84	1.0	1,89/75,70	III	4,88	33	37,92	249,94	38,33	93,25	1625
	HSB/HC-108	24,52	32,93	2.8	1,89/113,56	III	5,49	33	56,88	236,22	36,67	93,25	1625
	HSB/HC-121	27,25	36,71	3.3	2,64/113,56	III	5,18	27	50,23	213,36	41,67	149,20	1075
	HSB/HC-165	38,35	51,48	8.6	7,57/113,56	IV	6,10	43	91,69	265,18	35,56	248,67	1075
	HSB/HC-193	41,90	56,40	1.4	7,57/189,27	IV	5,79	41	82,07	240,79	40,56	248,67	1075
	HSB/HC-258	59,16	79,49	5.7	9,46/264,97	V	6,10	47	129,04	225,55	37,78	373,00	1075
	HSB/HC-290	66,98	90,09	7.1	9,46/264,97	V	6,71	50	129,89	228,60	40,56	373,00	1075
	HSB/HC-340	79,43	106,74	11.3	10,59/264,97	V	6,71	50	145,18	219,46	42,22	373,00	1075
	PT/PTN-279	56,34	75,70	0.2	17,03/227,12	V	5,18	108	154,51	659,89	34,44	373,00	1075
	PT/PTN-333	69,88	93,87	0.4	17,03/378,54	VI	5,49	117	169,23	659,89	37,22	559,50	1140
Power Throw™ ③	PT/PTN-385	80,90	109,01	0.6	17,03/378,54	VI	5,49	124	217,34	566,93	35,00	746,00	1140
	PT/PTN-500	104,89	141,19	0.5	22,71/378,54	VI	5,79	138	294,03	768,10	33,89	1119,00	1140
	PT/PTN-610	131,97	177,53	1.0	22,71/378,54	VI	6,71	151	332,52	705,61	36,11	1119,00	1140
	PT-952	211,43	284,66	1.1	53,00/757,08	VI	7,01	150	344,29	707,44	48,89	1492,00	1140
	V/VN-42	8,82	11,73	0.6	1,89/37,85	II	3,66 **4,88**	18 **12**	26,88	251,46	32,22	24,87	1050
	V/VN-59	12,48	16,65	0.5	3,02/56,78	II	4,57 **6,10**	22 **15**	32,68	306,32	35,56	24,87	1050
	V/VN-78	16,70	22,33	0.5	3,78/75,70	II	4,88 **6,71**	24 **16**	44,99	324,61	35,00	49,73	1050
	V/VN-95	20,30	27,25	0.5	4,92/94,63	II	4,88 **6,71**	24 **16**	47,11	341,38	38,33	49,73	1050
	V/VN-139	31,23	42,01	2.6	3,78/113,56	III	5,79 **7,93**	29 **19**	75,27	391,67	37,22	124,33	1075
Débit Vertical ③	V/VN-161	36,10	48,45	2.2	4,92/151,41	IV	6,40 **8,84**	32 **22**	83,34	432,82	38,33	248,67	1075
	V/VN-193	43,13	57,91	2.2	5,67/189,27	IV	7,01 **9,76**	35 **24**	99,05	515,11	38,33	248,67	1075
	V/VN-212	47,38	63,59	1.5	7,57/227,12	IV	7,01 **9,76**	35 **24**	102,16	530,35	40,00	248,67	1075
	V/VN-247	55,29	74,57	2.1	7,57/227,12	V	8,54 **11,28**	41 **28**	136,40	582,17	36,67	373,00	1075
	V/VN-279	62,29	74,03	2.1	8,70/283,90	V	9,76 **12,20**	48 **32**	154,51	659,89	36,67	373,00	1075
	V/VN-333	76,21	102,58	3.8	10,59/283,90	V	9,76 **12,20**	48 **32**	169,23	659,89	38,89	559,50	1140
	V/VN-385	88,52	119,24	5.0	12,49/283,90	VI	9,76 **11,89**	48 **32**	227,34	566,93	36,67	746,00	1140
	V/VN-500	114,77	154,44	4.8	11,35/378,54	VI	11,89 **14,33**	59 **40**	294,03	768,10	35,56	1119,00	1140
	V/VN-610	131,97	117,53	1.0	22,71/378,54	VI	11,59 **14,03**	57 **39**	332,52	705,61	36,11	1119,00	1140
	V-952	211,43	284,66	1.1	53,00/757,08	VI	11,89 **19,21**	59 **70**	344,29	707,44	48,89	1492,00	1140

Tableau 10.2
Performances des modèles standard en conditions normales : eau d'entrée à 93,33°C, air froid à 15,56°C
Moteur à la vitesse lente ④

Type	Modèle N°	KW	Données eau		Données air						Moteur	
			lt/min	Perte de charge (pi colonne d'eau)	Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée à la hauteur maxi ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	W	Vitesse approx.
	HSB/HC-18	2,90	4,92	0.5	I	2,74	11	6,22	121,92	38,33	12,43	1000
	HSB/HC-24	3,63	6,43	0.8	I	3,05	12	6,50	129,54	42,78	29,84	1000
Débit horizontal	HSB/HC-33	4,69	2,70	0.2	I	3,35	14	11,17	131,06	36,67	29,84	1000
	HSB/HC-47	6,91	12,11	0.4	II	3,96	18	12,73	149,35	41,67	62,17	1000
	HSB/HC-63	10,14	17,79	0.6	II	4,57	18	19,38	128,02	41,11	62,17	1000
	HSB/HC-86	13,45	23,84	1.0	II	4,88	20	23,34	156,97	43,33	93,25	1000
	HSB/HC-108	18,84	32,93	2.8	II	5,49	20	35,51	149,35	41,11	93,25	1000

① Modèles horizontaux avec volets horizontaux ouverts à 30° du plan vertical. Les modèles verticaux avec déflecteur à jet conique avec volets ouverts au maximum sont indiqués en caractères gras. Les hauteurs de montage en caractères ordinaires, correspondent à des données de hauteur et de portée SANS déflecteur.

② Le débit en m^3/min pour les modèles horizontaux est le DÉBIT D'ENTRÉE. Les débits en m^3/min pour les modèles verticaux et Power Throw™ sont les DÉBITS DE SORTIE.

② Les modèles V et PT sont équipés de tubes en cuivre, les modèles VN et PTN de tubes en cupro-nickel 90/10.

④ Nécessite un régulateur électronique de vitesse pour le moteur.

PERFORMANCES NOMINALES DES MODÈLES EAU CHAUDE

EAU D'ENTRÉE À 200°F ET AIR FROID À 60°F

CHUTE DE 20°F ENTRE L'ENTRÉE ET LA SORTIE

Performances des modèles à eau chaude – basse température de sortie

Tableau 11.1

Performances des modèles à basse température de sortie en conditions normales : eau d'entrée à 93,33°C et air froid à 15,56°C – Moteur à la vitesse rapide

Type	Modèle N°	KW	Données eau: lt/min	Perte de charge (pi colonne d'eau)	lt/min min/max	Données air: Classe de bruit ④	Hauteur maximum de montage (m) ①		Portée de l'air chaud à la hauteur maxi. ①		m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Moteur: W	Vitesse approx.
Débit Horizontal	HSB/HC-18L	3,31	4,54	0.4	1,13/18,92	II	3,05		21		10,30	198,12	31,11	12,43	1550
	HSB/HC-24L	4,01	5,29	0.6	1,13/18,92	II	3,66		22		12,31	236,22	31,11	29,84	1550
	HSB/HC-33L	5,65	7,57	0.2	1,51/37,85	II	3,96		26		19,66	222,50	29,44	29,84	1550
	HSB/HC-47L	6,18	8,32	0.2	1,51/37,85	III	4,57		34		24,19	271,27	27,78	62,17	1550
	HSB/HC-63L	11,10	15,14	0.4	1,89/75,70	III	5,18		35		33,11	211,84	31,67	62,17	1550
	HSB/HC-86L	13,07	17,41	0.6	1,89/75,70	III	5,49		38		42,73	271,27	30,56	93,25	1625
	HSB/HC-108L	19,37	26,11	1.8	3,02/113,56	III	6,10		38		60,84	248,41	31,11	93,25	1625
	HSB/HC-121L	19,54	26,11	1.9	3,02/113,56	III	5,79		31		58,58	239,27	31,67	149,20	1075
	HSB/HC-165L	33,17	44,66	6.6	7,57/113,56	IV	7,01		48		98,48	280,42	31,67	248,67	1075
	HSB/HC-258L	43,19	58,29	3.2	9,46/264,97	V	7,01		54		131,73	224,03	31,67	373,00	1075
	HSB/HC-290L	47,20	63,59	3.7	9,46/264,97	V	7,62		57		142,63	243,84	31,67	373,00	1075
	HSB/HC-340L	58,86	79,11	6.6	9,46/264,97	V	7,62		57		157,77	231,65	33,89	373,00	1075
Power Throw™ ③	PT/PTN-610L	101,06	135,89	0,6	22,71/378,54	VI	7,32		158		350,92	745,24	30,00	1119,00	1140
Débit Vertical ③	V/VN-42L	6,74	9,08	0.4	1,89/37,85	II	4,27	**5,49**	21	**14**	27,16	254,51	28,33	24,87	1050
	V/VN-59L	9,55	12,87	0.3	3,02/56,78	II	5,18	**7,01**	25	**17**	33,67	315,47	30,00	24,87	1050
	V/VN-78L	12,77	17,03	0.3	3,78/75,70	II	6,10	**8,54**	31	**21**	49,24	356,62	28,89	49,73	1050
	V/VN-95L	15,56	20,81	0.3	4,92/94,63	II	6,10	**8,54**	31	**21**	49,80	359,66	31,67	49,73	1050
	V/VN-139L	23,79	32,17	1.6	3,78/113,56	III	7,32	**10,06**	37	**25**	80,93	420,62	30,56	124,33	1075
	V/VN-161L	27,51	37,09	1.3	4,92/151,42	IV	8,54	**11,28**	41	**28**	96,22	499,87	30,00	248,67	1075
	V/VN-193L	32,96	44,28	1.3	5,67/189,27	IV	8,84	**11,59**	43	**29**	104,99	545,59	31,67	248,67	1075
	V/VN-212L	36,16	48,83	0.9	7,57/227,12	IV	8,84	**11,59**	43	**29**	108,38	562,36	32,78	248,67	1075
	V/VN-247L	42,07	56,78	1.2	7,57/227,12	V	10,37	**13,72**	51	**35**	144,61	618,74	30,56	373,00	1075
	V/VN-279L	47,52	63,97	1.2	8,70/283,90	V	11,59	**14,64**	57	**39**	163,85	701,04	30,56	373,00	1075
	V/VN-333L	58,10	78,35	2.3	8,70/283,90	V	11,59	**14,64**	57	**39**	179,42	701,04	32,22	559,50	1140
	V/VN-385L	67,13	90,47	3.0	8,70/283,90	VI	11,59	**14,03**	57	**49**	230,36	600,46	30,56	746,00	1140
	V/VN-500L	86,44	116,21	2.8	11,35/378,54	VI	14,64	**17,38**	72	**49**	311,30	813,82	29,44	1119,00	1140
	V/VN-610L	101,06	135,89	0.6	22,71/378,54	VI	14,33	**16,77**	70	**48**	350,92	745,24	30,00	1119,00	1140
	V-952L	160,18	215,38	0.7	52,99/378,54	VI	14,64	**18,60**	72	**68**	362,24	743,71	38,89	1492,00	1140

Tableau 11.2

Performances des modèles à basse température de sortie en conditions normales : eau d'entrée à 93,33°C et air froid à 15,56°C – Moteur à la vitesse rapide ④

Type	Modèle N°	KW	Données eau: lt/min	Perte de charge (pi colonne d'eau)	Données air: Classe de bruit ④	Hauteur maximum de montage (m) ①	Portée à la hauteur maxi ①	m^3/min ②	Vitesse de sortie (m/min)	Temp. air finale (°C)	Moteur: W	Vitesse approx.
Débit Horizontal	HSB/HC-18L	2,55	4,54	0.4	I	3,05	13	6,50	124,97	34,44	12,43	1000
	HSB/HC-24L	3,05	5,29	0.6	I	3,66	14	7,49	144,78	35,00	29,84	1000
	HSB/HC-33L	4,31	7,57	0.2	I	3,96	16	12,16	138,68	32,78	29,84	1000
	HSB/HC-47L	4,78	8,32	0.2	II	4,57	21	15,28	173,74	30,56	62,17	1000
	HSB/HC-63L	8,50	15,14	0.4	II	5,18	21	20,51	132,59	35,56	62,17	1000
	HSB/HC-86L	9,93	17,41	0.6	II	5,49	23	26,17	167,64	33,89	93,25	1000
	HSB/HC-108L	14,80	26,11	1.8	II	6,10	23	37,63	155,45	34,44	93,25	1000

① Modèles horizontaux avec volets horizontaux ouverts à 30° du plan vertical. Les modèles verticaux avec déflecteur à jet conique avec volets ouverts au maximum sont indiqués en caractères gras. Les hauteurs de montage en caractères ordinaires, correspondent à des données de hauteur et de portée SANS déflecteur.

② Le débit en m^3/min pour les modèles horizontaux est le DÉBIT D'ENTRÉE. Les débits en m^3/min pour les modèles verticaux et Power Throw™ sont les DÉBITS DE SORTIE.

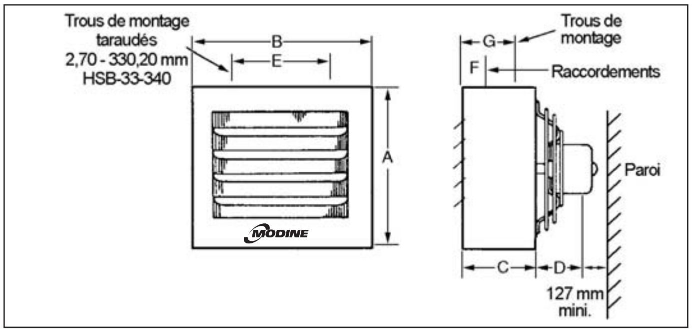
② Les modèles V et PT sont équipés de tubes en cuivre, les modèles VN et PTN de tubes en cupro-nickel 90/10.

④ Nécessite un régulateur électronique de vitesse pour le moteur.

DIMENSIONS / DONNÉES MOTEUR

Modèles à débit horizontal — Deux styles

Modèle HSB - Haut/Bas — Entrée/Sortie



Modèle HC - Entrée/Sortie sur le côté

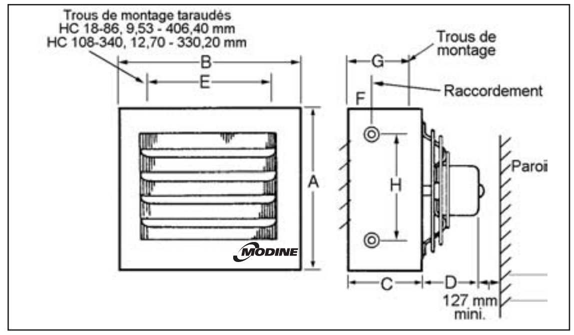


Tableau 12.1 - Dimensions des modèles HSB et HC ① ②

Numéro de modèle	A	B	C	D 115 Std. Moteur	D 115V Anti-défl. Moteur	E	F	G	H	Raccords femelles NPT	Diamètre ventilateur	Poids d'expédition approx. kg.
HSB-18	314,33	330,20	152,40	127,00	304,80	-	76,20	-	-	19,05	228,60	7,26
HSB-24	314,33	330,20	152,40	165,10	304,80	-	76,20	-	-	19,05	228,60	9,08
HSB-33	415,93	444,50	222,25	165,10	311,15	279,40	92,08	152,40	-	31,75	304,80	15,44
HSB-47	415,93	444,50	222,25	203,20	311,15	279,40	92,08	152,40	-	31,75	304,80	16,34
HSB-63	519,11	546,10	222,25	203,20	323,85	381,00	92,08	152,40	-	31,75	355,60	21,79
HSB-86	519,11	546,10	222,25	228,60	323,85	381,00	92,08	152,40	-	31,75	355,60	26,31
HSB-108	620,71	647,70	241,30	203,20	292,10	457,20	95,25	161,93	-	31,75	457,20	33,60
HSB-121	620,71	647,70	241,30	190,50	279,40	457,20	95,25	161,93	-	31,75	457,20	34,50
HSB-165	774,70	774,70	234,95	241,30	355,60	539,75	95,25	161,93	-	31,75	558,80	41,77
HSB-193	774,70	774,70	234,95	241,30	355,60	539,75	95,25	161,93	-	31,75	558,80	44,49
HSB-258	977,90	977,90	317,50	266,70	355,60	469,90	92,08	200,03	-	31,75	558,80	73,55
HSB-290	977,90	977,90	317,50	266,70	355,60	469,90	92,08	200,03	-	31,75	609,60	76,27
HSB-340	977,90	1130,30	317,50	266,70	355,60	469,90	92,08	200,03	-	31,75	609,60	79,90
HC-18	292,10	323,85	152,40	127,00	304,80	142,88	57,15	104,78	190,50	12,70	228,60	7,26
HC-24	292,10	323,85	152,40	165,10	304,80	142,88	57,15	104,78	190,50	12,70	228,60	9,08
HC-33	381,00	444,50	222,25	165,10	311,15	279,40	92,08	152,40	254,00	19,05	304,80	15,44
HC-47	381,00	444,50	222,25	203,20	311,15	279,40	92,08	152,40	254,00	19,05	304,80	15,89
HC-63	469,90	546,10	222,25	203,20	323,85	381,00	92,08	152,40	355,60	19,05	304,80	21,79
HC-86	469,90	546,10	222,25	228,60	323,85	381,00	92,08	152,40	355,60	19,05	355,60	23,61
HC-108	571,50	647,70	241,30	203,20	292,10	457,20	92,08	161,93	457,20	19,05	457,20	33,60
HC-121	571,50	647,70	241,30	190,50	279,40	457,20	92,08	161,93	457,20	19,05	457,20	34,50
HC-165	673,10	749,30	234,95	241,30	355,60	539,75	92,08	161,93	558,80	19,05	558,80	41,77
HC-193	774,70	32-1/2	234,95	241,30	355,60	539,75	92,08	120,65	660,40	31,75	558,80	44,49
HC-258	977,90	977,90	317,50	266,70	355,60	469,90	92,08	203,20	863,60	31,75	558,80	74,00
HC-290	977,90	977,90	317,50	266,70	355,60	469,90	92,08	203,20	863,60	31,75	609,60	76,27
HC-340	977,90	1130,30	317,50	266,70	355,60	469,90	92,08	203,20	863,60	31,75	609,60	79,90

① Toutes dimensions en mm. ② Dimensions pour les modèles standard et à basse température de sortie.

