35D Single Duct Units
Variable Volume System

HEATING & COOLING

Installation Instructions

This book includes installation instructions for 35DA, DP, DN and DV units.
For 35DC units, see separate 35DC installation instructions.

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NOTE: Control service and troubleshooting information for 35DV units can be found in VVT Reference and Troubleshooting Guides available from your local Carrier representative.

SAFETY CONSIDERATIONS

SAFETY NOTE

Air-handling equipment will provide safe and reliable service when operated within design specifications. The equipment should be operated and serviced only by authorized personnel who have a thorough knowledge of system operation, safety devices and emergency procedures.

Good judgment should be used in applying any manufacturer's instruction to avoid injury to personnel or damage to equipment and property.

⚠ WARNING

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

⚠ WARNING

If it is necessary to remove and dispose of mercury contractors in electric heat section, follow all local, state and federal laws regarding disposal of equipment containing hazardous materials.

PRE-INSTALLATION

General — The 35D is a single duct, variable volume terminal available with analog electronic, pneumatic, or Carrier PIC (Product Integrated Controls) or VVT (variable volume and temperature) control options factory installed, together with hot water and electric heat options mounted on the box. Figure 1 shows the basic box; units with controls are shown in Fig. 2-8. Figure 9 provides the model number nomenclature for the unit. Figure 10 provides the electric heat model number nomenclature. Refer to Fig. 11-15 for unit and control dimensions. See Fig. 16 and 17 for dimensions of 35D unit with hot water coils. See Fig. 18 for dimensions of 35D unit with electric heat. Accessory octopus dimensions are shown in Fig. 19.

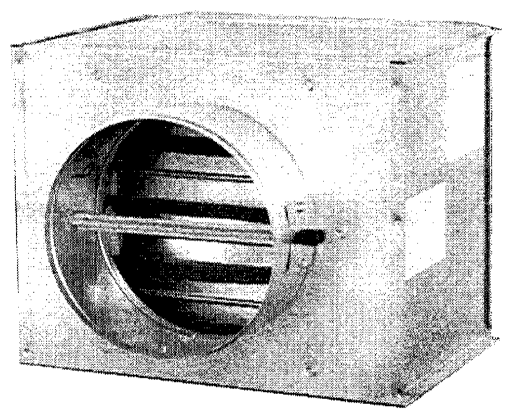


Fig. 1 — 35D Single Duct Unit

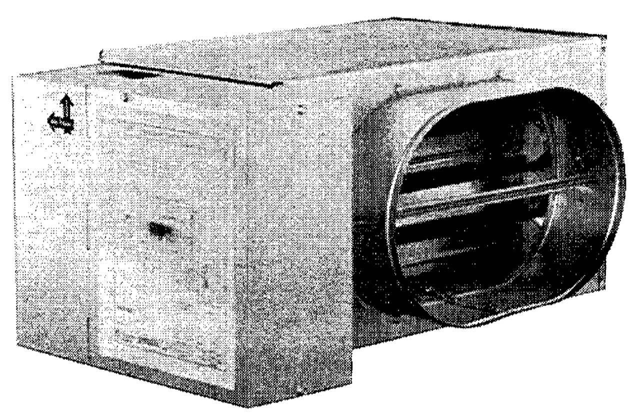


Fig. 2 — 35DA Unit with Analog Electronic Control

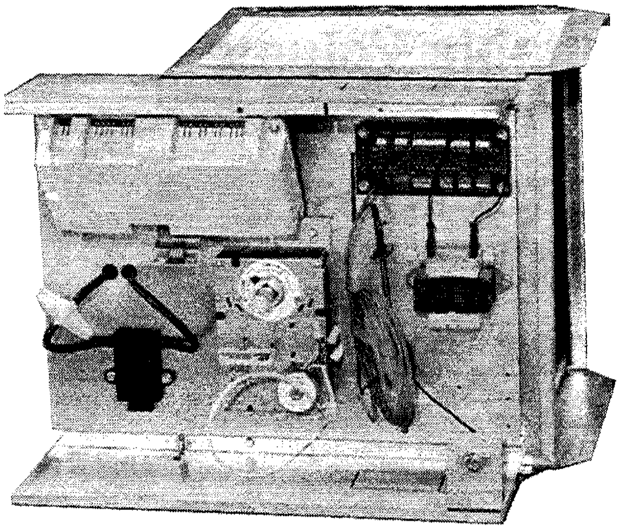


Fig. 3 — 35DC Unit with PIC (Product Integrated Control)

