INSTALLATION INSTRUCTIONS
CHMS METAL SHEATH DUCT HEATERS

Fig. 1 Model CHMS-3-F Flange
Type with straight elements
(All straight element heaters must be flanged).

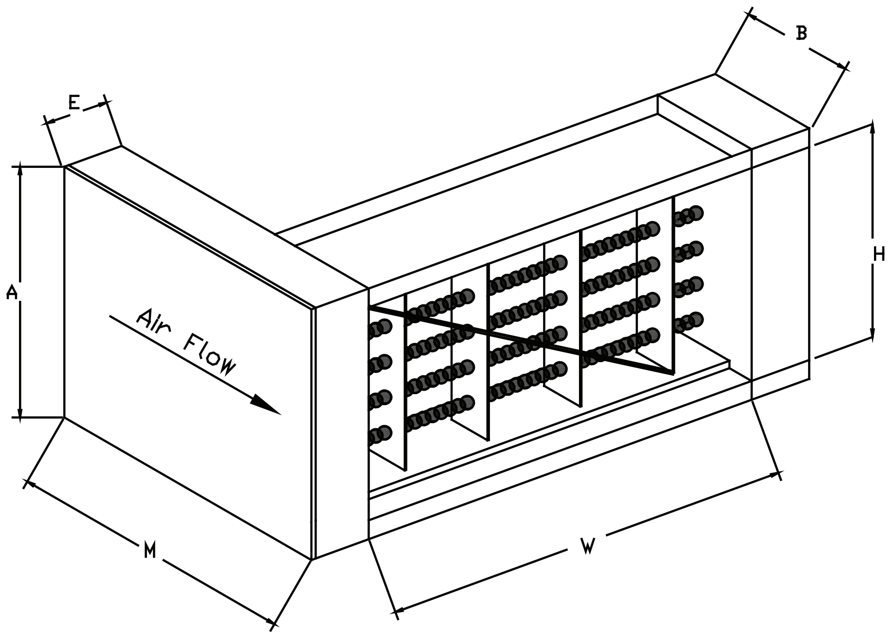
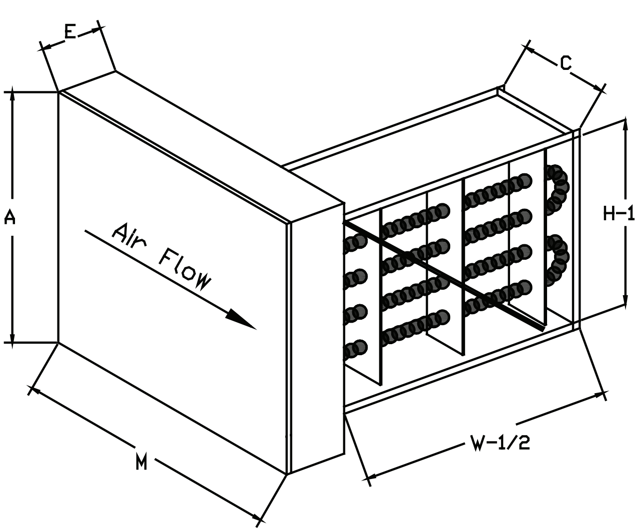
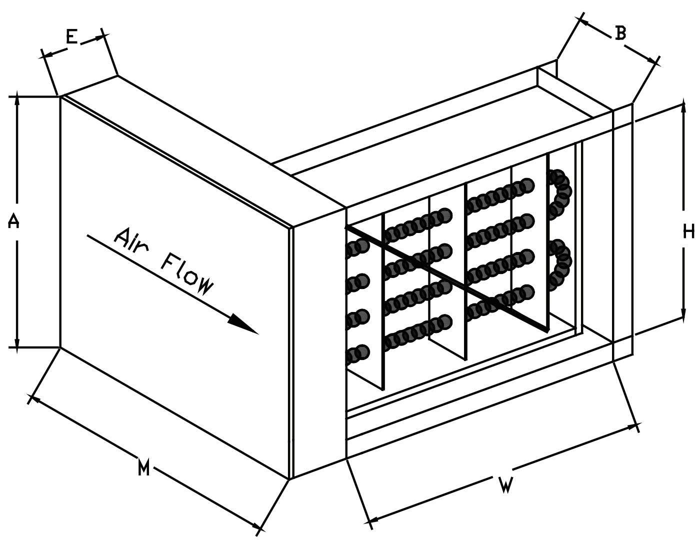


Fig. 2 CHMS-3-I Insert
Type with “U” Bend Elements



Type 3 CHMS-3-F Flange
Type with “U” Bend Elements



WARNING: All electrical connections in the heater, including both field and factory made connections, should be checked for tightness.