Tableau 12.2 - Modèles HSB et HC - Ampérages des moteurs

		Type, tension et code puissance du moteur							
		Totalement étanche avec protection thermique						Antidéflagrant avec protection thermique	
Numéro de modèle	Moteur W ①	115/60/1 01 A	200/60/1 S.O. A	230/60/1 02 A	200-208/60/3 04 A	230/460/3 05 A	575/60/3 10 A	115/60/1 06 A	230/460/60/3 09 A
HSB/HC-18	12,43	0.8	②	0.44	②	②	②	3.1	-
HSB/HC-24	29,84	1.6	②	0.44	②	②	②	3.1	-
HSB/HC-33	29,84	1.6	②	1	②	②	②	3.1	-
HSB/HC-47	62,17	2.2	②	1	②	②	②	3.1	-
HSB/HC-63	62,17	2.2	②	1	②	②	②	3.1	-
HSB/HC-86	93,25	2.3	②	1	②	②	②	3.1	-
HSB/HC-108	93,25	2.3	②	1	②	②	②	3.1	-
HSB/HC-121	149,20	2.8	②	1.5	②	②	②	4.1	1.5/0.75
HSB/HC-165	248,67	5.4	②	2.23	②	②	②	6.1	1.5/0.75
HSB/HC-193	248,67	5.4	②	2.23	②	②	②	6.1	1.5/0.75
HSB/HC-258	373,00	7.5	②	3.5	②	②	②	5.8	2.0/1.0
HSB/HC-290	373,00	7.5	②	3.5	②	②	②	5.8	2.0/1.0
HSB/HC-340	373,00	7.5	②	3.5	②	②	②	5.8	2.0/1.0

① W moteur pour tous modèles HSB/HC avec code puissance 01.
② Tous les types monophasés 200V/60Hz/1 et tous les types triphasés 200, 230, 460 et 575 V, Les numérols de modèle avec une note ②, nécessitent que les appareils 115V/60Hz/1 code puissance 01 soient utilisés avec un transformateur d'accessoires livré séparément. Voir la documentation #1-556 pour de plus amples informations.

DIMENSIONS / DONNÉES MOTEUR

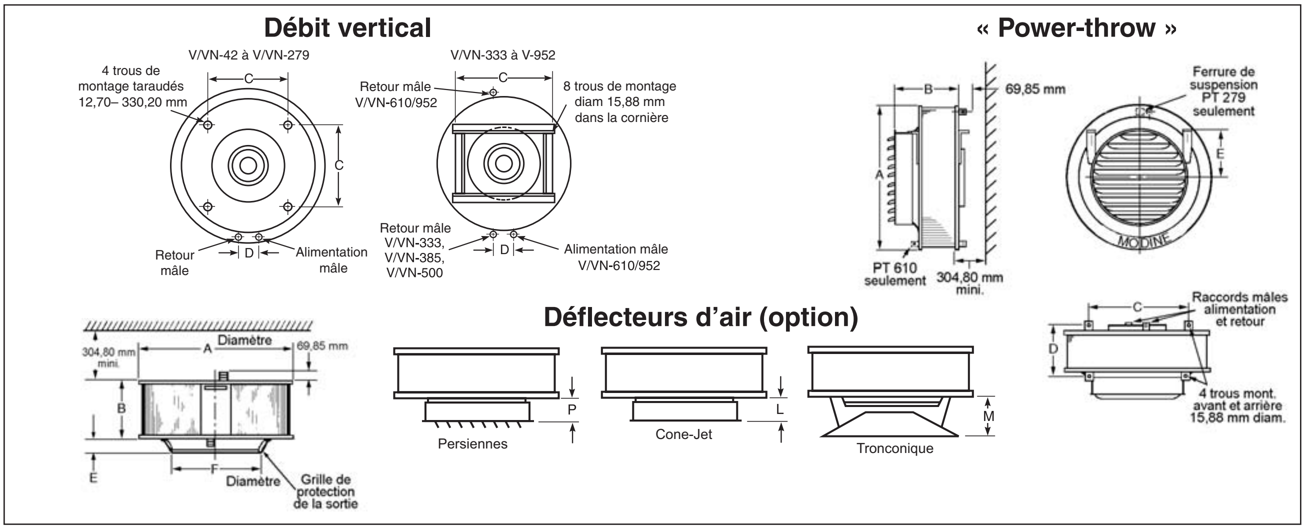


Tableau 13.1 - Dimensions des modèles V/VN et PT/PTN ① ②

Modèle N°	A	B	C	D	E	F	L	M	N	P	Ventilateur Dia.	Racc. mâle NPT Haut	Racc. mâle NPT Bas	Poids d'expédition approx. kg.
V/VN-42	628,65	92,08	288,93	53,98	111,13	368,30	165,10	304,80	260,35	165,10	355,60	31,75	31,75	16,34
V/VN-59	628,65	130,18	288,93	53,98	111,13	368,30	165,10	304,80	260,35	165,10	355,60	31,75	31,75	19,07
V/VN-78	628,65	168,28	288,93	53,98	66,68	419,10	165,10	304,80	330,20	165,10	406,40	31,75	31,75	20,88
V/VN-95	628,65	206,38	288,93	53,98	66,68	419,10	165,10	304,80	330,20	165,10	406,40	31,75	31,75	21,79
V/VN-139	882,65	174,63	466,73	53,98	76,20	495,30	190,50	330,20	285,75	190,50	482,60	38,10	25,40	31,78
V/VN-161	882,65	212,73	466,73	53,98	76,20	495,30	190,50	330,20	285,75	190,50	482,60	38,10	25,40	36,32
V/VN-193	882,65	250,83	466,73	53,98	76,20	495,30	190,50	330,20	285,75	190,50	482,60	38,10	25,40	39,04
V/VN-212	882,65	327,03	466,73	63,50	76,20	495,30	190,50	330,20	285,75	190,50	482,60	50,80	31,75	42,68
V/VN-247	882,65	327,03	466,73	63,50	76,20	546,10	203,20	406,40	323,85	203,20	533,40	50,80	31,75	49,03
V/VN-279	882,65	365,13	466,73	63,50	76,20	546,10	203,20	406,40	323,85	203,20	533,40	50,80	31,75	50,85
V/VN-333	1098,55	371,48	609,60	73,03	79,38	571,50	215,90	406,40	304,80	215,90	558,80	63,50	38,10	75,36
V/VN-385	1098,55	368,30	609,60	73,03	88,90	698,50	254,00	533,40	355,60	254,00	685,80	63,50	38,10	76,27
V/VN-500	1098,55	482,60	609,60	73,03	88,90	698,50	254,00	533,40	355,60	254,00	685,80	63,50	38,10	163,44
V/VN-610	1308,10	485,78	758,83	—	95,25	774,70	266,70	533,40	—	266,70	762,00	63,50	38,10	204,30
V-952	1365,25	536,58	762,00	—	88,90	787,40	—	558,80	—	476,25	762,00	76,20	76,20	221,10
PT/PTN-279	882,65	574,68	641,35	425,45	250,83	—	—	—	—	—	533,40	50,80	31,75	55,39
PT/PTN-333	1098,55	581,03	762,00	400,05	365,13	—	—	—	—	—	558,80	63,50	38,10	79,90
PT/PTN-385	1098,55	603,25	762,00	400,05	365,13	—	—	—	—	—	685,80	63,50	38,10	83,54
PT/PTN-500	1098,55	736,60	762,00	514,35	365,13	—	—	—	—	—	685,80	63,50	38,10	170,70
PT/PTN-610	1308,10	752,48	762,00	771,53	533,40	—	—	—	—	—	762,00	63,50	38,10	214,29
PT-952	1365,25	669,93	762,00	587,38	682,63	—	—	—	—	—	762,00	76,20	76,20	221,10

① Toutes dimensions en mm. ② Dimensions pour les modèles standard et à basse température de sortie.

Tableau 13.2 - Modèles V/VN et PT/PTN – Ampérage des moteurs

		Type, tension et code puissance du moteur							
		Totalement étanche avec protection thermique ②						Antidéflagrant avec protection thermique	
Numéro de modèle	Moteur W ①	115/60/1 01 A	200/60/1 S.O. A	230/60/1 02 A	200-208/60/3 04 A	230/460/3 05 A	575/60/3 10 A	115/60/1 06 A	230/460/60/3 09 A
V/VN-42	24,87	1.9	③	1.28	③	③	③	4.1	-
V/VN-59	24,87	1.9	③	1.28	③	③	③	4.1	-
V/VN-78	49,73	2.4	③	1.28	③	③	③	4.1	-
V/VN-95	49,73	2.4	③	1.28	③	③	③	4.1	-
V/VN-139	149,20	2.8	③	1.5	③	③	③	4.1	1.5/.75
V/VN-161	248,67	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-193	248,67	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-212	248,67	5.4	③	2.23	③	③	③	6.1	1.5/.75
V/VN-247	373,00	7.5	③	3.5	③	③	③	5.8	2.0/1.0
V/VN, PT/PTN-279	373,00	7.5	③	3.5	③	③	③	5.8	2.0/1.0
V/VN, PT/PTN-333	559,50	8.8	③	4.4	③	③	③	-	-
V/VN, PT/PTN-385	746,00	-	-	-	4	4.0/2.0	4.6	-	3.5/1.75
V/VN, PT/PTN-500	1119,00	-	-	-	5.8	5.2/2.6	2	-	5.8/2.9
V/VN, PT/PTN-610	1119,00	-	-	-	5.8	5.2/2.6	2	-	5.8/2.9
V, PT-952	1492,00	-	-	-	-	6.8/3.4	-	-	6.2/3.1

① V/VN-42 à V/VN,PT/PTN-333, moteurs listés pour code puissance 01. V/VN,PT/PTN333 à V/VN,PT/PTN610, moteurs listés pour code puissance 04 et V/PT-952, moteurs listés pour code puissance 05.

② Pour modèles V/VN/PT/PTN385 et au-dessus, les moteurs pour code puissance 04, 05, et 10 n'ont pas de protection thermique.

③ Pour les tensions d'alimentation de 200V/60Hz/1 et tous les moteurs triphasés antidéflagrants 200, 230, 460 et 575 V, les types accompagnés d'une note ③, nécessitent que les modèles 115V/60Hz/1 de code de puissance 01 soient utilisés avec un transformateur d'accessoires livré séparément. Voir la documentation #1-556 pour de plus amples informations.

MAINTENANCE / ENTRETIEN

Tout l'équipement de chauffage doit être entretenu avant la saison pour assurer un bon fonctionnement. Les points particuliers suivants doivent faire l'objet d'un entretien plus fréquent basé sur l'environnement dans lequel fonctionne le système et sur sa fréquence d'utilisation.

Moteurs

A. Nettoyage

Retirer la graisse et la saleté du moteur à chaque inspection ou graissage. Les moteurs à carcasse ouverte doivent être nettoyés à l'air comprimé avant chaque saison de chauffage ou en même temps que les échangeurs, si l'intervalle est plus fréquent.

B. Lubrication

1. Graisser les moteurs selon les instructions du fabricant (plaques du moteur).
2. En l'absence d'instructions de graissage du moteur, huiler les paliers après deux mille heures de fonctionnement avec de l'huile moteur SAE20 pour une utilisation normale. Ajuster la périodicité en fonction de l'utilisation et de l'environnement.
3. Certains moteurs ne comportent pas d'orifices de lubrification. Il sont graissés à vie et n'ont pas besoin d'autre lubrication.

C. Protection contre les surcharges

Une variation de la tension du secteur, en plus ou en moins par rapport à la tension nominale, peut causer une surchauffe et des dommages sérieux au moteur. Vérifier souvent la tension du secteur local. Il est recommandé d'utiliser un démarreur manuel séparé avec protection thermique pour tous les moteurs qui ne comportent pas une protection thermique incorporée.

Échangeurs

A. Nettoyage

Les échangeurs doivent être nettoyés au moins une fois par ans, et plus souvent si l'environnement est défavorable. Un échangeur encrassé de poussière, de déchets textiles ou de graisse perd sa capacité d'échange, parfois dans des proportions considérables, ce qui peut causer des dommages au moteur.

Les deux méthodes de nettoyage les plus courantes sont :

1. Brosser les ailettes du côté de l'entrée d'air de l'échangeur et faire fonctionner le ventilateur pour évacuer la poussière libre.
2. Utiliser un jet d'air comprimé sur le côté sortie de l'échangeur (près des volets sur les modèles où le ventilateur est derrière l'échangeur; côté ventilateur sur les autres).

Pour nettoyer à fond l'échangeur, retirer le moteur et le ventilateur avant de vaporiser une solution modérément alcaline sur les ailettes. Laisser agir quelques minutes et laver à l'eau chaude. (Pour les deux opérations, on peut utiliser un pistolet à vapeur.)

Les échangeurs exposés à des vapeurs corrosives doivent être vérifiés et nettoyés fréquemment.

B. Protection contre la corrosion interne

1. Utiliser de l'eau traitée, sans exagérer la quantité de produits pour chaudière. Le fournisseur du produit détartrant ou un laboratoire de traitement des eaux pourra donner des conseils utiles.
2. Si l'eau utilisée est très calcaire, il est recommandé de faire des rinçages périodiques du circuit du serpentin. Utiliser une solution alcaline-chelant introduite au niveau de la pompe principale du système hydronic. Rincer abondamment.

AVERTISSEMENT : L'EMPLOI D'ACIDES INORGANIQUES (MINÉRAL), COMME L'ACIDE CHLORHYDRIQUE (MURIATIQUE), MÊME INHIBÉS, PEUT CAUSER DES DOMMAGES GRAVES, DE LA CORROSION ET DES FUITES.

3. L'eau alimentaire de la chaudière doit être désaérée (particulièrement lorsqu'on ajoute un gros volume d'eau).
4. Assurer un écoulement rapide et continu du condensat en utilisant des tuyauteries et des purgeurs de diamètre convenable. Vérifier que les purgeurs fonctionnent. Nettoyer les crépines en amont des purgeurs. (Lorsque le purgeur ne fonctionne pas, le condensat s'accumule dans le serpentin et peut provoquer un effet de bélier hydraulique.)
5. Chaque appareil doit être convenablement mis à l'air libre.
6. Utiliser de la vapeur basse pression, dans la mesure du possible.

Carters

A. Nettoyage

Les carters devraient être nettoyés périodiquement pour enlever la saleté, la graisse et les substances corrosives qui risquent d'attaquer la peinture. Les zones de rouille ou de corrosion doivent être nettoyées et repeintes.

B. Inspection générale

Resserrer les fixations de la grille de protection et du support du moteur. Vérifier que l'hélice tourne librement, avec un jeu suffisant, et qu'elle est bien calée sur l'arbre.

À la fin d'une opération d'entretien, fixer sur l'équipement une étiquette indiquant la date d'inspection, de graissage et de nettoyage.

MAINTENANCE

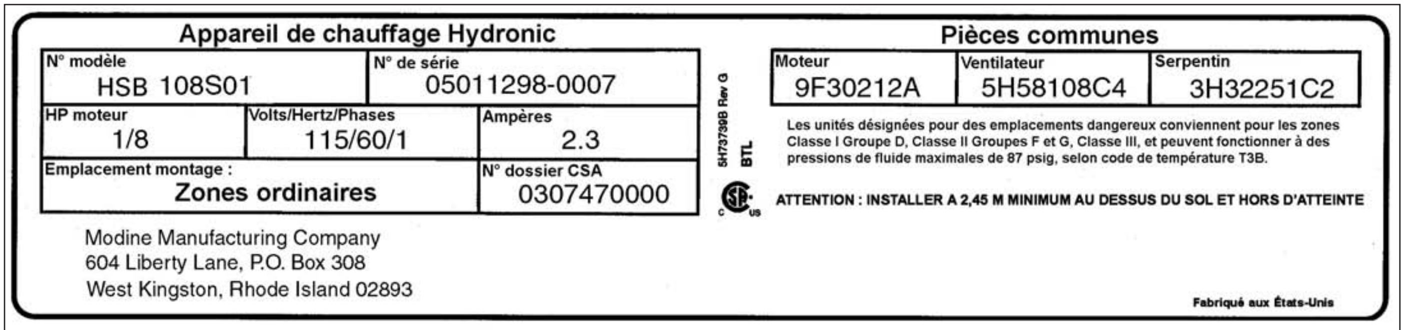
Si un technicien d'entretien qualifé ne peut pas résoudre le problème, consulter un représentant de la compagnie de gaz locale ou un représentant local de Modine.

Pour toute intervention d'entretien ou de réparation, ou pour commander des pièces de rechange, il faut toujours donner le numéro de modèle et le numéro de série complets, tels qu'ils figurent sur la plaque signalétique (Figure 14.1.)

Pièces de rechange

Pour commander des pièces, adressez-vous à votre représentant local. Vous aurez besoin du numéro de modèle complet et du numéro de série.

Figure 14.1
Plaque signalétique du modèle



Appareil de chauffage Hydronic

N° modèle	N° de série	
HSB 108S01	05011298-0007	
HP moteur	**Volts/Hertz/Phases**	**Ampères**
1/8	115/60/1	2.3
Emplacement montage :		**N° dossier CSA**
Zones ordinaires		0307470000

Modine Manufacturing Company
604 Liberty Lane, P.O. Box 308
West Kingston, Rhode Island 02893

5H73739B Rev G
BTL

Pièces communes

Moteur	Ventilateur	Serpentin
9F30212A	5H58108C4	3H32251C2

Les unités désignées pour des emplacements dangereux conviennent pour les zones Classe I Groupe D, Classe II Groupes F et G, Classe III, et peuvent fonctionner à des pressions de fluide maximales de 87 psig, selon code de température T3B.

ATTENTION : INSTALLER A 2,45 M MINIMUM AU DESSUS DU SOL ET HORS D'ATTEINTE

Fabriqué aux États-Unis

⚠ AVERTISSEMENT

Pour l'entretien et les réparations de cet appareil, n'utiliser que des pièces d'origine certifiées. Pour la liste complète des pièces de rechange, consulter Modine Manufacturing Company. Toute substitution de pièce ou d'organe de commande non approuvée par le fabricant engage la responsabilité du propriétaire.

⚠ ATTENTION

Ne jamais réutiliser un composant électrique qui a été atteint par l'eau. Ces composants doivent être remplacés.

IMPORTANT

Pour essayer la plupart des Solutions possibles suggérées dans le tableau de dépannage 15.1, reportez-vous aux sections correspondantes du manuel.

Tableau 15.1
Dépannage

Système incapable de maintenir la température de consigne

1. Capacité insuffisante des appareils de chauffage, de la chaudière, de la pompe ou des tuyauteries.
2. Extraction d'air excessive (ventilateurs d'extraction ajoutés après l'installation du chauffage?).
3. Appareil de chauffage tournant à basse vitesse alors qu'il a été dimensionné pour tourner à grande vitesse.
4. Appareil monté trop haut — l'air chaud n'atteint pas le niveau du plancher.
5. Thermostat — mal placé ou mal réglé, ou défectueux.
6. Échangeur encrassé ou colmaté.

L'appareil souffle de l'air froid

1. Robinet d'arrêt manuel fermé.
2. Pression de vapeur insuffisante ou débit d'eau chaude insuffisant.
3. Aquastat défectueux.
4. Mise à l'air libre incorrecte.
5. Purgeur de vapeur inopérant.
6. Tube collecteur d'impuretés trop court (système à vapeur).
7. Tuyauterie de retour obstruée (système à vapeur).
8. Pompe insuffisante ou défectueuse (système à eau chaude).

Système ne chauffe pas quand c'est nécessaire

1. Moteur défectueux ou connexions défectueuses.
2. Thermostat, aquastat ou limiteur de pression inopérant.

La chaleur n'atteint pas le plancher

1. Appareils de chauffage montés trop haut.
2. Vitesse du ventilateur trop basse.
3. Température de l'air de sortie trop élevée.
4. Volets du registre mal réglés.
5. Type de diffuseur incorrect (sur appareils verticaux).
6. Appareil mal dimensionné (débit d'air insuffisant).
7. Type d'appareil mal choisi (un débit vertical serait plus efficace).
8. Flux d'air chaud contrarié par la ventilation ou des courants d'air.
9. Obstacles bloquant le flux d'air chaud.

Fonctionnement bruyant

1. Boulons ou vis desserrés.
2. Pales tordues ou mal équilibrées.
3. Accumulation de poussière sur les pales.
4. Rivets du moyeu ou des pales desserrés.
5. Butée axiale du moteur usée.
6. Supports du moteur tordus, hélice décentrée dans le venturi.
7. Appareil monté de manière trop rigide, ce qui transmet les bruits de vibrations.
8. Conduit trop rigide, transmet les vibrations.
9. Câble BX touchant l'appareil, bruit causé par les vibrations du carter.