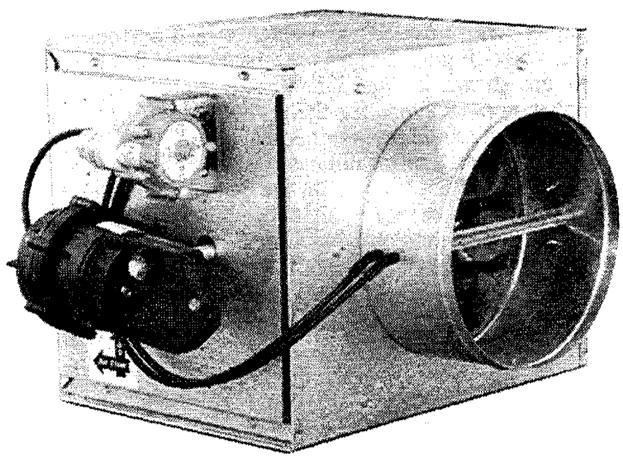


Fig. 4 — 35DP Unit with Pneumatic Control

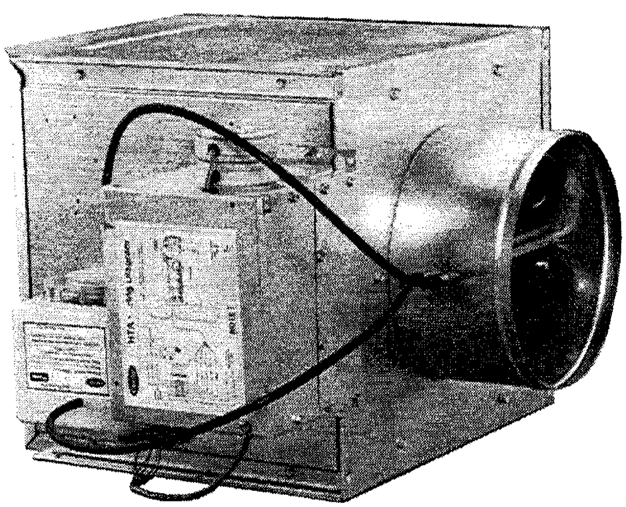


Fig. 5 — 35DV Unit with VVT Control

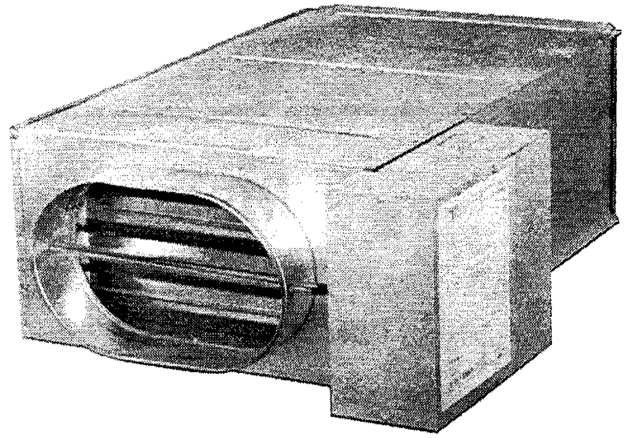


Fig. 6 — 35DA Unit with Attenuator and Analog Electronic Controls

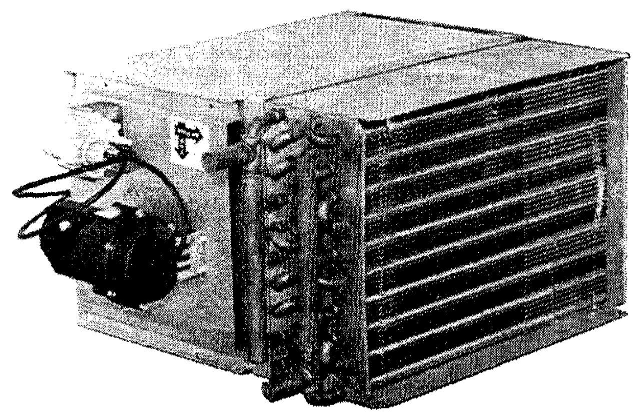


Fig. 7 — 35DP Unit with Hot Water Coil and Pneumatic Control

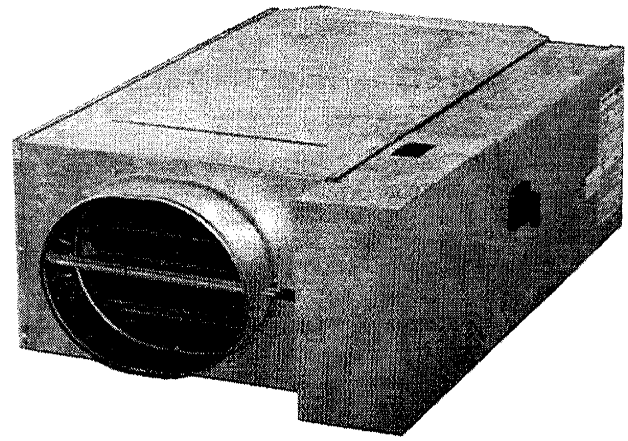


Fig. 8 — 35DA Unit with Electric Heat, Attenuator, and Analog Electronic Controls

35DC 12 4101 E R A N P

Model

35DA — Analog Electronic
35DC — PIC (Product Integrated Controls)*
35DN — No Controls
35DP — Pneumatic
35DV — VVT (Variable Volume and Temperature)