APPLICATION REQUIRMENTS

1. The duct system must provide uniform air flow over the entire face area on the heating elements.

2. For satisfactory and safe operation the minimum air velocity must be maintained as determined from the graphs within these instructions.

3. The air duct should be installed in accordance with the standards of the National Fire Protection Association for the installation of air conditioning and ventilating systems of other than residence - type (pamphlet no. 90 A) and residence - type warm air heating and air conditioning systems (pamphlet no. 90 B).

4. The heater should be installed at least 48" downstream from the outlet of a heat pump, central air conditioner, or fan coil unit.

5. Maximum inlet air temperature is 100 deg. F.

6. Series CHMS heaters are intended to be installed in duct systems having zero clearance to combustible surfaces.

7. Series CHMS heaters are intended for horizontal or vertical-up air flow.

INSTALLATION RESTRICTIONS

1. Heater should be installed at least four feet downstream from heat pump, central cooling air conditioner, fan coil unit, or VAV valve. See fig. 4.

2. Maintain at least four feet of straight duct up stream of heater and at least two feet of straight duct downstream of the heater. These dimensions apply to the inside dimension of duct elbows. See figs. 5 and 6.

3. Changes in duct size, air filters, humidifiers, dampers, etc., should be at least four feet from either side of the heater. This distance should be maintained with flexible duct and flexible duct connectors.

4. Heaters to be installed in an internally lined duct are sized for duct open area (inside dimensions) so that air flow across the heating elements is not restricted. See figs. 7 and 8.

5. Do not install CHMS heaters outdoors. Do not install with rooftop equipment where exposed to weather.**<u>CHMSO outdoor rated heaters must be used for outdoor applications.</u>**

6. Do not install these heaters in series in the air stream. Stacked installation is permitted as defined in the installation procedures. See fig. 11.