Fuites au niveau de l'appareil

1. Raccord mal serré.
2. Corrosion interne.

Les employés se plaignent de courants d'air chaud

1. Flux d'air mal dirigé (directement vers le personnel).
2. Volets du registre mal réglés.
3. Type de diffuseur incorrect (sur appareils verticaux).
4. Air de sortie trop chaud.

Appareil tourne trop longtemps

1. Thermostat mal positionné (par exemple contre un mur froid).
2. Ventilateurs d'extraction trop puissants. (La ventilation a pu être augmentée depuis l'installation du système de chauffage).
3. Aquastat ou limiteur de pression défectueux.
4. Appareil sous-dimensionné.

Défaillances répétées du moteur

1. Tension trop haute ou trop basse.
2. Graissage excessif ou insuffisant.
3. Câblage du moteur inadéquat (section trop faible).
4. Connexions électriques défectueuses.
5. Température de l'air trop élevée autour du moteur.
6. Manque de circulation d'air dans l'appareil (échangeur encrassé, volets fermés, gaines de distribution trop longues).
7. Ventilateur mal équilibré.
8. Tension mal équilbrée entre les 3 phases.

Défaillance prématurée

1. Forte corrosion interne causée par la qualité de l'eau de la chaudière.

Défaillance de l'échangeur

1. Forte corrosion interne causée par la qualité de l'eau.
2. Type de traitement de l'eau alimentaire.
3. Présence d'air dans le circuit causant des coups de bélier.
4. Trop d'air extérieur par des températures froides (gel de l'eau).
5. Fonctionnement continu au-dessus de 150 PSI (375°F) (systèmes à vapeur).

GARANTIE

Le Vendeur garantit ses produits contre tout défaut de matières ou de fabrication, SAUF si la défaillance est attribuable à une substitution de matières en situation d'urgence causée par la non-disponibilité des matières normalement utilisées. La présente garantie couvre le remplacement de toutes les pièces fournies par l'usine du Vendeur, mais ne couvre pas la main-d'oeuvre de toute nature ni les matières qui ne sont pas fournies par le Vendeur, ni les charges afférentes à la main-d'oeuvre ou aux matières non fournies par le Vendeur, que cette main-d'oeuvre ou ces matières, et les charges qui s'y rattachent, correspondent à des remplacements de pièces, à des réglages, à des réparations, ou à tout autre travail effectué. Cette garantie n'est pas applicable à tout équipement réparé ou modifié en dehors des établissements du Vendeur d'une manière qui, selon le jugement du Vendeur, affecte sa stabilité, ou qui a été utilisé dans des conditions anormales, de manière négligente ou au-delà des conditions de service pour lesquelles l'équipement en cause a été conçu. Cette garantie ne couvre pas non plus les effets des propriétés physiques ou chimiques de l'eau, de la vapeur ou des autres liquides ou gaz utilisés avec l'équipement.

L'ACHETEUR RECONNAÎT QUE LA GARANTIE DU VENDEUR À L'ÉGARD DES DÉFAUTS DE FABRICATION OU DE MATIÈRES, AVEC LES LIMITATIONS ÉNONCÉES ICI, TIENT LIEU ET EXCLUT TOUTE AUTRE FORME DE GARANTIE, TANT EXPRESSE QU'IMPLICITE, QU'ELLE DÉCOULE DE LA LOI, DE RAPPORTS D'AFFAIRES, DES PRATIQUES COMMERCIALES USUELLES OU AUTRES, **ET QU'IL NE BÉNÉFICIE PAS D'AUTRES GARANTIES, NOTAMMENT DE QUALITÉ MARCHANDE OU D'APTITUDE À UN USAGE PARTICULIER, AU-DELÀ DE LA DESCRIPTION DU PRODUIT CONFIRMÉE PAR L'ACHETEUR ET LE VENDEUR À LA DATE DE L'ACCORD FINAL.**

Pour les appareils fonctionnant au gaz ou au mazout, cette garantie est annulée si l'apport calorifique du combustible utilisé excède de plus de 5 % la valeur nominale inscrite sur la plaque signalétique du produit, ou si le produit a, de l'avis du Vendeur, été installé dans une atmosphère corrosive, exposé à l'action de liquides ou de gaz corrosifs, ou a été soumis à une utilisation anormale ou négligente, à un accident, à un choc thermique excessif, à une humidité excessive, à des dommages physiques, à des chocs mécaniques, à l'abrasion, à des modifications non autorisées ou à un fonctionnement non conforme aux instructions imprimées du Vendeur, ou encore dont le numéro de série a été altéré, rendu illisible ou enlevé.

Échangeurs de chaleur

Pour les appareils de chauffage au gaz à combustion non séparée offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE TOUT ÉCHANGEUR DE CHALEUR QUI, DURANT UNE PÉRIODE DE DIX ANS À COMPTER DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE DIX ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DURANT CENT VINGT-SIX MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT ÉCHANGEUR EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES CI-DESSUS, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR. POUR LES APPAREILS DE CHAUFFAGE AU GAZ INSTALLÉS DANS UN ENVIRONNEMENT À HAUT TAUX D'HUMIDITÉ ET UTILISANT DES ÉCHANGEURS DE CHALEUR EN ACIER INOXYDABLE, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES CI-DESSUS, SERA LIMITÉE À DIX ANS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Pour les appareils infrarouges À FAIBLE Intensité CHAUFFÉS au GAZ offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE TOUT ÉCHANGEUR DE CHALEUR QUI, DURANT UNE PÉRIODE DE CINQ (5) ANS À COMPTER DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR INITIAL OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE CINQ ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE CINQ ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DURANT SOIXANTE-SIX MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT ÉCHANGEUR EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES CI-DESSUS, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Échangeurs de chaleur (condenseurs) de tous les produits offerts par le Vendeur, sauf les appareils de chauffage et les appareils infrarouges chauffés au gaz, à combustion non séparée, tous les brûleurs sauf ceux des appareils infrarouges, et les pièces en tôle utilisées dans tous les produits offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE TOUT ÉCHANGEUR DE CHALEUR (CONDENSEUR) OU BRÛLEUR QUI, DURANT UNE PÉRIODE D'UN AN À COMPTER DE LA DATE DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE D'UN AN À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DE DIX-HUIT MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT ÉCHANGEUR EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES CI-DESSUS, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Brûleurs

Pour les appareils infrarouges de faible intensité chauffés au gaz offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE TOUT BRÛLEUR QUI, DURANT UNE PÉRIODE DE DEUX ANS À COMPTER DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR INITIAL OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE DEUX ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DE TRENTE MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT PRODUIT EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES CI-DESSUS, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Pour les appareils à haute Intensité chauffés au gaz offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE TOUT BRÛLEUR QUI, DURANT UNE PÉRIODE DE DIX ANS À COMPTER DE LA DATE DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR INITIAL OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE DIX ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DE CENT-VINGT-SIX MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT PRODUIT EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES ICI, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Tous les autres composants, sauf les échangeurs de chaleur (condenseurs), les brûleurs et les pièces en tôle

Pour les produits du Vendeur, sauf les appareils à chauffage direct et les appareils à haute intensité

Les appareils infrarouges à chauffage au gaz

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT DANS UN ÉTABLISSEMENT DU VENDEUR DE LA OU DES PIÈCES DÉFECTUEUSES QUI, DURANT UNE PÉRIODE DE DEUX ANS À COMPTER DE LA DATE DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE DE DEUX ANS À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DE TRENTE MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA OU SERONT RETOURNÉES EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OU L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LEDIT PRODUIT EST DÉFECTUEUX, SAUF SI LE PRODUIT EST DESTINÉ À ÊTRE INCORPORÉ PAR L'ACHETEUR DANS UN ÉQUIPEMENT FABRIQUÉ PAR LUI, AUQUEL CAS, LA DURÉE DE L'OBLIGATION DU VENDEUR, AVEC LES LIMITATIONS ÉNONCÉES ICI, SERA LIMITÉE À UN AN À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR.

Pour les appareils de chauffage direct et les appareils infrarouges chauffés au gaz offerts par le Vendeur

LE RECOURS DE L'ACHETEUR EN CAS DE DÉFAILLANCE SOUS GARANTIE, À L'EXCLUSION DE TOUS LES REMÈDES PRÉVUS PAR LA LOI, EST LIMITÉ À LA RÉPARATION OU AU REMPLACEMENT, AU GRÉ DU VENDEUR, DANS UN ÉTABLISSEMENT DU VENDEUR DE LA OU DES PIÈCES QUI, DURANT UNE PÉRIODE D'UN AN À COMPTER DE LA PREMIÈRE UTILISATION BÉNÉFICIAIRE PAR L'ACHETEUR INITIAL OU TOUT AUTRE UTILISATEUR, DURANT UNE PÉRIODE D'UN AN À COMPTER DE LA DATE DE REVENTE PAR L'ACHETEUR DANS UN ÉTAT NON MODIFIÉ QUELCONQUE, OU DE DIX-HUIT MOIS À COMPTER DE LA DATE D'EXPÉDITION PAR LE VENDEUR, À LA PREMIÈRE DE CES ÉCHÉANCES, SERA RETOURNÉ EN PORT PAYÉ AU VENDEUR, DANS LA MESURE OÙ L'INSPECTION FAITE PAR LE VENDEUR PERMET DE CONCLURE QUE LES PIÈCES SONT DÉFECTUEUSES.

L'ACHETEUR CONVIENT QU'EN AUCUN CAS LE VENDEUR NE SERA RESPONSABLE DES COÛTS DE TRAITEMENT, DES PERTES DE REVENUS, DES PERTES D'ACHALANDAGE, OU AUTRES DOMMAGES INCIDENTS OU CONSÉCUTIFS, DÉCOULANT DE LA COMMANDE OU DE L'UTILISATION DE SES PRODUITS, QU'ILS SOIENT LE RÉSULTAT DU NON-RESPECT DES CLAUSES DE GARANTIE, D'UNE NON-CONFORMITÉ AUX SPÉCIFICATIONS DE COMMANDE, DE RETARDS DE LIVRAISON OU DE TOUTE AUTRE PERTE SUBIE PAR L'ACHETEUR.

Modine Manufacturing Company a mis en place un programme d'amélioration continue des ses produits et se réserve donc le droit d'apporter sans préavis des modifications à la conception et aux spécifications de ses produits.

MODINE

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9/05 - 2M Litho aux États-unis

Please read and save these instructions. *Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.*

Domex, Centrifugal Roof, Direct & Belt Drive Exhausters

Description

PennBarry roof-mounted ventilators are belt-driven centrifugal exhausters designed to meet air delivery requirements where steady exhaust is needed under moderate static pressure. Housings are of spun aluminum construction with built-in bird screen. Ventilators are furnished with self-aligning, pre-lubricated, ball bearing pillow blocks, spark proof aluminum wheels, and aluminum backdraft damper.

Receiving and Handling

PennBarry fans are carefully inspected before leaving the factory. When the unit is received, inspect the carton for any signs of tampering. Inspect the unit for any damage that may have occurred during transit and check for loose, missing or damaged parts. Mishandled units can void the warranty provisions. If units are damaged in transit, it is the responsibility of the receiver to make all claims against the carrier. PennBarry is not responsible for damages incurred during shipment.

Avoid severe jarring and/or dropping. Handle units with care to prevent damage to components or finishes. If the unit is scratched due to mishandling, the protective coating may be damaged. Incorrect lifting may damage the fan and void the warranty.

Storage

Long-term storage requires special attention. Store units on a level, solid surface, preferably indoors. If outside storage is necessary, protect the units against moisture and dirt by encasing the cartons in plastic or in some similar weatherproof material. Periodically inspect units and rotate wheels to spread bearing lubricant. Failure to rotate wheels results in reduced bearing life and may void the manufacturer's warranty. If the unit will be stored for an extended time, remove belts. Belts which remain under tension in a stationary position for extended periods are likely to have a reduced operating life.

Unpacking

Place the carton in an upright position and remove the staples or use a sharp (knife edge) tool to carefully cut or scribe the sealing tape on both sides at the top of the carton. Open carton flaps. Remove any cardboard and wooden filler pieces, as well as loose components or accessories shipped with the unit.

Carefully remove the unit from the carton. Inspect the unit for any damage that may have occurred during transit and check for loose, missing or damaged parts.

Installation

INSTALLING MOTORS

In some instances, large frame motors may be shipped loose and require field mounting. If so, carefully review motor mounting installation procedures per Figure 1, Figure 2 and Figure 3.

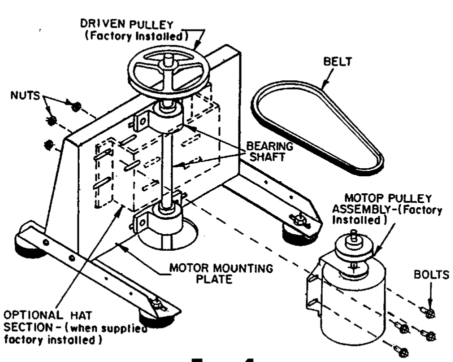
INSTALLING THE DAMPERS: ROOF MOUNTING

When required, install dampers prior to mounting the unit on the curb or frame. Secure dampers to the inside of the roof opening (preferred) or curb without undue twisting, which may distort the damper frame. Damper frame must be reasonably level on all sides. Check for free operation. If dampers are motor operated type, ascertain that proper voltage is impressed on motor terminals.

POSITIONING AND RUNNING POWER LINES: ROOF MOUNTING

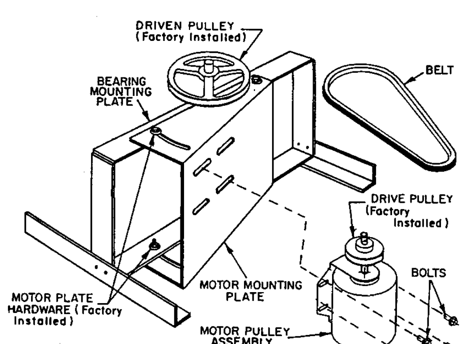
Power is normally brought from within the building through proper conduit lines and placed inside one corner of the curb. Feed power line through the clearance hole provided in the damper, if furnished, and in turn through the ventilator to the disconnect switch, if furnished, and motor.

Figure 1: Motor Installation Procedures



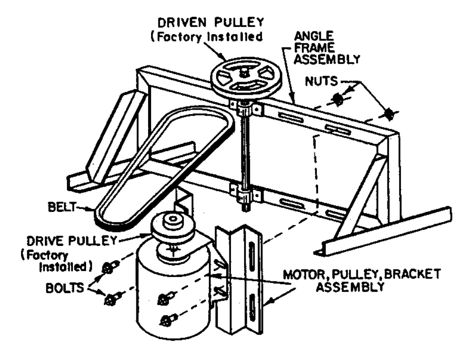
Type 1

Figure 2: Motor Installation Procedures



Type 2

Figure 3: Motor Installation Procedures



Type 3

When power lines are brought up to the unit, provide a generous amount of slack to allow for motor adjustments and to permit movement of motor for belt tension adjustments. Ground motor adequately and securely. Protect power lines from sharp objects. Do not kink power line or permit it to contact hot surfaces, chemicals, grease or oil. Use only UL recognized electrical parts, rated for proper voltage, load and environment. Check motor name plate.

ANCHORING AND SECURING THE VENTILATOR: ROOF MOUNTING

Whenever possible, anchor the fan by fastening through the vertical portion of the mounting flange. The type, size and number of fasteners depends upon the unit size and curb construction. If code or specification prescribes fastening through the top (vertical portion) of the mounting flange, use neoprene or lead washers under the head of each fastener.

Guy down large units installed in areas subject to high winds or unusual field conditions. If the installer removes any ventilator parts to facilitate installation or electrical connections, reassemble all parts by replacing all spacers, washers, nuts, bolts, fasteners and components exactly as they were found prior to removal. Draw all fasteners tight and secure. Fasteners should be protected against corrosion.

MOTOR INSTALLATION PROCEDURES

1. Install motor pulley assembly (bracket if provided - type 3) with hardware provided through holes in motor mounting plate/frame. Keep driven pulley and drive pulley in line. (Do not tighten hardware).
2. Install belt over drive and driven pulleys, pull up on motor mounting plate/bracket until belt is tight. Tighten motor plate hardware.
3. Wire motor or plug harness connector (from motor if equipped) into terminal socket at end of junction box. Unit is now ready to test to check for smooth operation.
4. See belt adjustment label, and Fig. 4, for more details.
5. Check for proper wheel rotation.

Start-Up and Operation

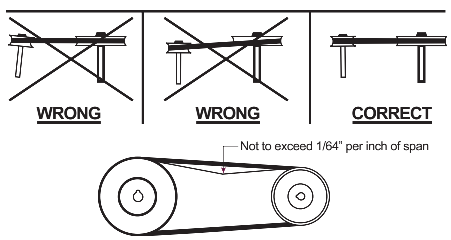
Carefully inspect the unit before start-up. All motor bearings should be properly lubricated and all fasteners should be securely tightened. Rotate centrifugal wheel by hand to insure free movement.

⚠ CAUTION ***Before placing hand on centrifugal wheel or belts, lock out power source.) Check all set-screws and keys. Tighten when necessary.***

Check condition of belts and the amount of tension prior to start-up. DO NOT overtighten, as bearing damage will occur.

Recommended belt tension should permit deflection of 1/64" per inch of span. Exercise extreme care when adjusting belts as not to misalign the pulleys. Any misalignment will cause a sharp reduction in belt life and produce squeaky, annoying noises. On units equipped with two groove pulleys, adjust all belts with equal tension. Belts must be adjusted after approximately. 40 hours. of operation.

Figure 4: Pulley Alignment & Tension



⚠ CAUTION ***Whenever belts are removed or installed, never force belts over pulleys without loosening motor first to relieve belt tension.***

Make sure inlets and approaches to the unit are free from obstruction. To assure maximum air movement, make sure adequate supply air is available to ventilated space.

Before putting fan into operation, complete the following check list:

a. Turn off and LOCK OUT the power source.
b. Make sure installation is in accordance with manufacturer's instructions.
c. Check and tighten all fasteners.
d. Spin centrifugal wheel to see if rotation is free.
e. Check all set-screws and keys: tighten if necessary.
f. Torqued set screws have a colored Torque Seal mark indicating the correct torque has been applied.
g. Check belt or direct drive coupling for alignment (use recommended belt tension gauges).
h. Check belt for proper sheave selection.
i. Make sure there is no foreign or loose material in ductwork leading to and from fan or in the fan itself.
j. Properly secure all safety guards.
k. Secure all access doors to fan and ductwork.
l. Check line voltage with motor nameplate.
m. Check wiring.

⚠ CAUTION ***(On single phase motors, the terminal block must be set up in accordance with the nameplate instructions and/or wiring diagram. This set up must match the line voltage. If the motor is multi-speed or multi-voltage, the winding leads must be grouped and connected as shown on the motor wiring diagram. The line voltage must correspond with proper grouping of motor leads. The wiring diagram must be followed explicitly or serious motor or starter damage will occur.) Don't operate at RPM higher than catalog.***

The ventilator has been checked at the factory prior to shipment for mechanical noises. If mechanical noises should develop:

a. Check rotating components for adequate clearance (wheel alignment procedures are on page 7) and direction of rotation. CCW looking from drive side.
b. Check proper belt tension and pulley alignment.
c. Check installation and anchoring.
d. Check fan bearings.

Switch on electrical supply and allow fan to reach full speed.

Check carefully for:

1. Correct rotation of the centrifugal wheel.

⚠ CAUTION ***Incorrect rotation overloads motor severely and results in serious motor damage. To change rotation of three phase units, interchange any 2 of the 3 line leads. On single phase units, change the terminal block set-up following the wiring diagram on the motor.***

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2. Check motor and bearing temperatures for excessive heat.

⚠ CAUTION ***Use care when touching the exterior of an operating motor. Modern motors normally run hot. They are designed to operate at higher temperatures. This is a normal condition but they may be hot enough to be painful or injurious to the touch.***

If any problem is indicated, TURN OFF POWER TO UNIT IMMEDIATELY. Lock out the electrical supply, check carefully for the cause of the trouble and correct as needed. Even if the fan appears to be operating satisfactorily, shut down after a brief period and check all fasteners, setscrews and keys for tightness.

During the first eight (8) hours of operation, check the fan periodically for excessive vibration or noise. At this time, also check motor input current and motor bearing temperatures to insure that they do not exceed manufacturer's recommendations. After eight hours of satisfactory operation, shut down the fan and lock out the electrical power to check the following items and adjust if necessary:

a. All set-screws, keys and fasteners.

b. Drive coupling alignment.

c. Belt alignment.

d. Belt tension.

Maintenance

Do not attempt maintenance on fan until the electrical supply has been completely disconnected. If a disconnect switch has not been provided, remove all fuses from the circuit and lock the fuse panel so they cannot accidentally be replaced.

Lubrication is a primary maintenance responsibility. Check all bearings periodically. Inspect belts for tightness. If the fan is installed in a corrosive or dirty atmosphere, periodically clean the impeller, inlet and other moving parts.

FAN SHAFT LUBRICATION

Fan shaft bearing pillow blocks are furnished in either the prelubricated sealed-for-life type or the greasable type depending on what was ordered. The prelubricated type requires no servicing for 7 to 10 years of normal use and the greasable type are factory greased eliminating the need for greasing initially. Follow the lubricating schedule recommended by the factory. When required, apply grease while the shaft is rotating. This practice should not supersede any safety considerations.

⚠ CAUTION ***Use low pressure grease guns only. High pressure guns tend to blow out or unseat bearing seals, leaving the bearing open to collect grime, dust and foreign particles.***

LUBRICATION SCHEDULE

Always follow the bearing manufacturer's recommended lubrication schedule. If none is available us the following general schedule.

a. Under average conditions where ambient temperatures do not exceed 120°F., lubrication is required 1 to 2 times a year.

b. Under dirt laden atmospheres or where there is a temperature range of 120°F to 150°F, lubrication is required from 3 to 6 times a year.

c. Under extreme temperature conditions and extremely dirty atmospheres, lubrication should be at least once or twice a month.

Table 1: Recommended Lubricants

Manufacturer	Product	Temp. Range
BP	LG-#P-1	Below 32° F (0° C)
Gulf	Gulfcrown EP-1	
Imperial Oil	Unirex EP-1	
Shell	Alvania R-1	
BP	Energrease, MPMK11	32° F to 150° F (0° C to 66° C)
Gulf	Gulfcrown EP-2	
Imperial Oil	Unirex EP-2	
Shell	Alvania R-3	
Sun Oil	Sun Prestige 42	
Texaco	Regal AFB2	

MOTOR LUBRICATION

In general, standard motors are furnished with prelubricated, sealed-for-life ball bearings which require no lubrication for 7 to 10 years of normal service. Where motors have been ordered with greasable bearings, these bearings are factory lubricated and require no attention for one year under normal conditions. If grease relief fittings are provided, remove them when performing maintenance to allow grease to flow out. Whenever possible, apply grease while the motor is running. This practice should not supersede any safety considerations. DO NOT OVER GREASE, as most lubricants deteriorate motor windings, thereby reducing motor life.

Hidden Danger

In addition to the normal dangers of rotating machinery, fans present an additional hazard in their ability to suck in not only air, but loose material as well. Solid objects can pass through the fan and be discharged by the impeller as potentially dangerous projectiles. Therefore, screen intake to ductwork, whenever possible, to prevent the accidental entrance of solid objects. Never open access doors to a duct system with the fan running.

When starting the fan for the first time, completely inspect the ductwork and interior of the fan (with power locked off), to make certain there is no foreign material which can be sucked into or blown through the ductwork.

Guards

All fans have moving parts which require guarding in the same way as other moving machinery.

Where the fan is accessible to untrained personnel or the general public, use maximum safety guards, even at the cost of some performance loss. Unprotected fans located less than 7' above the floor also require guarding as specified in the Occupational Safety and Health Act (OSHA).

PennBarry recommends the use of guards on all exposed nonducted fans, ceiling and wall mounted.

Centrifugal fans may be connected directly to ductwork which will prevent contact with the internal moving parts, but when the inlet or outlet is exposed, install a suitable guard.

Troubleshooting Checklist

Symptom	Possible Cause(s)	Corrective Action
Excessive noise	1. Defective or loose motor bearings	1. Replace motor with same frame size, RPM, HP
	2. Ventilator base not securely anchored	2. Reset properly
	3. Loose or unbalanced wheel/propeller	3. Tighten screws, remove build-up, balance wheel/propeller
	4. Misaligned pulleys or shaft	4. correct alignment
	5. Loose or damaged wheel/propeller	4. Replace wheel/propeller
	6. Wheel running in wrong direction	6. Reverse direction
Fan inoperative	1. Blown fuse or open circuit breaker	1. Replace fuses or circuit breaker
	2. Loose or disconnected wiring	2. Shut off power and check wiring for proper connections
	3. Defective motor	3. Repair or replace motor
	4. Broken belts	4. Replace belts
Insufficient airflow	1. Open access doors or loose sections of ducts	1. Check for leakage
	2. Clogged filters	2. Clean filters
	3. Operation in wrong direction	3. Correct rotation of wheel
	4. Insufficient make-up air direction	4. Add make-up fan or louver opening
Water leaking into ductwork or collection of grease under fan	1. Fan installed with slope in the wrong direction	1. Slope should be fitted in the direction of the drainage opening or grease collection box and drain spout
	2. Clogged drain spout	2. Clean drain spout
	3. Cooling tube or motor dome top removed	3. Install new cooling tube with gasket and dome top
	4. Grease container full	4. Empty grease box
Motor overheating	1. Belt slippage	1. Adjust tension or replace bad belts
	2. Overvoltage or under voltage	2. Contact power supply company
	3. Operation in wrong direction	3. Reverse direction of motor
	4. Fan speed too high	4. Slow down fan by opening variable pitch pulley on motor shaft
	5. Incorrect motor (service factor 1.0, low ambient temperature)	5. Replace motor with correct open, NEMA service factors (1.15 or higher) with 40 degrees ambient
	6. Blocked cooling tube or leaky gasket	6. Remove blockage and seal cooling tube in place
	7. Insufficient airflow to kitchen hood fan operating on low speed with kitchen in full operation	7. Check airflow under hood and adjust kitchen equipment output
	8. Undersized motor	8. Check motor ratings with catalog speed and air capacity chart

Note: Care should be taken to follow all local electrical, safety and building codes. Provisions of the National Electric Code (NEC), as wells as the Occupational Safety and Health Act (OSHA) should be followed.

All motors are checked prior to shipment. If motor defects should develop, prompt service can be obtained from the nearest authorized service station of the motor manufacturer while under warranty. Exchange, repair or replacement will be provided on a no charge basis if the motor is defective within the warranty period. The PennBarry representative in your area will provide a name and address of an authorized service station if requested. WARNING: Motor guarantee is void unless overload protection is provided in motor wiring circuit.

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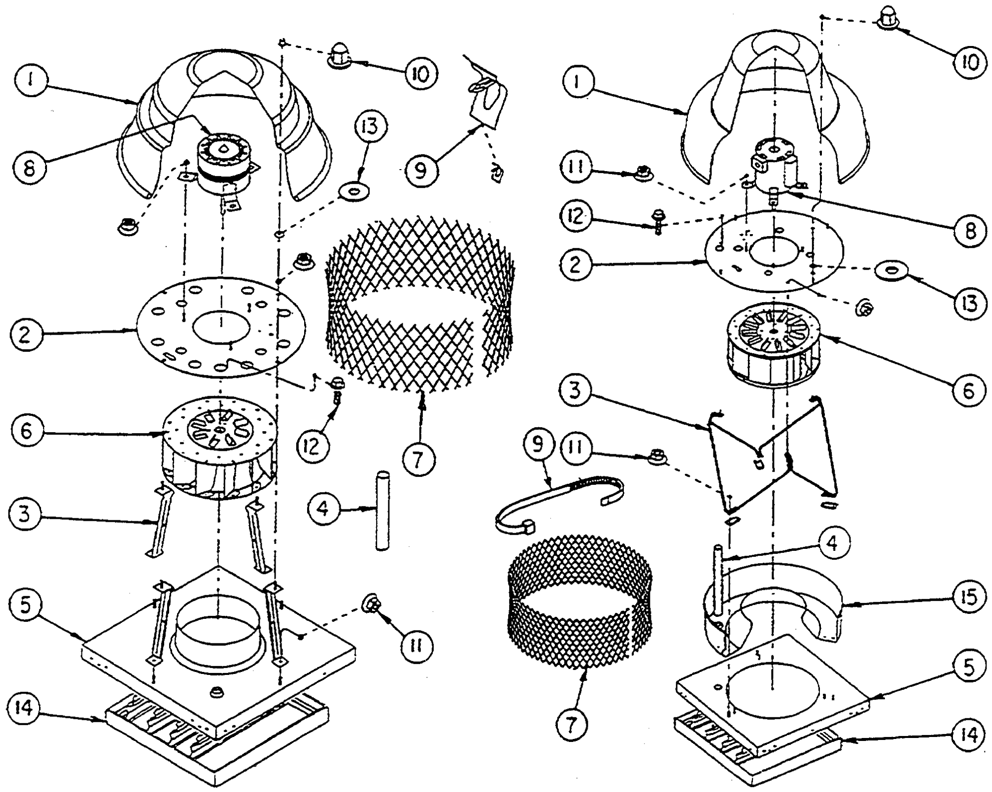
Direct Drive Models DX06R, DX08S/R, 10S/R, 11S/R, 11Q, 13V/S/R, 13Q, 16V/S/R, Q1 & Q2

Figure 5:
(Left Image) DX06R, DX08S/R, 10S/R, 11S/R, 11Q, 13V/S/R & 13Q (Right Image) DX16V/S/R, Q1 & Q2



Part	Description
1	Hood Apron
2	Top Plate
3	Brace
4	Conduit Pipe
5	Base
6	Wheel
7	Screen
8	Motor
9	Screen Clip
10	Acorn Nut
11	1/4-20 Nut
12	1/4-20 Bolt
13	Washer
14	Backdraft Damper
15	Venturi

Direct Drive Models	
Fan Size	Base Dim.
6	18.5
8	18.5
10	18.5
11	18.5
13	18.5
16	20.5

Fan Base Dimensions (outside curb dimension should be 1" smaller than inside fan base dimension)

Belt Drive Models DX06B-36B, KB, JB & MB

Figure 6: DX06B, 08B

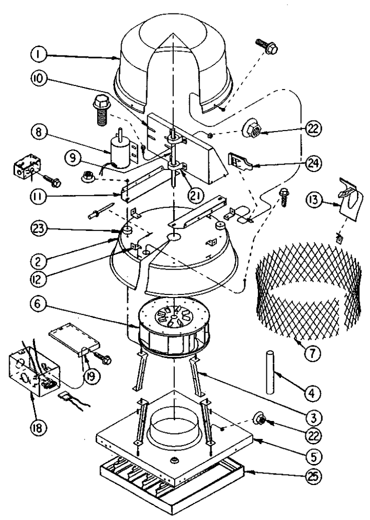
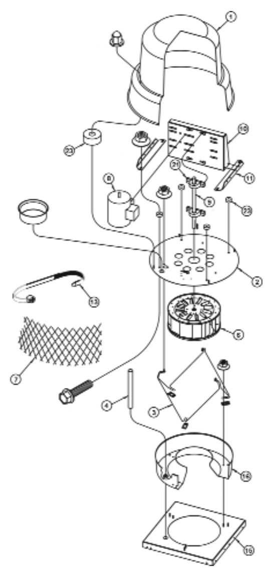


Figure 7: DX11B



Part	Description
1	Hood
2	Top Plate Apron
3	Vertical Brace
4	Conduit Pipe
5	Base Venturi
6	Centrifugal Wheel
7	Screen
8	Motor
9	Shaft
10	Motor Bearing Frame
11	Motor Frame Support Angle
12	Hood Mounting Lug
13	Screen Clip
14	Top Plate
15	Base
16	Venturi
17	Apron
18	Junction Box
19	Junction Box Cover
20	Baffle
21	Bearings
22	1/4-20 Nut
23	Rubber Bushing
24	Bolt Clip
25	Backdraft Damper
26	Bearing Support Plate
27	Motor Support Plate
28	Motor Pulley
29	Fan Pulley
30	Belt

Figure 8: KB, JB, MB

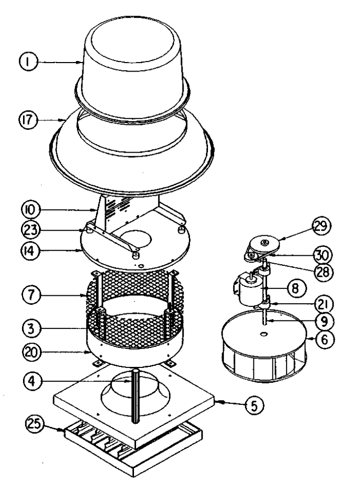
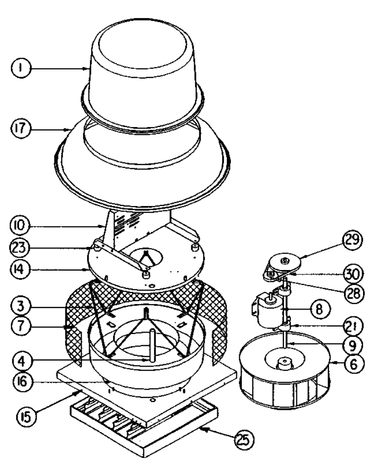


Figure 9: DX11BA thru DX36B



Belt Drive Models	
Fan Size	Base Dim.
06B	18.5
08B	18.5
11B(A)	20.5
12B	24.75
14B	24.75
16B	28.5
18B	28.5
24B	33.5
30B	36.5
36B	44.5
KB	52.5
JB	59
MB	63.5

Maximum Fan RPM and Motor Horsepower Size Belt Drive Models													
Fan Size	06B	08B	11B(A)	12B	14B	16B	18B	24B	30B	36B	KB	JB	MB
Max Safe RPM	1437	1437	1575	2007	1793	1631	1326	1275	988	810	600	480	440
Max Motor Frame Size	42	42	56	56	56	145T	145T	184T	184T	213T	213T	215T	254T

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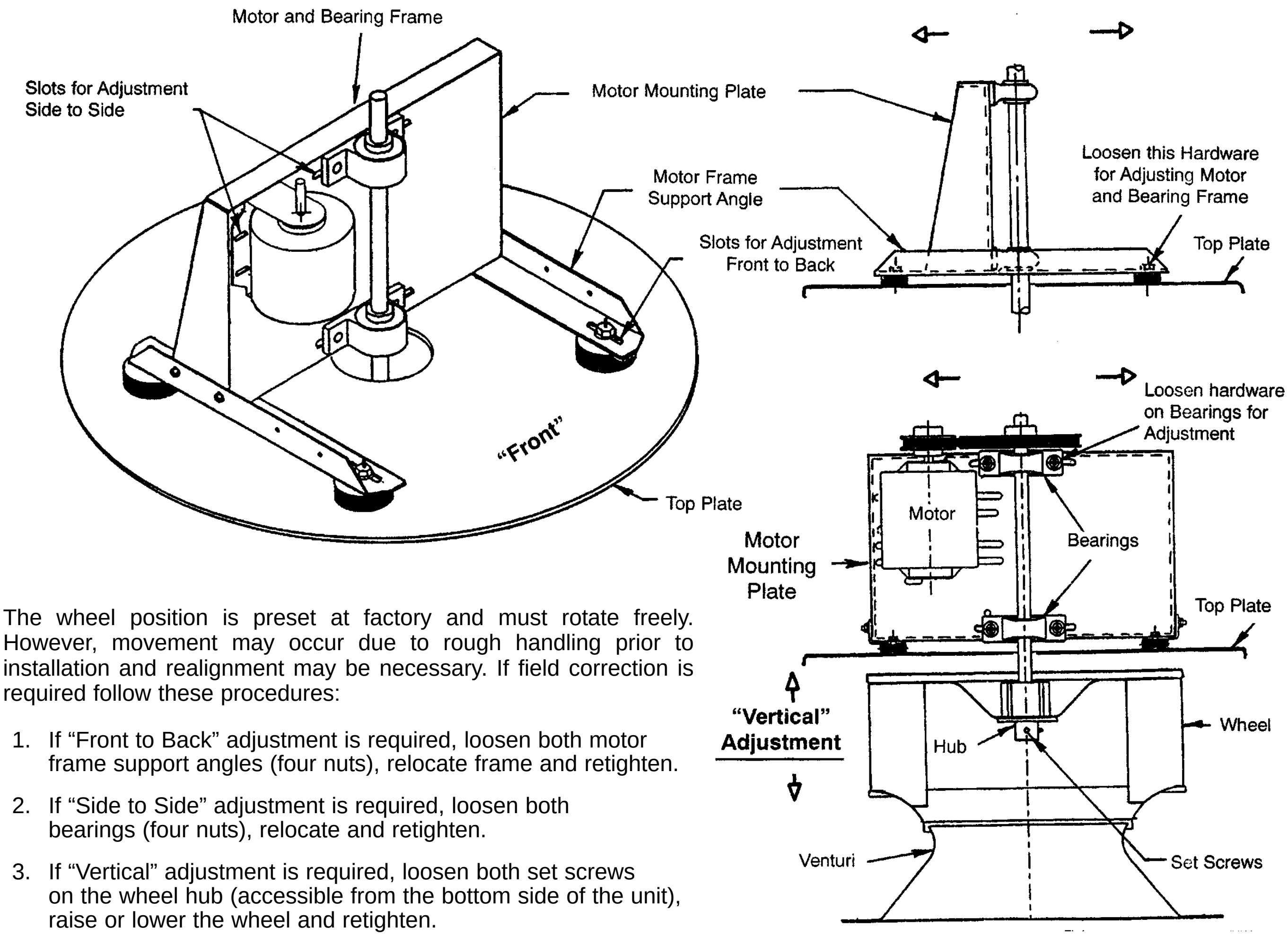
Wheel Alignment Procedures

Figure 10

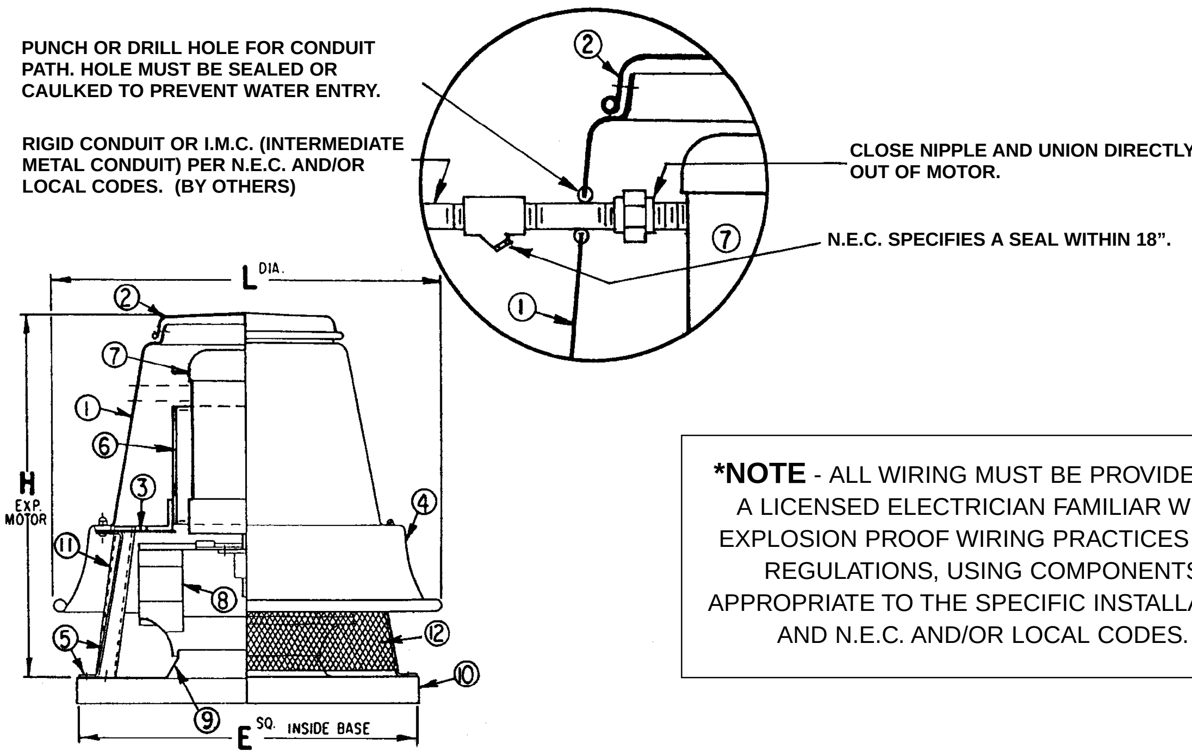


The wheel position is preset at factory and must rotate freely. However, movement may occur due to rough handling prior to installation and realignment may be necessary. If field correction is required follow these procedures:

1. If "Front to Back" adjustment is required, loosen both motor frame support angles (four nuts), relocate frame and retighten.
2. If "Side to Side" adjustment is required, loosen both bearings (four nuts), relocate and retighten.
3. If "Vertical" adjustment is required, loosen both set screws on the wheel hub (accessible from the bottom side of the unit), raise or lower the wheel and retighten.