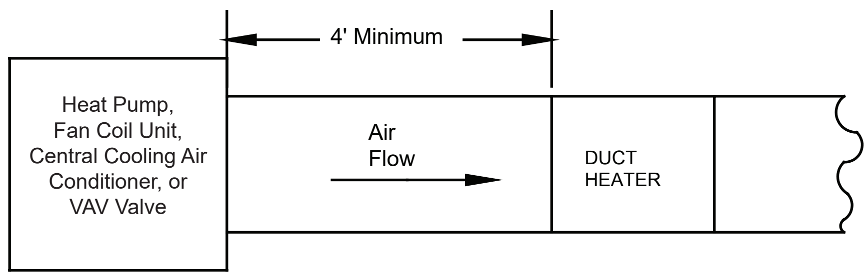


Figure 4

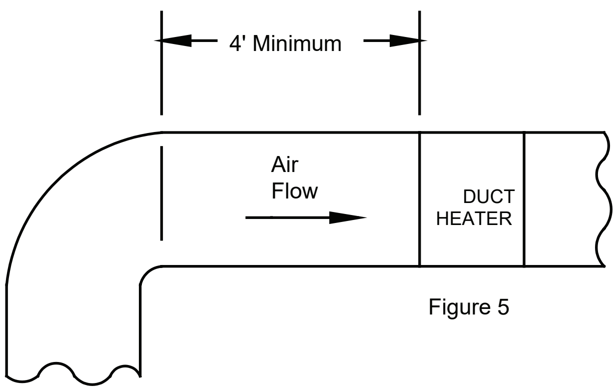


Figure 5

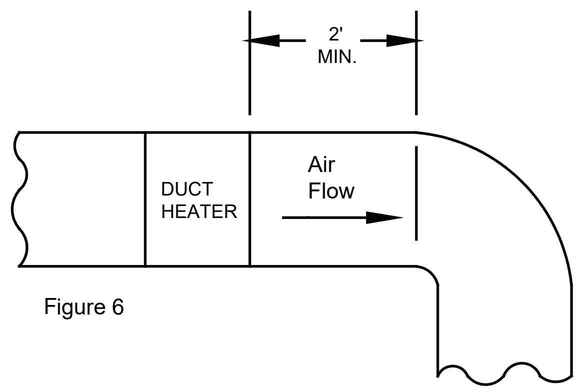


Figure 6

Figure 7

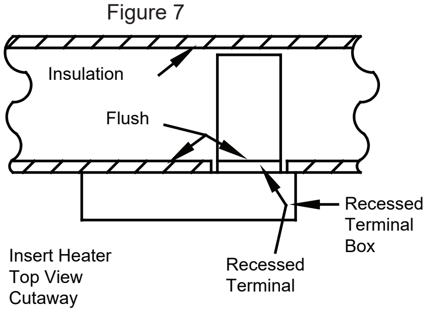
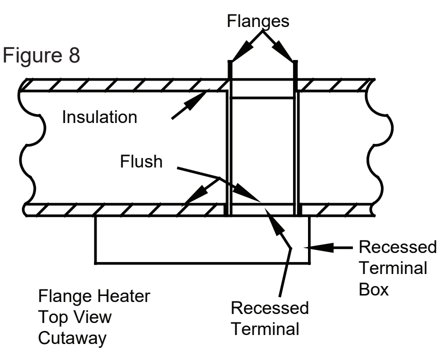


Figure 8



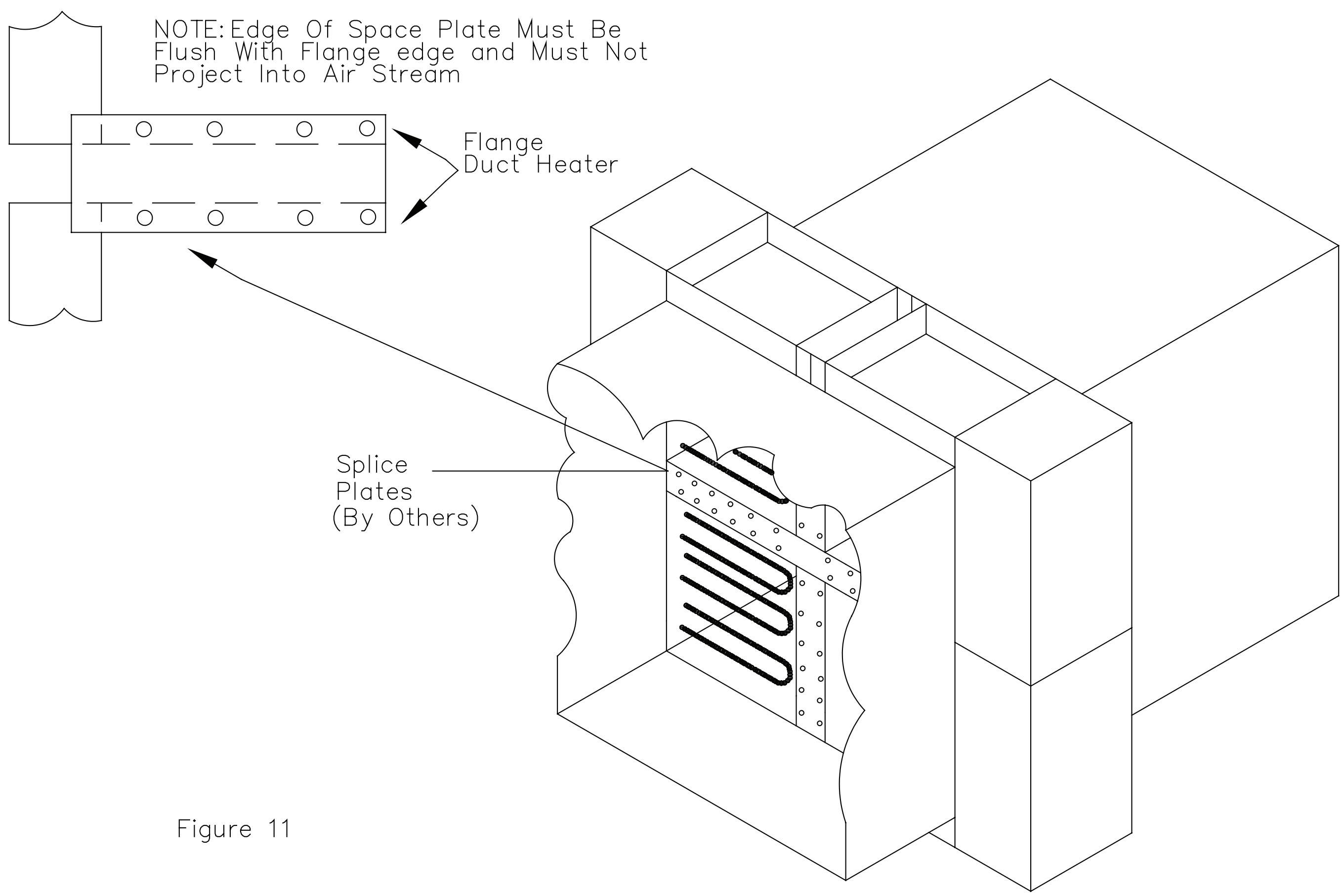

NOTE: Edge Of Space Plate Must Be Flush With Flange edge and Must Not Project Into Air Stream
Flange
Duct Heater
Splice
Plates
(By Others)

Figure 11

INSTALLATION PROCEDURES

1. Make sure air flow arrow on heater corresponds to air flow through duct and heater is properly positioned if marked with “Top”.

2. The heater terminal compartment should not be enclosed by insulation, etc.

3. Insert Type (fig. 9) Cut a hole in the side of the duct 1/8” larger than the element housing (H-1 X C). Attach the back of the terminal box to the duct. See figs. 2 and 7.

4. Flange Type (fig. 10) Provide duct flanges to match heater flanges. Attach the heater to duct flanges with screws. See figs. 3 and 8.

5. Care should be taken to assure that no field attached screws are in the area of internal wiring or components. The end terminal box on heaters illustrated by fig. 1 is not to be enclosed in the duct system. Inspect the inside of the end terminal box during and after installation to assure that field attached screws do not interfere with internal wires or components.

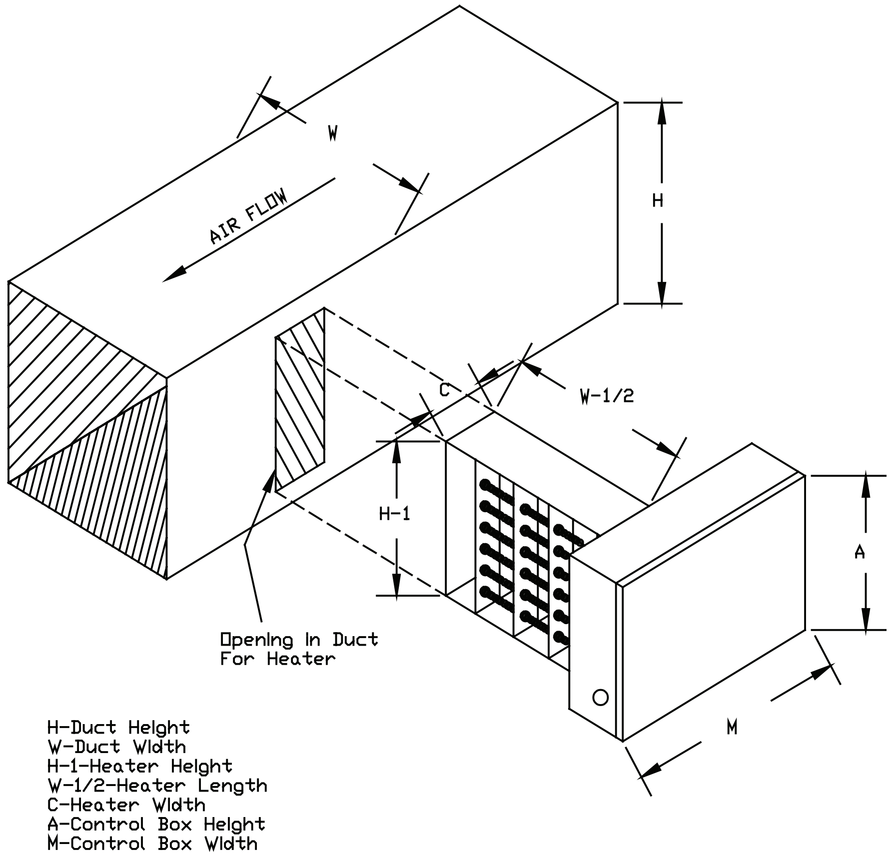
6. After installation, prior to field wiring, inspect the inside of the control box and remove any dust, dirt, or metal flakes that are present.

7. The installation of duct heaters should be such that sufficient working space is provided as required by paragraph 110.26 of the N.E.C.