Direct Drive - Explosion Proof Motor

Spun Aluminum Centrifugal Roof Exhauster



***NOTE** - ALL WIRING MUST BE PROVIDED BY A LICENSED ELECTRICIAN FAMILIAR WITH EXPLOSION PROOF WIRING PRACTICES AND REGULATIONS, USING COMPONENTS APPROPRIATE TO THE SPECIFIC INSTALLATION AND N.E.C. AND/OR LOCAL CODES.

Legend

1. Motor Dome
2. Motor Hood Top (For Exp. Motor)
3. Top Plate
4. Discharge Apron
5. Structural Support Braces
6. Motor Mounting Plate
7. Motor (Exp. Motor)
8. Centrifugal Fan Wheel with Cooling Vanes
9. Spun Venturi
10. Mounting Base
11. Conduit Guide (Not for Exp. Motor)
12. Aluminum Bird Screen

Dimensional Data

	DX08Q	DX10Q	DX11Q	DX13Q	DX16Q
L DIA.	20 7/8	20 7/8	20 7/8	21 7/16	28 1/2
H EXP. MOTOR	18	19	19	19	26 11/16

† Outside dimension of curb should be 1 1/2" less than 'E' dimension

All dimensions in inches.

Material: Spun Aluminum Housing

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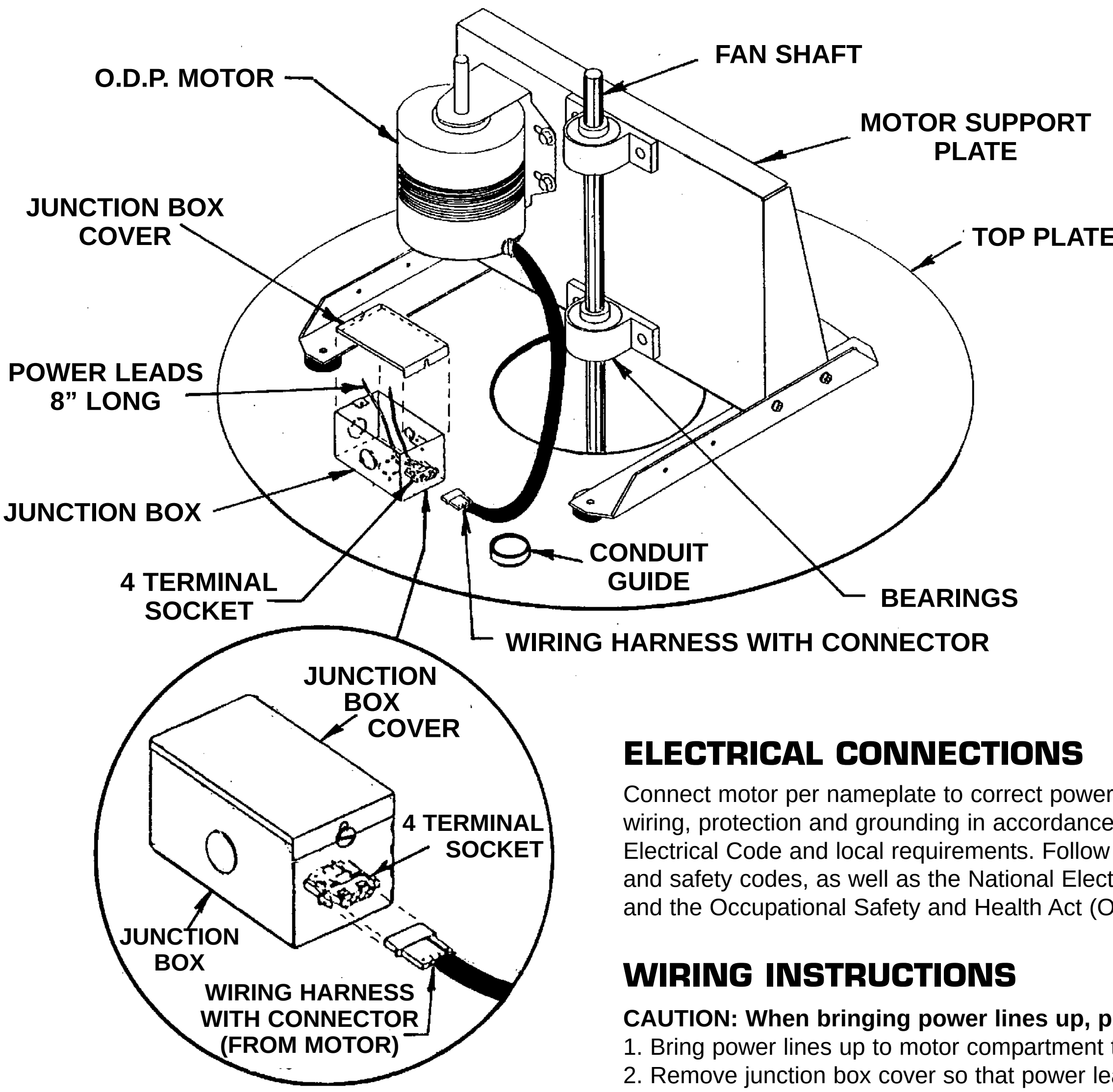
Wiring Harness - Disconnect Device

O.D.P. Motors (ITW Harness) 115/220 Single Phase



ELECTRICAL CONNECTIONS

Connect motor per nameplate to correct power supply. Install all wiring, protection and grounding in accordance with National Electrical Code and local requirements. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

WIRING INSTRUCTIONS

CAUTION: When bringing power lines up, power MUST be off.

1. Bring power lines up to motor compartment thru conduit guide.
2. Remove junction box cover so that power leads are exposed.
3. Remove one knock-out, attach connector and run power lines from source into junction box.
4. Terminal socket has two 8" long pigtails already stripped. Make connection to power lines using proper size wire nuts and fold wires back into box.
5. Replace junction box cover and secure in place with screw.
6. Plug harness connector (from motor) into terminal socket at end of junction box. Unit is now ready to test.

Limited One Year Warranty

What Products Are Covered

PennBarry Fans and Ventilators (each, a "PennBarry Product")

One Year Limited Warranty For PennBarry Products

PennBarry warrants to the original commercial purchaser that the PennBarry Products will be free from defects in material and workmanship for a period of one (1) year from the date of shipment.

Exclusive Remedy

PennBarry will, at its option, repair or replace (without removal or installation) the affected components of any defective PennBarry Product; repair or replace (without removal or installation) the entire defective PennBarry Product; or refund the invoice price of the PennBarry Product. In all cases, a reasonable time period must be allowed for warranty repairs to be completed.

What You Must Do

In order to make a claim under these warranties:

1. You must be the original commercial purchaser of the PennBarry Product.
2. You must promptly notify us, within the warranty period, of any defect and provide us with any substantiation that we may reasonably request.
3. The PennBarry Product must have been installed and maintained in accordance with good industry practice and any specific PennBarry recommendations.

Exclusions

These warranties do not cover defects caused by:

1. Improper design or operation of the system into which the PennBarry Product is incorporated.
2. Improper installation.
3. Accident, abuse or misuse.
4. Unreasonable use (including any use for non-commercial purposes, failure to provide reasonable and necessary maintenance as specified by PennBarry, misapplication and operation in excess of stated performance characteristics).
5. Components not manufactured by PennBarry.

Limitations

1. In all cases, PennBarry reserves the right to fully satisfy its obligations under the Limited Warranties by refunding the invoice price of the defective PennBarry Product (or, if the PennBarry Product has been discontinued, of the most nearly comparable current product).
2. PennBarry reserves the right to furnish a substitute or replacement component or product in the event a PennBarry Product or any component of the product is discontinued or otherwise unavailable.
3. PennBarry's only obligation with respect to components not manufactured by PennBarry shall be to pass through the warranty made by the manufacturer of the defective component.

General

The foregoing warranties are exclusive and in lieu of all other warranties except that of title, whether written, oral or implied, in fact or in law (including any warranty of merchantability or fitness for a particular purpose).

PennBarry hereby disclaims any liability for special, punitive, indirect, incidental or consequential damages, including without limitation lost profits or revenues, loss of use of equipment, cost of capital, cost of substitute products, facilities or services, downtime, shutdown or slowdown costs.

The remedies of the original commercial purchaser set forth herein are exclusive and the liability of PennBarry with respect to the PennBarry Products, whether in contract, tort, warranty, strict liability or other legal theory shall not exceed the invoice price charged by PennBarry to its customer for the affected PennBarry Product at the time the claim is made.

Inquiries regarding these warranties should be sent to: PennBarry, 1401 North Plano Road, Richardson, TX 75081.

1401 North Plano Road, Richardson, Texas 75081
Phone: 972-234-3202 ▪ Fax: 972-497-0468

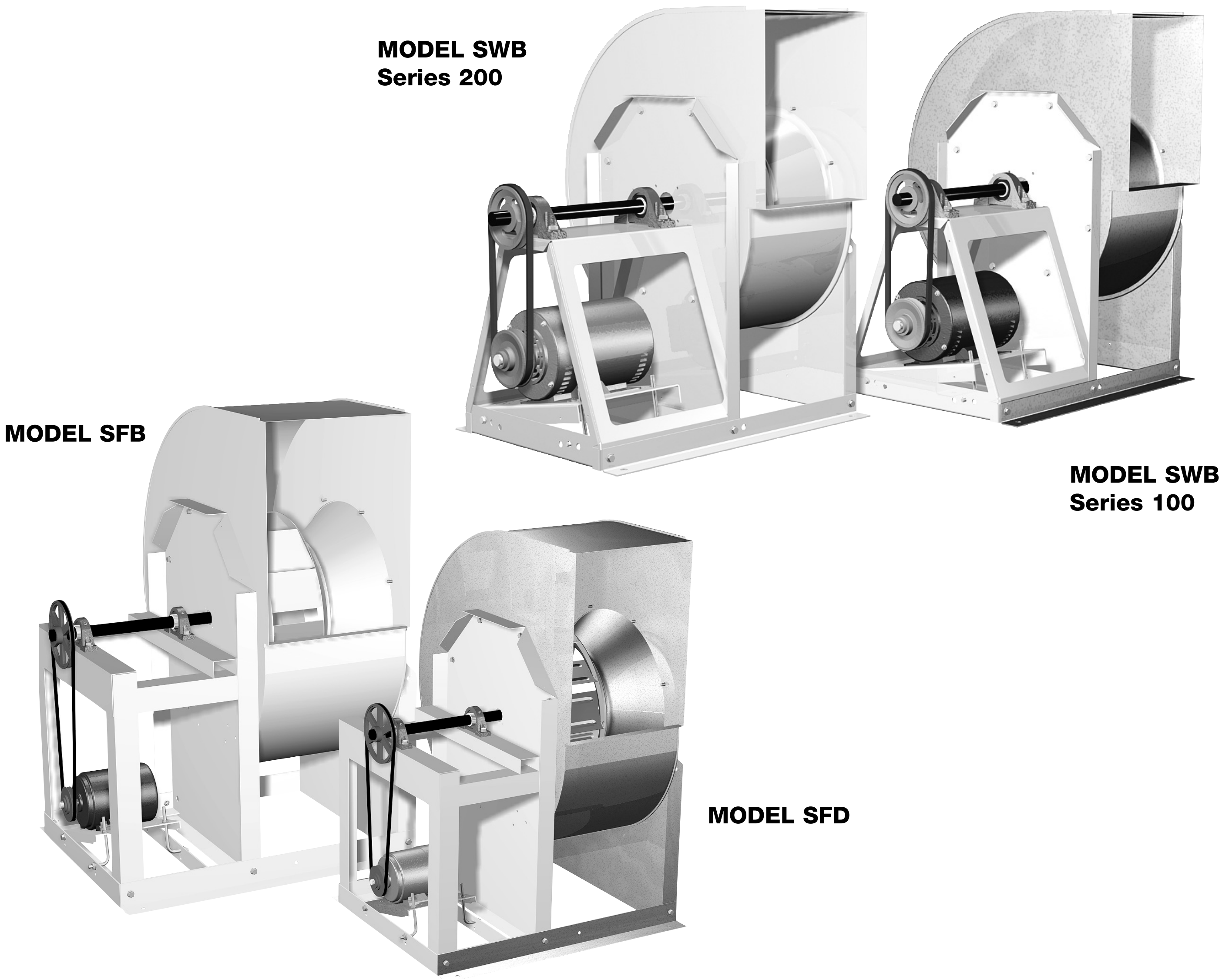
READ AND SAVE THESE INSTRUCTIONS

PN 455308

GREENHECK®
Building Value in Air.

Centrifugal Utility Fans
Model SWB (Series 100 & 200)
Models SFB and SFD

Installation, Operation and Maintenance Manual



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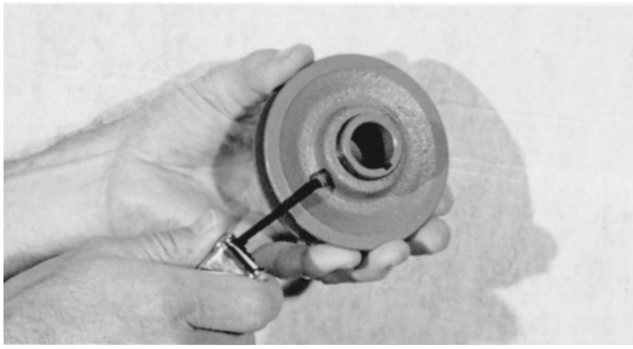
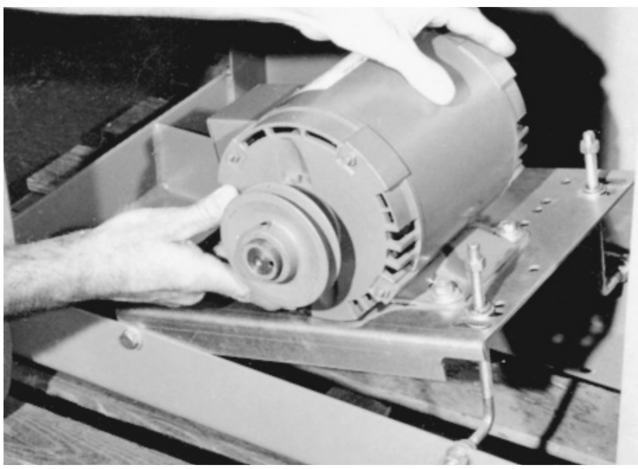
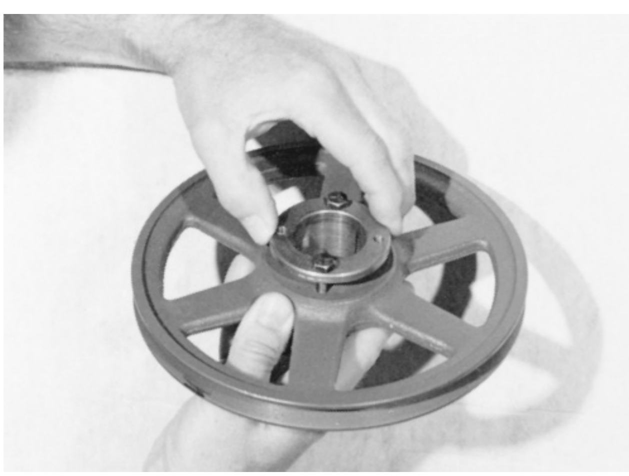
MOTOR AND DRIVE INSTALLATION INSTRUCTIONS
(Model SWB units are shipped from stock without motors or drives)



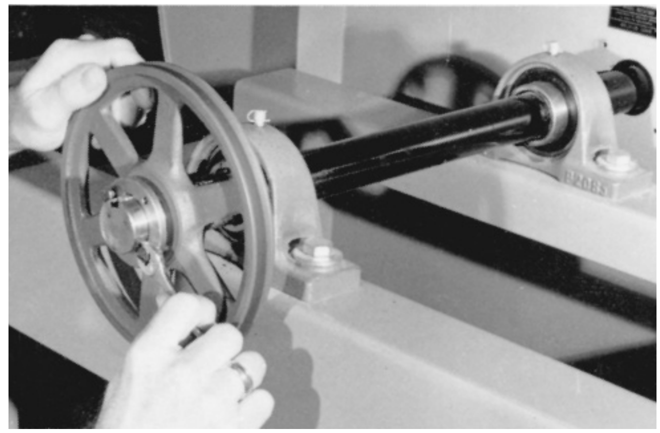
1. Adjust motor pulley to its closed position for maximum fan speed or increments of 1/2 turn open (maximum of 5 turns open) for reduced fan speed. Tighten set screw on flat area only.



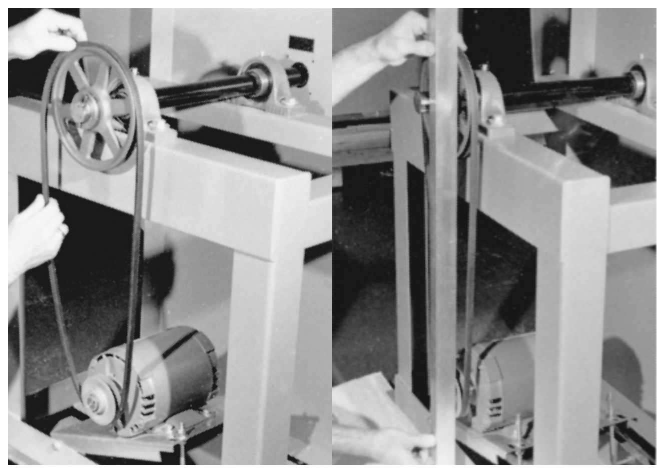
2. Install motor pulley to the motor shaft and install motor to the motor plate. Prepunched holes are provided for most common motor frame sizes.



3. If supplied, install taperlock bushing into shaft pulley.



4. Install shaft pulley to fan shaft.



5. Install drive belt(s). Belts should not be forced over pulleys. Align motor and shaft pulleys with a straight edge. Tighten all set screws.

6. Adjust belt tension. See page 6 for belt tensioning instructions.

INSTALLATION

Inspect the unit for any damage and report it to the shipper immediately. Also, check to see that all accessory items are accounted for.

Move the fan to the desired location and fasten securely through mounting holes provided in the base angles. The unit must be set level (shimming may be necessary). Flexible duct connections and vibration isolators should be used where noise is a factor.

The motor voltage and ampere rating must be checked for compatibility with the electrical supply prior to final electrical connection. Supply wiring to the fan must be properly fused and conform to local and national electrical codes.

The discharge is factory set as specified by customer order, however, it can be rotated to other discharge positions in the field if necessary. Removal of the housing bolts allows the discharge to be rotated to the clockwise positions below (Fig. 1). For TAD, BD and BAD discharge positions a portion of the frame angle must be removed.

VIEWED FROM DRIVE SIDE OF THE FAN

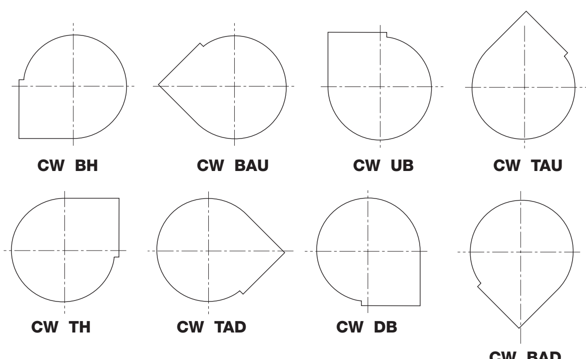


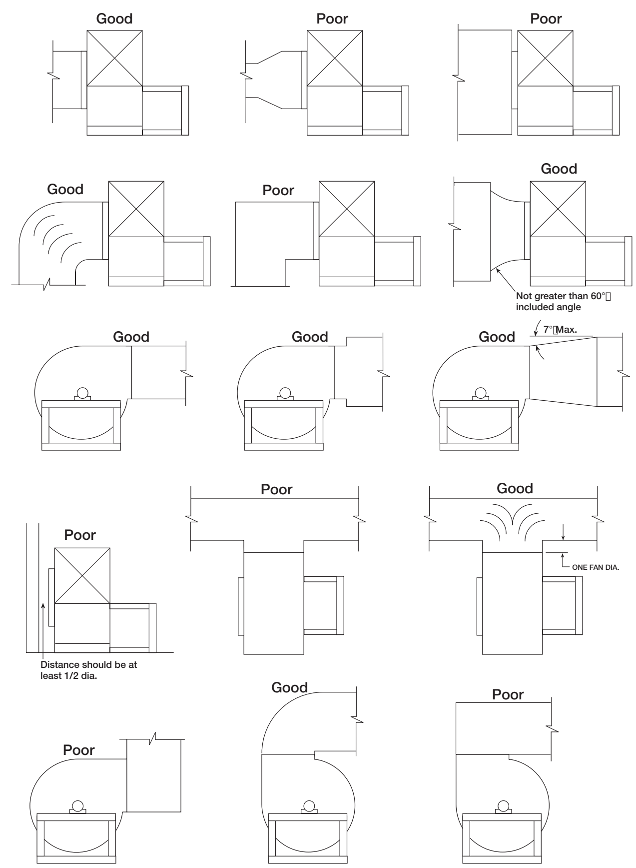
Fig. 1

Clockwise rotation shown. Counterclockwise discharge positions are a mirror image of those shown. The SWB 100 Series is clockwise rotation only. Fan rotation is always viewed from the drive side of the housing.

AFFECT OF INSTALLATION ON PERFORMANCE

Restricted or unstable flow at the fan inlet can cause pre-rotation of incoming air or uneven loading of the fan wheel, yielding large system losses, increased sound levels and structural failure of the fan wheel. Free discharge or turbulent flow in the discharge ductwork will also result in system effect losses.

The examples below show the system layout and inlet and discharge configurations which can affect fan performance.



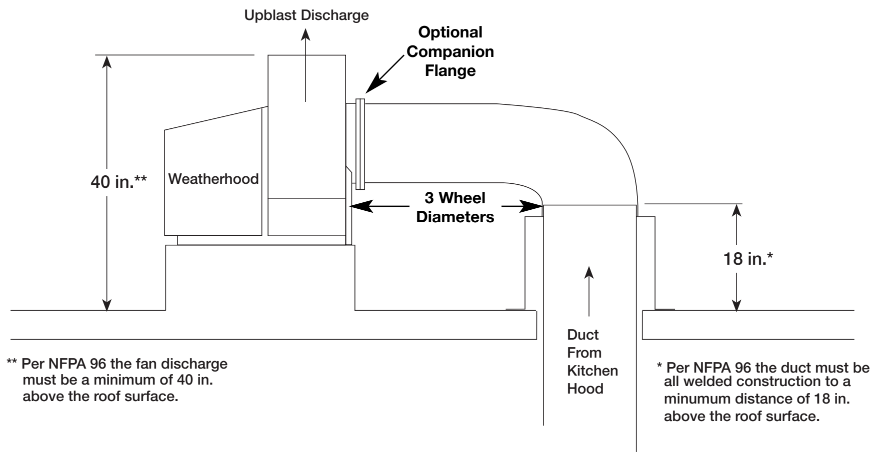
INSTALLATION OF UL/cUL 762 LISTED FANS FOR RESTAURANT EXHAUST

The UL/cUL 762 listing for restaurant exhaust is available on SWB 200 Series fan sizes 10-36 with a weatherhood. UL/cUL 762 fans are listed for a maximum operating temperature of 375°F and include a bolted access door and 1 in. drain connection. An outlet guard is strongly recommended when the fan discharge is accessible. An upblast discharge is recommended. The fan discharge must be a minimum of 40 in. above the roof line and the exhaust duct must be fully welded to a distance of 18 in. above the roof surface.

This drawing is for dimensional information only. See the latest edition of NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations for detailed installation instructions, materials, duct connections and clearances.

C UL US LISTED

Series 200 SWB models are listed for grease removal (UL/cUL 762) File no. MH11745.



** Per NFPA 96 the fan discharge must be a minimum of 40 in. above the roof surface.

* Per NFPA 96 the duct must be all welded construction to a minumum distance of 18 in. above the roof surface.

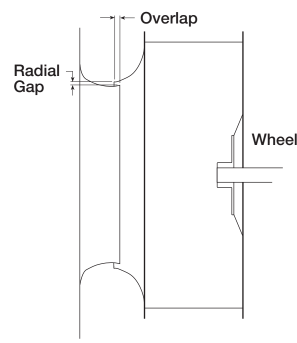
PRE-STARTING CHECKS

Wheels must rotate freely and not rub on the inlet venturi. Model SWB wheels overlap the inlet venturi as shown in Figure 2. Refer to the SWB fan wheel overlap and radial gap chart for proper dimensions.

Models SFD and SFB wheels do not overlap the venturi, but have a gap between the inlet venturi and the wheel (Fig. 3). Wheel position is preset at the factory and the unit is test run. Wheel movement may occur during shipment or installation and wheel alignment may be necessary.

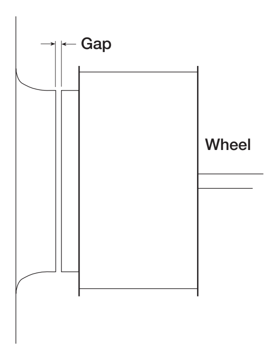
APPROXIMATE WHEEL CLEARANCE DIMENSIONS

Unit Size	SWB Overlap (inches) Series 100	SWB Overlap (inches) Series 200	SWB Radial Gap (inches)	SFD GAP (in.)	SFB GAP (in.)
6	-	-	-	3/8	-
7	-	-	-	3/8	-
9	-	-	-	1/2	1/2
10	3/8	1/4	5/32	1/2	1/2
12	3/8	-	5/32	-	1/2
13	7/16	1/4	5/32	-	1/2
15	1/2	1/4	5/32	-	1/2
16	1/2	1/4	5/32	-	-
18	5/8	3/8	5/32	-	1/2
20	5/8	3/8	5/32	-	5/8
22	11/16	-	5/32	-	5/8
24	3/4	3/8	5/32	-	-
25	-	-	-	-	3/4
27	7/8	-	3/16	-	3/4
30	15/16	1/2	3/16	-	3/4
33	1-1/16	-	3/16	-	-
36	1-3/16	1/2	3/16	-	-



MODEL SWB

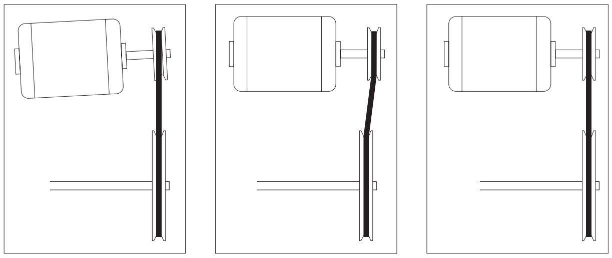
Fig. 2



MODEL SFD OR SFB

Fig. 3

On belt drive units, centering can be accomplished by (1) loosening the inlet cone bolts to move the inlet cone or by (2) loosening the bearings in order to move the shaft. Wheel and inlet cone overlap can be adjusted by loosening the wheel hub set screw and moving the wheel to the desired position. Tighten all fasteners and set screws securely and realign drive pulleys after adjustment. Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line (Fig. 4)



Wrong **Wrong** **Right**

Fig. 4

The adjustable motor pulley is set at the factory for the fan RPM specified by the customer. Fan RPM can be increased by closing or decreased by opening the adjustable motor pulley. Multi-groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in fan speed represents a substantial increase in load on the motor.

To avoid motor overheating and possible burnout, motor load amperes should always be checked and compared to nameplate rating when fan speed is increased.

Rotation direction of the wheel is critical and incorrect rotation will result in reduced air performance, increased motor loading and possible motor burnout.

Check wheel rotation by momentarily energizing the unit and noting if rotation is in the same direction as the airflow at the outlet and conforms to the rotation decal affixed to the unit (Fig. 5). NOTE: Models SFD and SFB units should be operated only when attached to the system for which they were designed. Without proper system static pressure the motor could be seriously overloaded.

WHEELS VIEWED FROM THE DRIVE SIDE

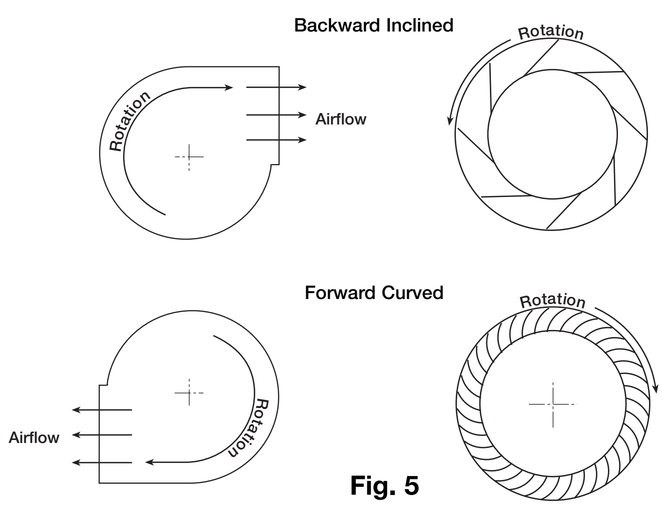


Fig. 5

WARNING

DISCONNECT AND SECURE TO THE "OFF" POSITION ALL ELECTRICAL POWER TO THE FAN PRIOR TO INSPECTION OR SERVICING. FAILURE TO COMPLY WITH THIS SAFETY PRECAUTION COULD RESULT IN SERIOUS INJURY OR DEATH.

BLOWER MAINTENANCE (BELT DRIVE)

Belts tend to stretch after a period of time. They should be periodically checked for tension and wear. When replacing belts, use the same type as supplied with the unit. Replacement of belts should be accomplished by loosening the tensioning “L-bolts” so the belts may be removed by hand. Do not force belts on or off as this may cause breakage of cords and lead to premature belt failure.

Belt tension should be adjusted to allow 1/64 in. of belt deflection per 1 in. of belt span. For example, a 16 in. belt span should have 16/64 in. or 1/4 in. of deflection with moderate thumb pressure at mid-point between the pulleys. (Fig. 6).

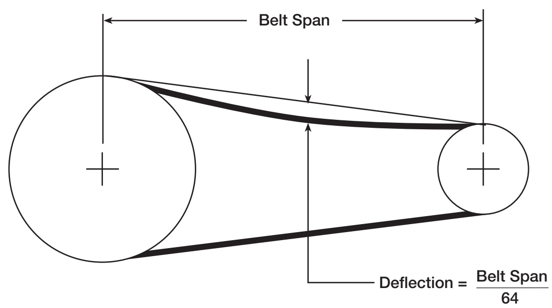


Fig. 6

Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. See the recommended bearing lubrication schedule.

BEARING LUBRICATION SCHEDULE FOR GREENHECK UTILITY FANS

(Relubrication schedule in months)

Fan RPM	Shaft Diameter in inches	
	3/4 to 1½	1¾ to 2
To 500	6	6
500-1000	6	5
1000-1500	5	4
1500-2000	4	3
2000-2500	4	2
2500-3000	3	1
3000-3500	2	1

If unusual conditions exist - temperatures below 32°F or above 200°F, moisture or contaminants - more frequent lubrication is required.

With the unit running add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal.

Be careful not to unseat the seal by over lubricating or using excessive pressure. A guide to the amount of grease to be used is to fill 30% to 60% of available space in the bearing and housing.

A high quality lithium based grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used.

Mobil 532
Mobilux #2
B Shell Alvania #2
Texaco Multifak #2
Texaco Premium #2
Unirex N2

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. A bearing collar which has loosened will cause premature failure of the fan shaft. Fasteners attaching the bearings to the drive frame should also be checked.

MOTOR MAINTENANCE (BELT AND DIRECT DRIVE)

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust and grease build-up on the motor housing assures proper motor cooling. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam, water or solvents.

Greasing of motors is intended only when fittings are provided. Many fractional horsepower motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer’s recommendations.

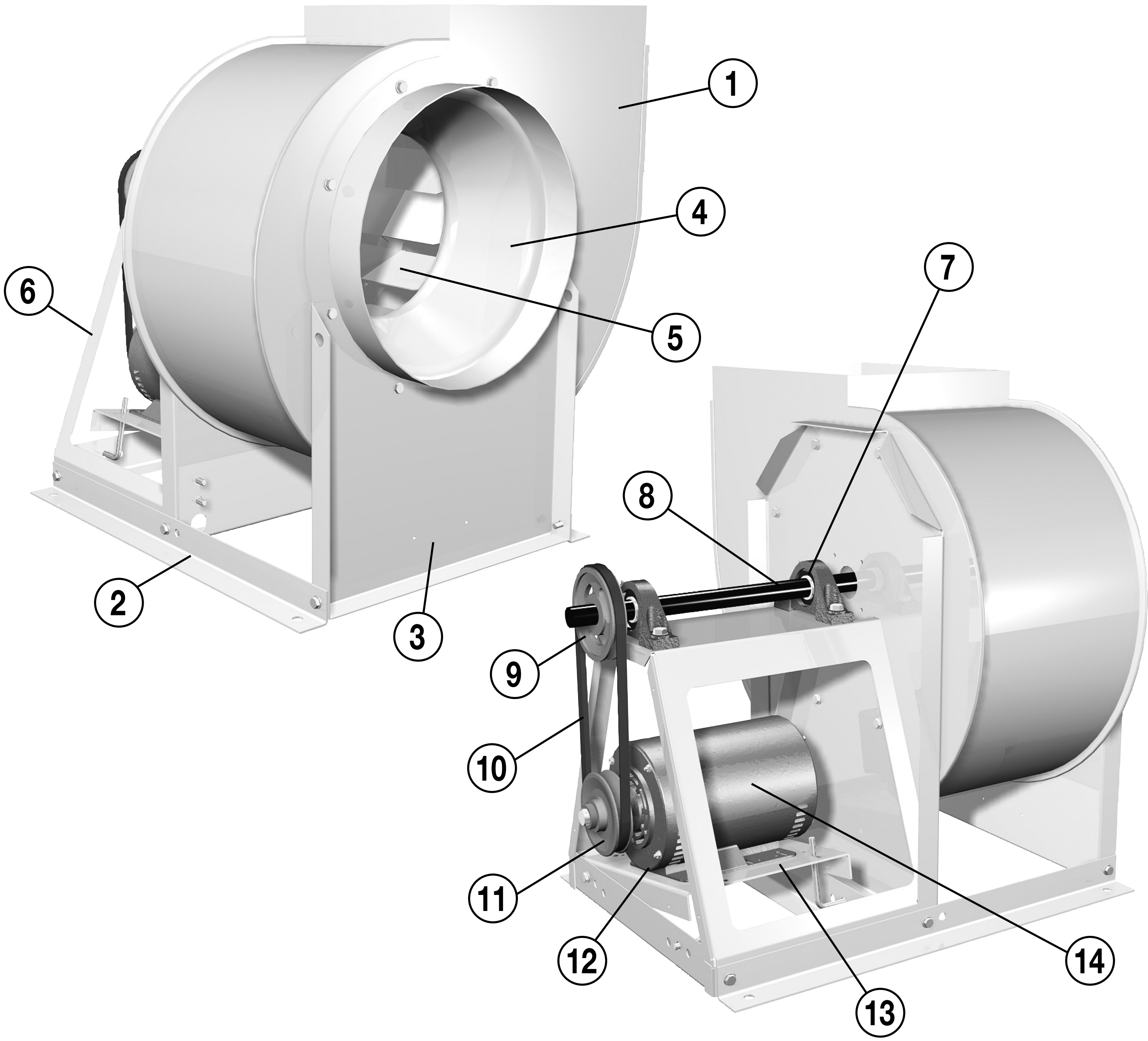
WHEEL AND FASTENER MAINTENANCE

Wheels require very little attention when exhausting clean air, however air heavily laden with grease or dirt will tend to accumulate on the wheel causing unbalance. Wheels exhausting dirty or grease laden air require frequent cleaning to assure smooth and safe operation.

All fasteners, including set screws in the bearing collars, should be checked for tightness each time maintenance checks are performed.

A proper maintenance program will help preserve the performance and reliability designed into the fan.

PARTS LIST



Always provide the unit model and serial number when requesting parts or information.