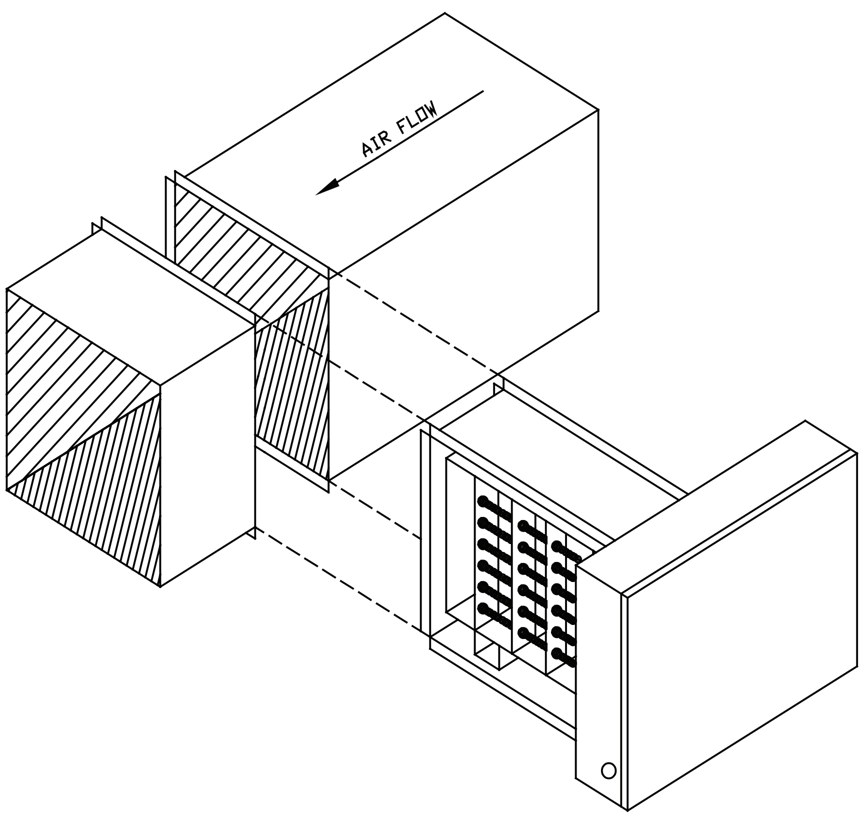
8. Multiple Duct Heaters (fig. 11) Flange type heaters may be combined in a heating bank as shown in fig. 11. Splice plates for fastening flange type duct heaters together to form a bank, must be field provided. Heaters are code marked at the factory for proper field arrangement in the duct.

9. Sufficient clearance for convection cooling must be allowed for all heaters with built in SCR controls. Provide at least 5 inches of free air space above and below cooling fins extending from heater control box.

10. On heaters supplied with an integral pressure differential air flow switch a minimum of .07 in. W.C. is necessary for proper heater operation. The velocity pickup tube for the air flow switch must be in the proper direction. When the heater is installed on the downstream or positive pressure side of the air moving fan, the arrow on the mounting flange of the pickup tube must point in the same direction as the air flow. When the heater is installed on the upstream or negative pressure side of the air moving fan, the arrow must point in the direction opposite to the air flow. If incorrectly installed, remove the two screws holding the pickup tube in place, rotate 180 deg. and reinstall.



Insert Type
Fig. 9



Flange Type
Fig. 10

ELECTRICAL WIRING INSTRUCTIONS

WARNING: Disconnect all power sources before doing any work on the heater installation.

1. Use the wiring diagram supplied with the heater as a guide in correlating field wiring with the heater internal wiring. Also note labels on the inside and outside of the heater. If there is more than one heating step, wire the unit so the steps are energized sequentially as numbered in the heater. The rule is: first stage on is last stage off. This also applies with pneumatically controlled heaters.

2. All field wiring to the heater must meet the requirements of the N.E.C. and applicable local codes.

3. Wiring to the heater must be rated for 75 degrees C. minimum.

4. For all single stage heaters and heaters rated less than 50 kilowatt, the supply conductors must be sized 125% of the rated amperage load.

5. For low voltage control circuits, use N.E.C. class 1 wiring as described in article 725 of the N.E.C.

6. A fan/air flow assurance method is required for the heater. If provided with an integral air flow switch see paragraph 10 installation procedures. On other heaters, the air supply fan must be inter locked with the heater so that the heater is not energized unless the fan in on. See wiring diagram.

7. If heater does not have built in disconnect switch or main circuit breaker, install a remote disconnect (furnished by others) in accordance with article 424-65 of the N.E.C. (National Electrical Code).

8. For low voltage control circuits using two supply transformer with heating / cooling thermostat, one for heating and one for cooling, a thermostat with isolating contacts must be used to prevent interconnection of the two different circuits.

9. N.E.C. requires the heater manufacturer to supply: 1) over-current protection where total heater amperage exceeds 48 amps, and 2) any contactors required for proper functioning of temperature limiting controls. When these are not provided as an integral part of a ETL listed heater, they are supplied in a remote ETL listed control panel shown on the wiring diagram.

10. When ETL listed duct heaters are used with ETL remote control panels, follow the specific interconnecting labels for matching the specific heater with the specific remote control panel.

11. All electrical connections in the heater, including both field and factory made connections, should be checked for tightness.