REPLACEMENT PARTS

1. Scroll housing
2. Drive frame - Base angle
3. Intake support panel
4. Inlet ring and cone
5. Wheel (Specify rotation)
6. Drive frame assembly
7. Pillow block bearings
8. Fan shaft
9. Shaft pulley
10. Belt
11. Motor pulley
12. Belt tensioning bolts
13. Motor plate
14. Motor

TROUBLESHOOTING

Problem	Cause	Corrective Action
Excessive Noise	Wheel Rubbing Inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-Belt Drive	Tighten sheaves on motor/fan shaft. Adjust belt tension. Align sheaves properly (see page 4). Replace worn belts or sheaves.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars & fasteners.
	Wheel Unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
Low CFM	Fan	Check wheel for correct rotation. Increase fan speed.*
	Duct System	See page 4.
High CFM	Fan	Decrease fan speed.
	Duct System	Resize ductwork. Access door, filters, grills not installed.
Static Pressure Wrong	Duct system has more or less restriction than anticipated	Change obstructions in system. Use correction factor to adjust for temperature/altitude. Resize ductwork. Clean filters/coils. Change fan speed.*
High Horsepower	Fan	Check rotation of wheel. Reduce fan speed.
	Duct System	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan Doesn't Operate	Electrical Supply	Check fuses/circuit breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.
Overheated Bearing	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.

NOTE: Always provide the unit model and serial numbers when requesting parts or service information.

*Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in burnout.

WARRANTY

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove to be defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

GREENHECK®
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171
www.greenheck.com

Saf-T Vent® CI Plus Specifications for Double Wall Special Gas Vent Applications

The Saf-T Vent® CI Plus system is an air-insulated double-wall product designed for commercial applications. It is approved for use on individual or common vented ANSI Category I, II, III, and IV Gas Burning Appliances and Direct Vent applications as approved by the appliance manufacturer.

The Saf-T Vent CI Plus factory-built Special Gas Vent system is Tested and Listed by Underwriters Laboratories to UL 1738 /ULC S636 for use with Listed natural gas or propane burning equipment that produce continuous flue-gas temperatures not above 550°F. The system is to be installed and sealed per manufacturers' instructions so all joints are gas tight, preventing leakage of products of combustion into a building.

The Saf-T Vent CI Plus system is a double-wall product that consists of a flue-gas conduit fabricated from AL 29-4C® stainless steel, which is highly suited for use with high-efficiency gas burning equipment, which produce excessive amounts of condensation in the vent. The outer jacket of the system is constructed of type 430 stainless steel with a space of approximately 1" between the flue-gas conduit and the jacket.

All joints in the Saf-T Vent CI Plus system are fastened with a new closure system* that combines the features of Heat-fab's tapered ends with a mechanical closure system which consists of tabs and a locking band. The locking band is tightened from a single location using a simple hand tool, pulling the two pieces together making a pressure tight assembly. When installed on positive pressure or condensing applications, the joints must be sealed. Diameters 5" through 16" are manufactured with a factory adhered seal. Diameters 18" through 32" must use an approved sealant on the job site. This closure system is tested to be gas tight at two and one-half times the Listed pressure rating of 15" water column.

When properly installed the Saf -T Vent CI Plus system may safely and securely be utilized in either interior or exterior installations. The system is capable of withstanding reasonable wind and incidental loads as required by UL standards.

*U.S. Patent No. 6,702,338

When connected to gas-burning appliances with a maximum continuous flue-gas temperature of 550°F, 5" through 24" diameter Saf-T Vent CI Plus can be fully enclosed vertically by combustible materials at 1" or greater clearance and 26" - 32" diameter at 2" or greater clearance. For horizontal applications refer to the Clearance Chart (publication # 11724).

The Saf-T Vent CI Plus system is to be sized in accordance with appliance manufacturers' specifications, the most current edition of NFPA 211 Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances, the most current edition of NFPA 54 National Fuel Gas Code (ANSI Z223.1), ASHRAE recommendations, and all applicable local and regional codes. This proper sizing, based on information supplied by the consumer, is reflected in scale drawings of the system provided by Heat-fab, Inc.

The Saf-T Vent CI Plus system is to be installed only in accordance with Heat-fab, Inc., "Installation and Maintenance Instructions" and with all applicable local, regional, and national codes.

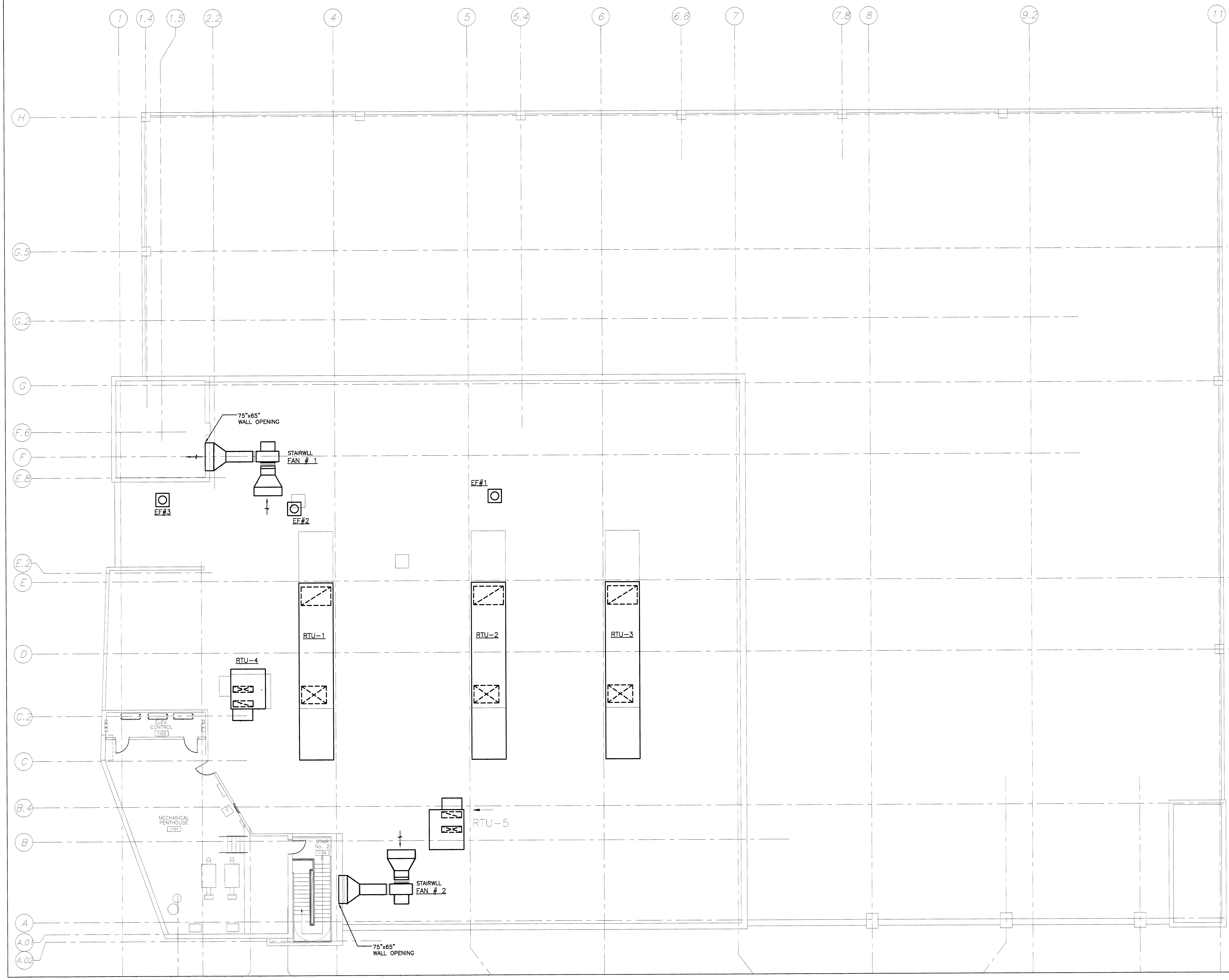
TECHNICAL SPECIFICATION

Product	Saf-T Vent CI Plus Special Gas Vent
Uses	Chimneys and Vents (Horizontal or Vertical) for ANSI Category I, II, III, and IV gas-burning appliances.
Fuels	Natural gas or propane fired equipment
Pressure	Positive up to 15" wc, negative, or neutral
Standard Diameters	5"-32"
Flue-Gas Conduit	AL 29-4C® stainless steel
Jacket	430 stainless steel
Insulation	Air Space 1"
Seal	Factory adhered seal (5"-16") RTV Sealant (18"-32")

www.heat-fab.com 130 Industrial Blvd., Turners Falls, MA 01376

heatfab
High-performance chimneys and vents

Pub #11462-011305



REV.	DESCRIPTION	DATE
–	100% CD	07/19/07

STATE OF MAINE
DANIEL D. THAYER
No. 5070
LICENSED
PROFESSIONAL ENGINEER

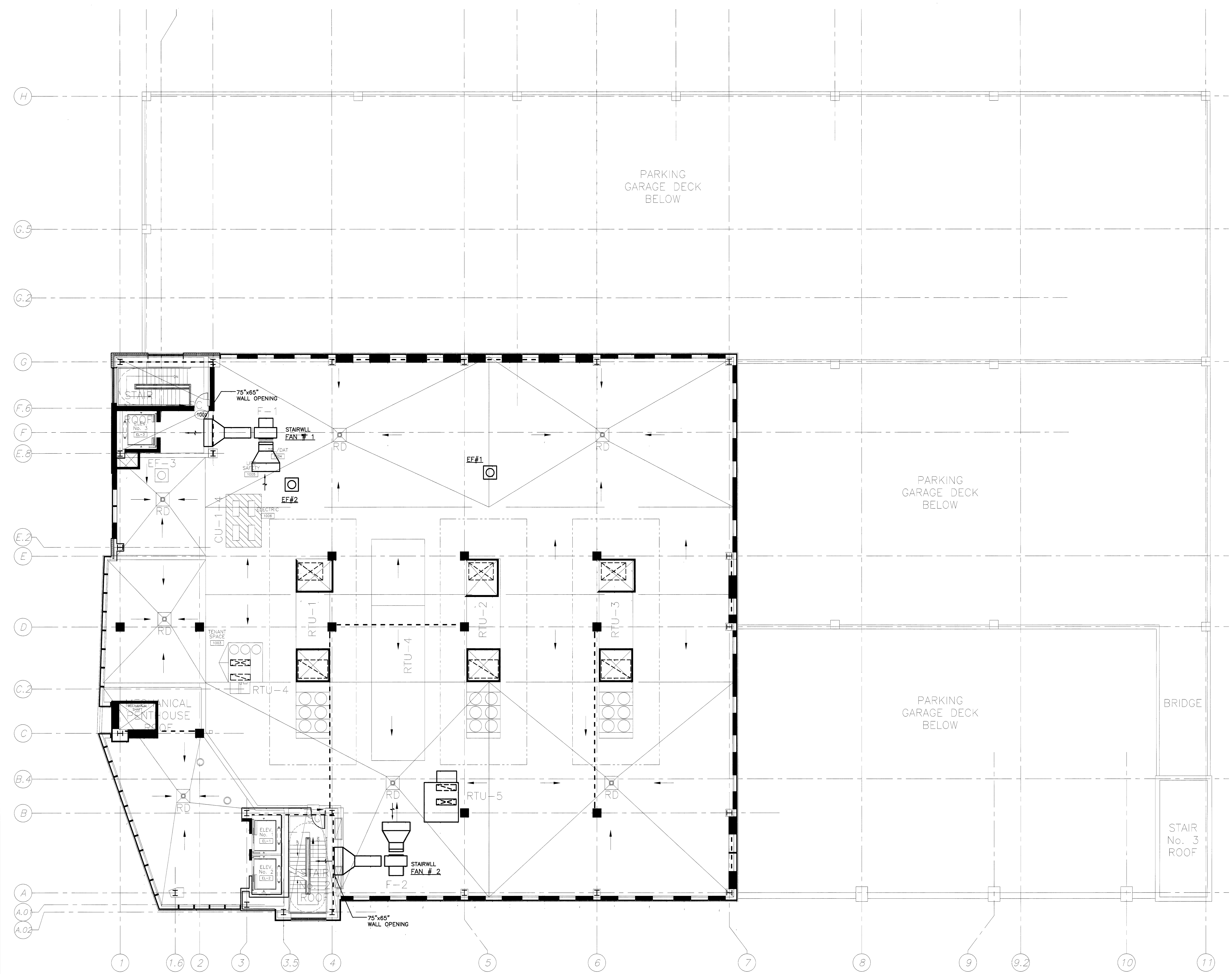
DESIGN/BUILD/MAINTAIN

THAYER
CORPORATION
1400 Hotel Road, P.O. Box 2058
AUBURN,MAINE 04211
Tel. (207)782-4197 Fax (207)782-1064

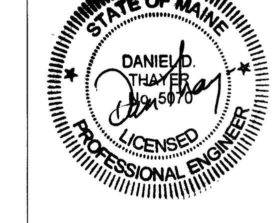
PROJECT: 84 MARGINAL WAY
PORTLAND, MAINE

SHEET TITLE: HVAC 11TH FLOOR

SCALE:	1/8"=1'-0"	DATE:	04/27/07
PROJECT MANAGER:	ADK		
JOB CAP/DRAWN:	MAS		
E OF RECORD:	D.THAYER,P.E.	SHEET No.	M11.0
THAYER CAD FILE	M11.0		



REV.	DESCRIPTION	DATE
–	100% CD	07/19/07



DESIGN/BUILD/MAINTAIN

THAYER CORPORATION
1400 Hotel Road, P.O. Box 2058
AUBURN, MAINE 04211
Tel. (207)782-4197 Fax (207)782-1064

PROJECT: 84 MARGINAL WAY
PORTLAND, MAINE

SHEET TITLE: ROOF PLAN

SCALE:	1/8"=1'-0"	DATE:	04/27/07
PROJECT MANAGER:	ADK		
JOB CAP/DRAWN:	MAS		
E OF RECORD:	D.THAYER,P.E.	SHEET No.	M12.0
THAYER CAD FILE	M12.0		

ROOFTOP PACKAGE A/C SCHEDULE

TAG	MANUFACTURER	MODEL	TOTAL COOLING (BTU/HR)	SENSIBLE COOLING (BTU/HR)	HEATING INPUT (BTU/HR)	HEATING OUTPUT (BTU/HR)	AIRFLOW (CFM)	ESP (IN W.C.)	SUPPLY FAN (HP)	EXHAUST FAN (HP)	DIMENSIONS	OPERATING WEIGHT	ELECTRICAL	LOCATION
AC-1	CARRIER	48Z8J090YLK610PS	1,095,780	830,110	975,000	790,000	35,000	2	60	30	41'6"L X 8'2"W X 6'11"H	13,532 LBS	460V 3 PH 286.9 MCA 350.0 MOCP	ROOF
AC-2	CARRIER	48Z8J090YLK610PS	1,095,780	830,110	975,000	790,000	35,000	2	60	30	41'6"L X 8'2"W X 6'11"H	13,532 LBS	460V 3 PH 286.9 MCA 350.0 MOCP	ROOF
AC-3	CARRIER	48Z8J090YLK610PS	1,095,780	830,110	975,000	790,000	35,000	2	60	30	41'6"L X 8'2"W X 6'11"H	13,532 LBS	460V 3 PH 286.9 MCA 350.0 MOCP	ROOF
AC-4	CARRIER	48PGEC16HD-6--	193,100	143,300	310,000	251,000	6,000	2	7 1/2	N/A	7'4"L X 9'0"W X 4'3"H	2,284 LBS	460V 3PH 40.8 MCA 50 MOCP	ROOF
AC-5	CARRIER	48PGEC16HD-6--	193,100	143,300	310,000	251,000	6,000	2	7 1/2	N/A	7'4"L X 9'0"W X 4'3"H	2,284 LBS	460V 3PH 40.8 MCA 50 MOCP	ROOF

BOILER SCHEDULES

TAG	MANUFACTURER	MODEL	OUTPUT (BTU/HR)	INPUT (BTU/HR)	DIMENSIONS	FLUE SIZE	WEIGHT	ELECTRICAL	LOCATION
B-1	BUDERUS	G515/7	711,000	995,000	62 1/4"L X 33 1/2"W X52 1/4" H	10"	3,300 LBS	120V 1 PH. 1/3 HP	BOILER ROOM
B-2	BUDERUS	G515/7	711,000	995,00	62 1/4"L X 33 1/2"W X52 1/4" H	10"	3,300 LBS	120V 1 PH. 1/3 HP	BOILER ROOM

CIRCULATOR SCHEDULES

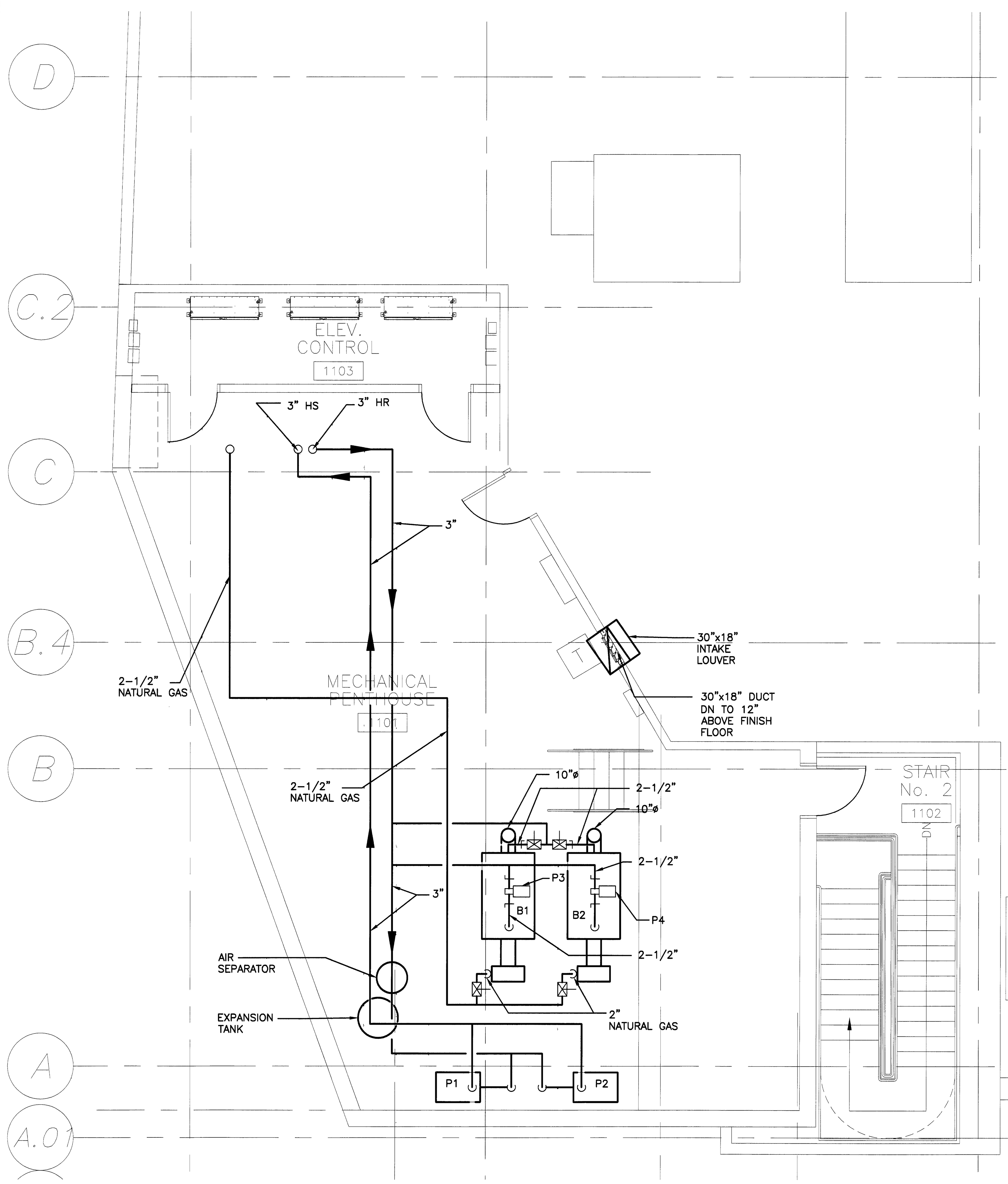
TAG	MANUFACTURER	MODEL	FLOW(GPM)	FT HD	HP	RPM	ELECTRICAL	LOCATION
P-1	B&G	SERIES 1510 2-1/2AB	174	40	3	VARIABLE	460V 3PH	BOILER ROOM
P-2	B&G	SERIES 1510 2-1/2AB	174	40	3	VARIABLE	460V 3PH	BOILER ROOM
P-3	B&G	SERIES 60 2X2X5-1/4	72	10	1/2	1800	460V 3PH	BOILER ROOM
P-4	B&G	SERIES 60 2X2X5-1/5	72	10	1/2	1800	460V 3PH	BOILER ROOM
P-5	TACO	007-IFC	3	10	1/15	3250	115V 1PH	ROOM 102
P-6	TACO	007-IFC	3	10	1/15	3250	115V 1PH	ROOM 103
P-7	TACO	007-IFC	3	10	1/15	3250	115V 1PH	ROOM 106
P-8	TACO	007-IFC	3	10	1/15	3250	115V 1PH	ROOM 109
P-9	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column D4
P-10	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column D5
P-11	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column D6
P-12	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column E4
P-13	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column E5
P-14	TACO	007-IFC	3	10	1/15	3250	115V 1PH	5th Floor Column E6
P-15	BERKLEY	BZTPMS	150	50(PSI)	3	VARIABLE	460V 3PH	ROOM 102
P-16	BERKLEY	BZTPMS	151	50(PSI)	3	VARIABLE	460V 3PH	ROOM 102

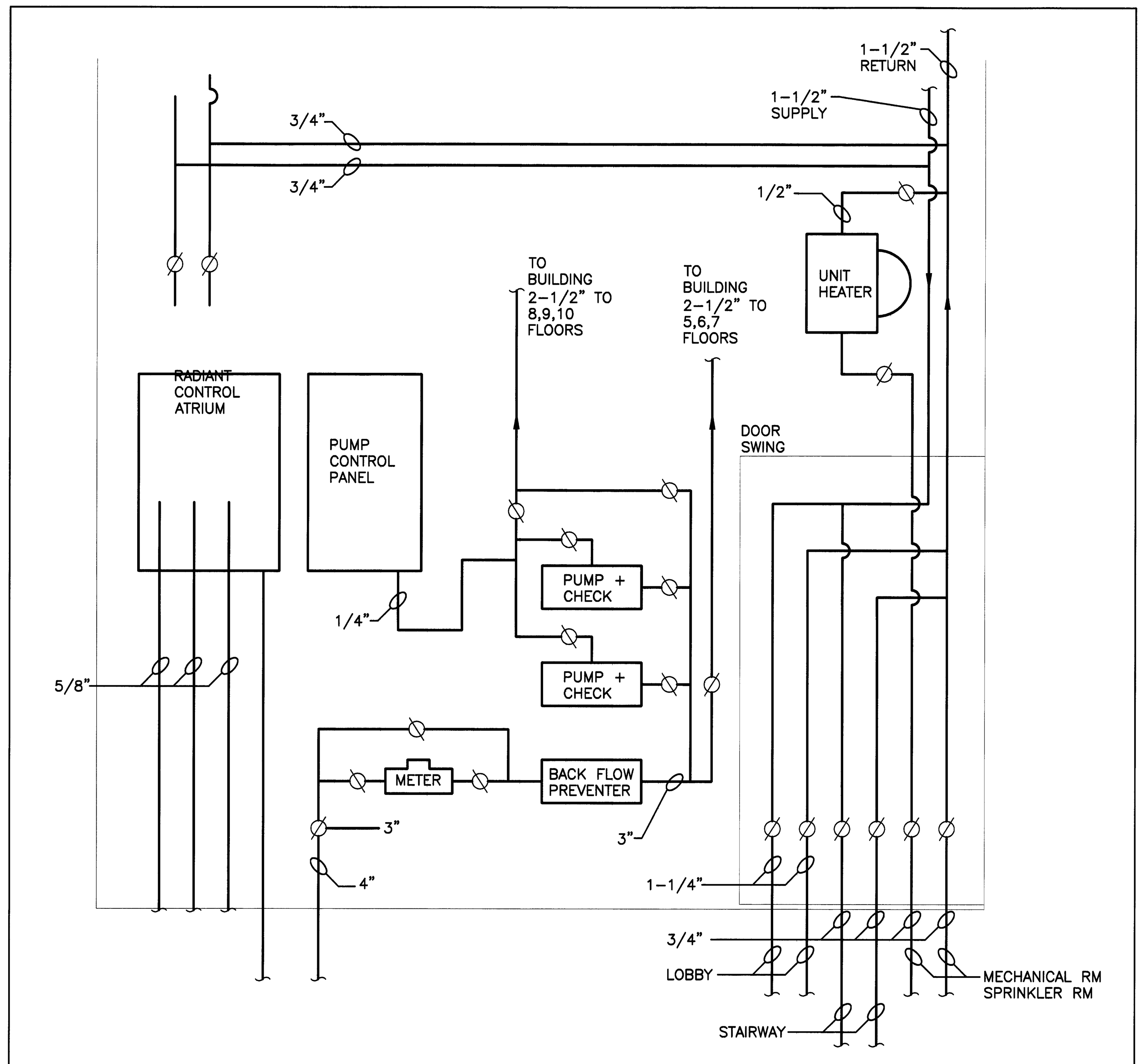
FAN SCHEDULES

TAG	MANUFACTURER	MODEL	AIRFLOW (CFM)	ESP(IN W.C.)	FAN RPM	MOTOR(HP)	DIMENSIONS	OPERATING WEIGHT	ELECTRICAL	LOCATION
SA-1	GREENHECK	SWB-236-200	25,000	2.5	1,047	20	60 7/8"L X 55 3/8"W X 83 1/8"H	1,170	460V 3PH 27.0FLA	ROOF
SA-2	GREENHECK	SBW-236-201	25,000	2.5	1,047	20	61 7/8"L X 55 3/8"W X 83 1/8"H	1,171	460V 3PH 27.0FLA	ROOF
EF-1	PENN	DX16B	4350	1.5	VARIABLE	3	39"W X 31"H	131	460V 3PH	ROOF
EF-2	PENN	DX14B	2400	1.5	VARIABLE	1 1/2	33 1/2"W X 29"H	98	460V 3PH	ROOF
EF-3	PENN	DX16B	5100	1.5	VARIABLE	3	39"W X 31"H	131	460V 3PH	ROOF

UNITARY HEATER SCHEDULES

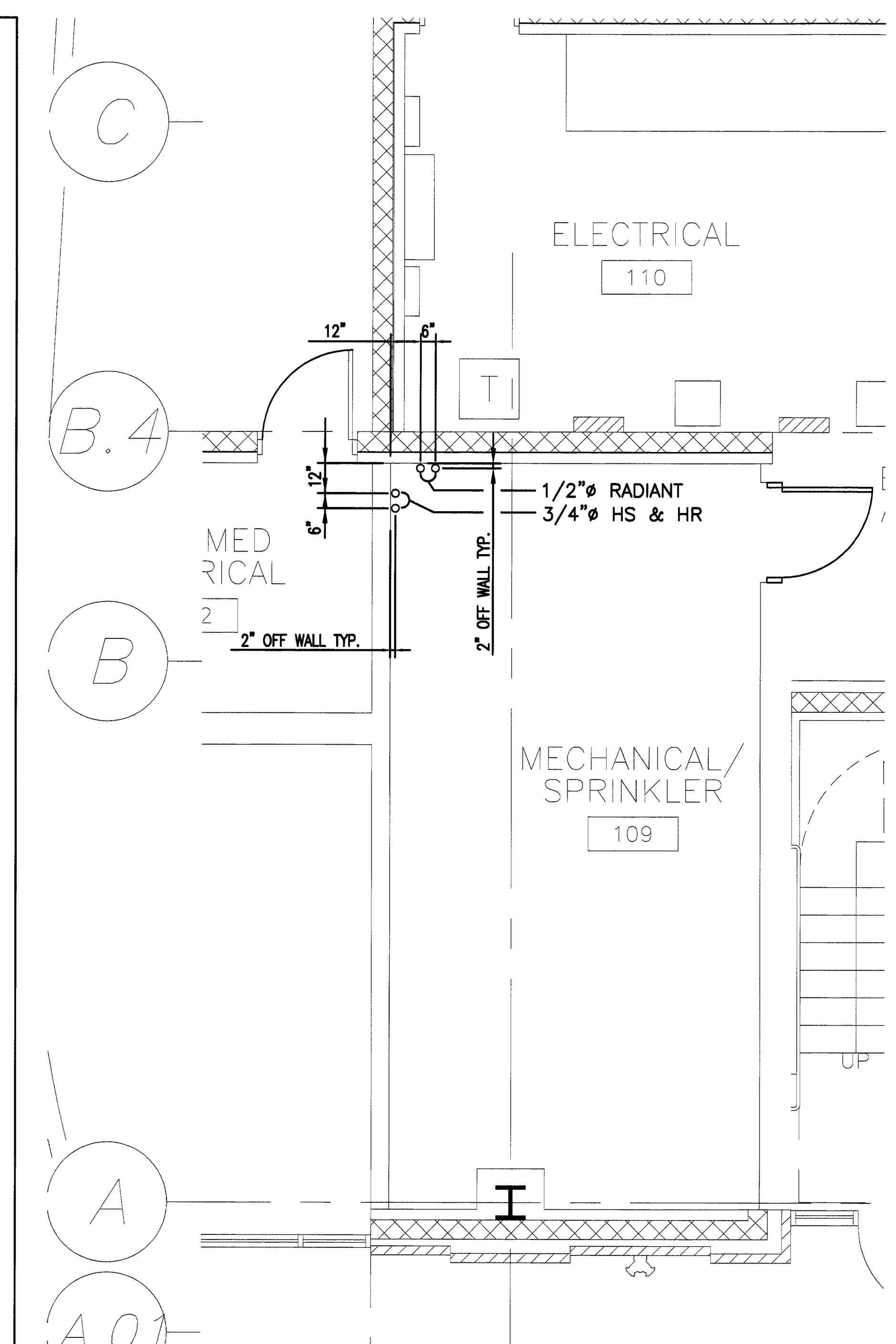
TAG	MANUFACTURER	MODEL	OUTPUT (BTU/HR)	FLOW(GPM)	FAN HP	ELECTRICAL	LOCATION
UH-1	MODINE	HC-24-01	16,200	1.7	1/25	115V 1PH	ROOM 102
CUH-1	MODINE	CW06-6	44,300	4.43	1/20	115V 1PH	STAIR 104
CUH-2	MODINE	CW06-6	44,300	4.43	1/20	115V 1PH	STAIR 106
CUH-3	MODINE	CW06-2	20,100	1	1/30	115V 1PH	LOBBY 203
CUH-4	MODINE	CW06-2	20,100	1	1/30	115V 1PH	LOBBY 303
CUH-5	MODINE	CW06-2	20,100	1	1/30	115V 1PH	LOBBY 403

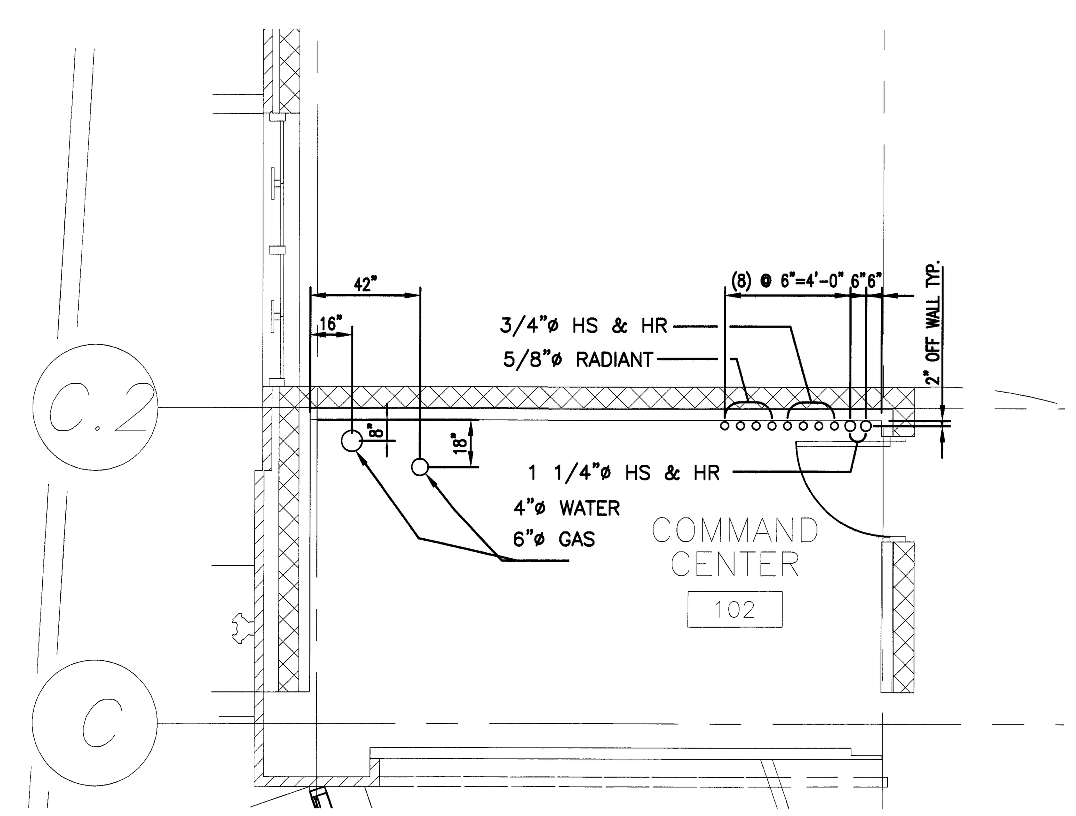




BOOSTER PUMP SYSTEM SCHEMATIC

NO SCALE





REV.	DESCRIPTION	DATE
-	100% CD	07/19/07

STATE OF MAINE DANIEL D. THAYER No. 5070 LICENSED PROFESSIONAL ENGINEER

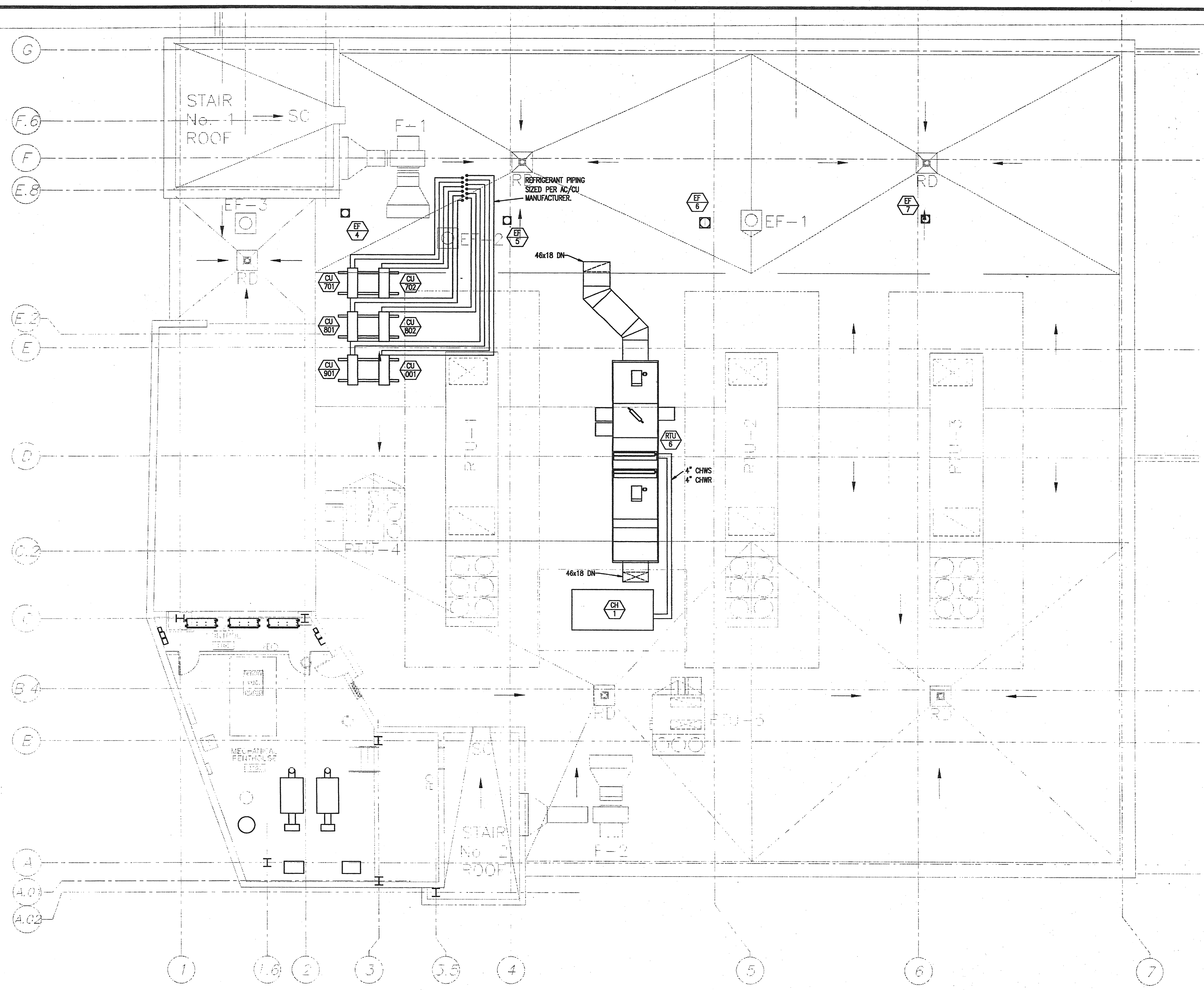
DESIGN/BUILD/MAINTAIN

THAYER CORPORATION
1400 Hotel Road, P.O. Box 2058
AUBURN,MAINE 04211
Tel. (207)782-4197 Fax (207)782-1064

PROJECT: 84 MARGINAL WAY
PORTLAND, MAINE

SHEET TITLE: PART PLAN, SCHEDULES & DETAIL

SCALE:	1/8"=1'-0"	DATE:	04/27/07
PROJECT MANAGER:	ADK		
JOB CAP/DRAWN:	MAS		
E OF RECORD:	D.THAYER,P.E.	SHEET No.	M13.0
THAYER CAD FILE	M11.0		



MECHANICAL DUCTWORK – ROOF – NEW WORK

SCALE: 1/8" = 1'-0"

HARRIMAN

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NGI 26393H006

Project Title

INTERMED MARGINAL WAY

PORTLAND, MAINE

HA Project No. 05182

Key Plan

N

STATE OF MAINE
CHRISTOPHER M. PIIK
No. 10696
12/17/2007
LICENSED
PROFESSIONAL ENGINEER

Mark	Date	Description
	12-17-07	ISSUE FOR PRICING
	11-05-07	50% CD REVIEW
	08-31-07	DESIGN DEVELOPMENT

Issue Dates

Drawing Status

REVIEW

Drawing Title

MECHANICAL
ROOF PLAN
NEW WORK

PA / PE: SPF | Drawn By: NMG

Drawing Number

M01.9