12. **Sizing of supply conductors**
    The required minimum size of supply conductors is marked at the field wiring terminals within the heater control box. The wire gauges are calculated as required by the N.E.C., article 424-3 (b) based on conductor insulation rated for 75 degree C. (167 degree F).

Calculation of line current (Amps)

$$\text{(Amps) Single Phase} = \frac{\text{Watts}}{\text{Volts}}$$

Example: Single Phase 5Kw, 208 Volts

$$\frac{5000\text{ Watts}}{208\text{ Volts}} = 24\text{ Amps}$$

$$\text{Three Phase Current} = \frac{\text{Watts}}{\text{Volts}}$$

Example: Three Phase 14.4Kw, 208 Volts

$$\frac{14400\text{ Watts}}{208\text{ Volts} \times 1.73} = \frac{14400}{360} = 40\text{ Amps}$$

CAUTION - DO NOT OPERATE WITHOUT PROPER AIR FLOW

For efficient and trouble free operation it is important that air flow be adequate over the complete heating area and particularly at element terminals. No electric duct heater should ever be operated with insufficient air flow because overheating and subsequent malfunction may result. The minimum air velocity required at any point should be determined from figure 12.

When heaters are installed in banks as shown in figure 11, the minimum air flow for the entire duct is not to be less than that required for the heater in the bank requiring the highest air flow rate.

1. Kw/sq. ft. = $\dfrac{\text{Heater Nameplate Kw}}{\text{Duct cross section area (sq. ft.)}}$

2. Determine minimum air velocity from Figure 12.

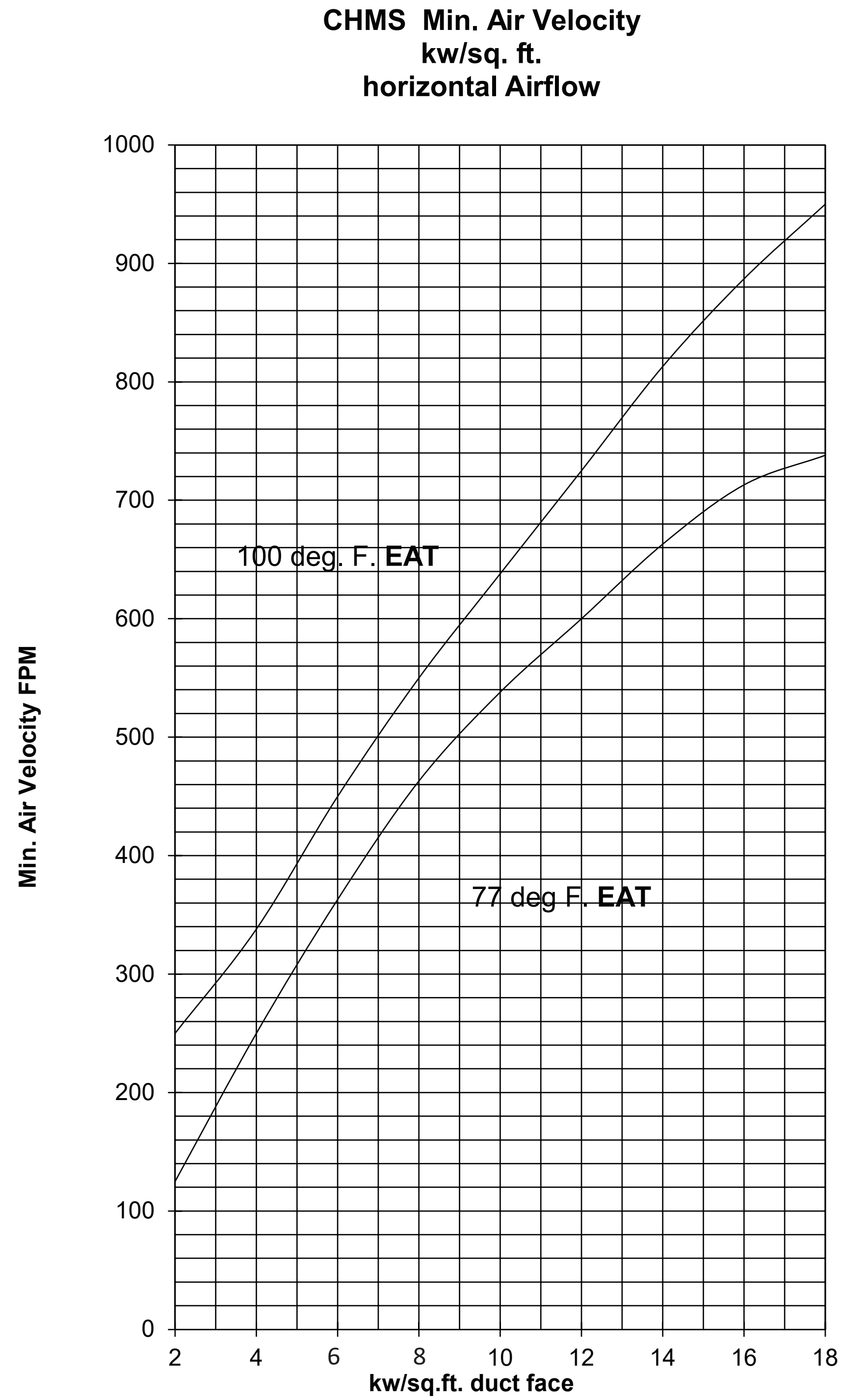

CHMS Min. Air Velocity
kw/sq. ft.
horizontal Airflow
Min. Air Velocity FPM
1000
900
800
700
600
500
400
300
200
100
0
2
4
6
8
10
12
14
16
18
kw/sq.ft. duct face
100 deg. F. EAT
77 deg F. EAT

Figure 12

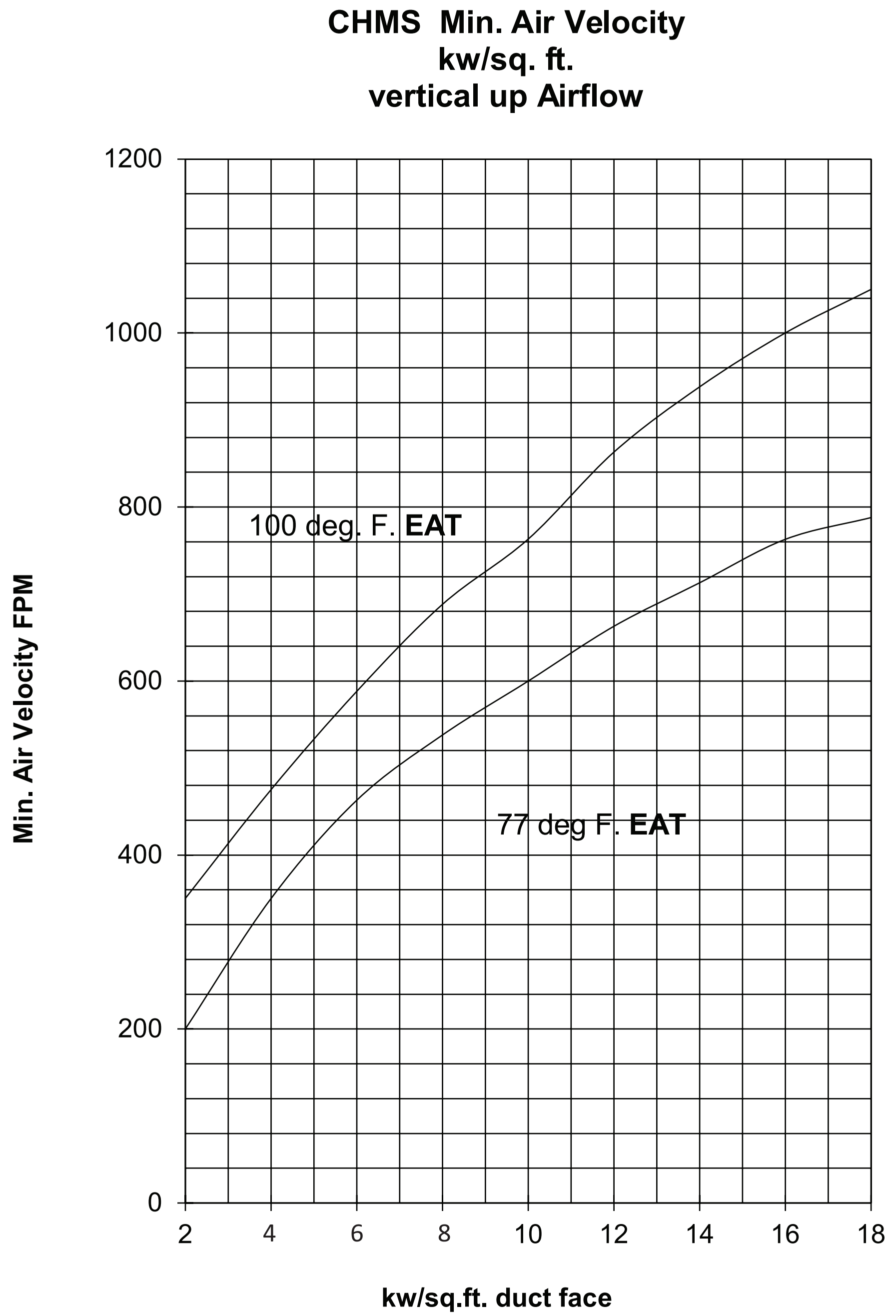

CHMS Min. Air Velocity
kw/sq. ft.
vertical up Airflow
Min. Air Velocity FPM
1200
1000
800
600
400
200
0
2
4
6
8
10
12
14
16
18
100 deg. F. EAT
77 deg F. EAT
kw/sq.ft. duct face

Figure 13

DUCT HEATER WIRING DIAGRAM
NOTES AND LEGEND

NOTES:

1. Field installed staging controller shown as typical. Coordinate field wiring with job requirements and actual controls used.
2. Wire so fan must run when heater is energized.
3. When the control circuit is 120 or 277 volt and it is preferable to wire for all switching in the hot line, jumper A2-Z may be removed and the HTCO(s) connected in series with the field installed staging controller. The neutral line must be connected to terminal Z (and B if applicable see figure 2).

CAUTION: If the A2-Z jumper is removed, the HTCO circuit must be field wired to directly de-energize all controlling contactor coils in the event the HTCO(s) (A1 to A2 cicuit) opens. See figure 1 for proper connections when BUC are not used or when CC and BUC are supplied from different circuits. See figure 2 for proper connections when BUC and CC are the same voltage.

FIGURE 1

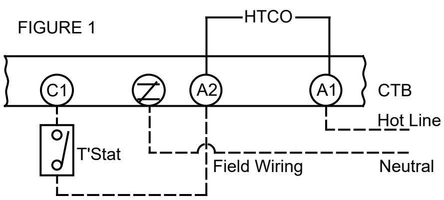
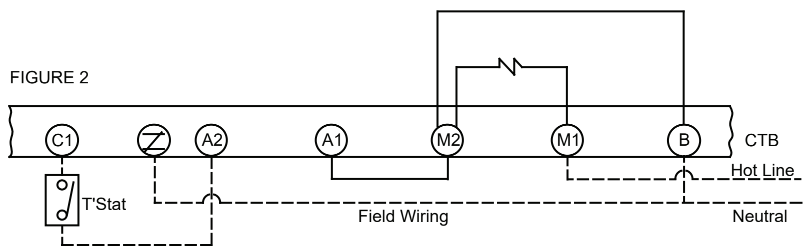


FIGURE 2



4. Control circuit must be NEC class 1 circuit.
5. Stage “C1” must always be first stage on and last stage off. All multiple stage heaters must controlled to sequence on in ascending order and sequence off in decending order as marked at control terminal block, ie: C1, C2, C3, etc...
6. On P.E. controlled heaters, P.E. Switches must be field set so that the sequence of operation is stage 1, first stage on, last stage off.
7. For supply circuit data see markings at supply terminals in the heater.
8. When heater uses a direct connected external control voltage source, that circuit must be N.E.C. Class 1 wiring and must be protected by an overcurrent device rated 20 amps or less. That overcurrent device must be external to the heater.
9. On heaters with fusing, see fuse replacement marking showing fuse size and type at fuse block(s) in heater.
10. On heaters with integral pressure differential air flow switches (designated AFS on wiring diagram) note: A minimum air flow equivalent of 0.07 in. W.C. minimum is required for operation.
11. Where applicable, see nameplate for control voltage, VA, etc...

Legend:

Factory Wiring
Field Wiring
Heating Element
Overcurrent Protection (Fused or Circuit Breakers)
Contacts of Contactor (adjacent no. indicates stage number)
Contactor Holding Coil (adjacent no. indicates stage number)
Wiring Terminal (adjacent no. indicates stage number)
Indicator Light
Secondary Overtemperature Limit Control
MRHTCO Manual Reset High Temperature Output
TCO Thermal Cutoff (one time - replaceable type)

HTCO	Automatic Reset High Temperature Cut-Out (Primary System)
CC	Controlling Contactor (adjacent no. indicates stage number)
BUC	Back-up Contactor
AFS	Air Pressure Type Fan Interlock Switch
FR	Fan Interlock Relay
FTB	Fan Interlock Terminal Block
TD	Time Delay Relay
PE	Pneumatic-Electric Switch
FDS	Fused Disconnect Switch (field Supplied Per Job Requirements)
GND	Connection For Ground Circuit
CTB	Control Circuit Terminal Block
LTB	Line Terminal Block For Power Supply Connections
CIS	Cover Interlock Switch
PR	Pilot Relay
PS	Pilot Switch