Unit Size

	Inlet	Nominal Airflow (CFM)
04	4"	200
05	5"	350
06	6"	500
07	7"	650
08	8"	800
09	9"	1050
10	10"	1350
12	12"†	1900
14	14"†	2500
16	16"†	3000
18	—†	4000

Control Sequence

1100-1127 — Analog Electronic
4100-4103; 4110-4113 — PIC
0000 — No Control
6100-6107 — Pneumatic
8100-8110 — VVT

Heat Type**

N — No Heat
E — Electric
1 — 1 row hot water coil; left hand
2 — 2 row hot water coil: left hand
3 — 3 row hot water coil; left hand
4 — 4 row hot water coil; left hand
5 — 1 row hot water coil; right hand
6 — 2 row hot water coil; right hand
7 — 3 row hot water coil; right hand
8 — 4 row hot water coil; right hand

Control Hand**

L — Left Hand
R — Right Hand

Packaging

P — Palletized||

Thermostat/Control Transformer

Thermostat (for Pnuematic Controls: 35DP)
N — No Thermostat
D — Direct Acting
R — Reverse Acting

Note: A thermostat/room sensor is provided as standard with 35DA (analog electronic) and 35DC (PIC) control packages. VVT units (35DV) require field-supplied thermostats.

Transformer (for Electronic Controls: 35DA, 35DC and 35DV)
N — No Control Transformer (non-electric heat) or Standard Transformer¶ (electric heat units)

A-L — Transformer for non-electric heat units ONLY

A	Analog	115 v/24 v
B	Analog	208-240 v/24 v
C	Analog	277 v/24 v
F	PIC	115 v/24 v
G	PIC	208-240 v/24 v
H	PIC	277 v/24 v
J	VVT	115 v/24 v
K	VVT	208-240 v/24 v
L	VVT	277 v/24 v

Unit Options††

N — None
A — Attenuator
B — Foil Lining
C — Attenuator and Foil Lining

*PIC controls provide electronic control of the 35D unit as part of the Carrier Comfort Network (CCN). For installation of 35D units with PIC controls, refer to separate 35DC Installation Instructions.
†Sizes 12, 14 and 16 have flat oval inlets that accommodate standard flex sizes. Size 18 has a 14-in. high by 16-in. wide inlet collar.
**Both hot water coil and control hand are determined by looking in direction of airflow.
††Electric heat units must have attenuator.
||For special packaging options, contact Savannah.
¶Units with electric heat do not require additional control transformers. Transformers are provided as part of the electric heater.

Fig. 9 — 35D Base Unit Model Number Nomenclature

Q R 125 4803 2 C AB

Unit Size

J — 04
K — 05
L — 06
M — 07
N — 08
O — 09
P — 10
Q — 12
R — 14
S — 16
T — 18

Heater Box Hand

Must be the same as digit 12 of Base Unit Model Number.

L — Left
R — Right

kW Rating

Available in .1 increments from .5 to 36.0 kW

Example:

Digits

3	4	5	
1	2	5	— 12.5 kW
0	1	0	— 1.0 kW

(Digit 5 will be read as a decimal)

Voltage/Phase

Digits

6	7	8	9	
1	2	0	1	— 120 V, 1Ph
2	0	8	1	— 208 V, 1Ph
2	4	0	1	— 240 V, 1Ph
2	7	7	1	— 277 V, 1Ph
2	0	8	3	— 208 V, 3Ph
4	8	0	3	— 480 V, 3Ph (4-wire only)

Heat Options

Enter required options in digits in any sequence; leave unused digits blank.

Blank — None
A — Door Interlocked disconnect switch (non-fused)
B — Line fusing
I — Mercury deenergizing contacts

(Option I is in place of standard magnetic deenergizing contactors.)

Control Type

C — PIC (Product Integrated Control)
D — Direct Acting (pnuematic)
R — Reverse Acting (pnuematic)
V — VVT (Variable Volume and Temperature)

Stages

1 — 1 Stage
2 — 2 Stage
3 — 3 Stage

Fig. 10 — Electric Heat Model Number Nomenclature

NOMINAL AIRFLOW (Cfm)	INLET SIZE (in.)	DIMENSIONS (in.)		
		Plenum Height (H)	Plenum Width (W)	Discharge (W) x (H)
200	4 Round	12½	10½	10½ x 12½
350	5 Round	12½	10½	10½ x 12½
500	6 Round	12½	10½	10½ x 12½
650	7 Round	12½	12½	12½ x 12½
800	8 Round	12½	12½	12½ x 12½
1050	9 Round	12½	14½	14½ x 12½
1300	10 Round	12½	14½	14½ x 12½
1900	12 Oval	12½	18½	18½ x 12½
2500	14 Oval	12½	21½	21½ x 12½
3000	16 Oval	12½	24½	24½ x 12½
4000	16 W x 14 H Rectangle	17½	21½	21½ x 17½

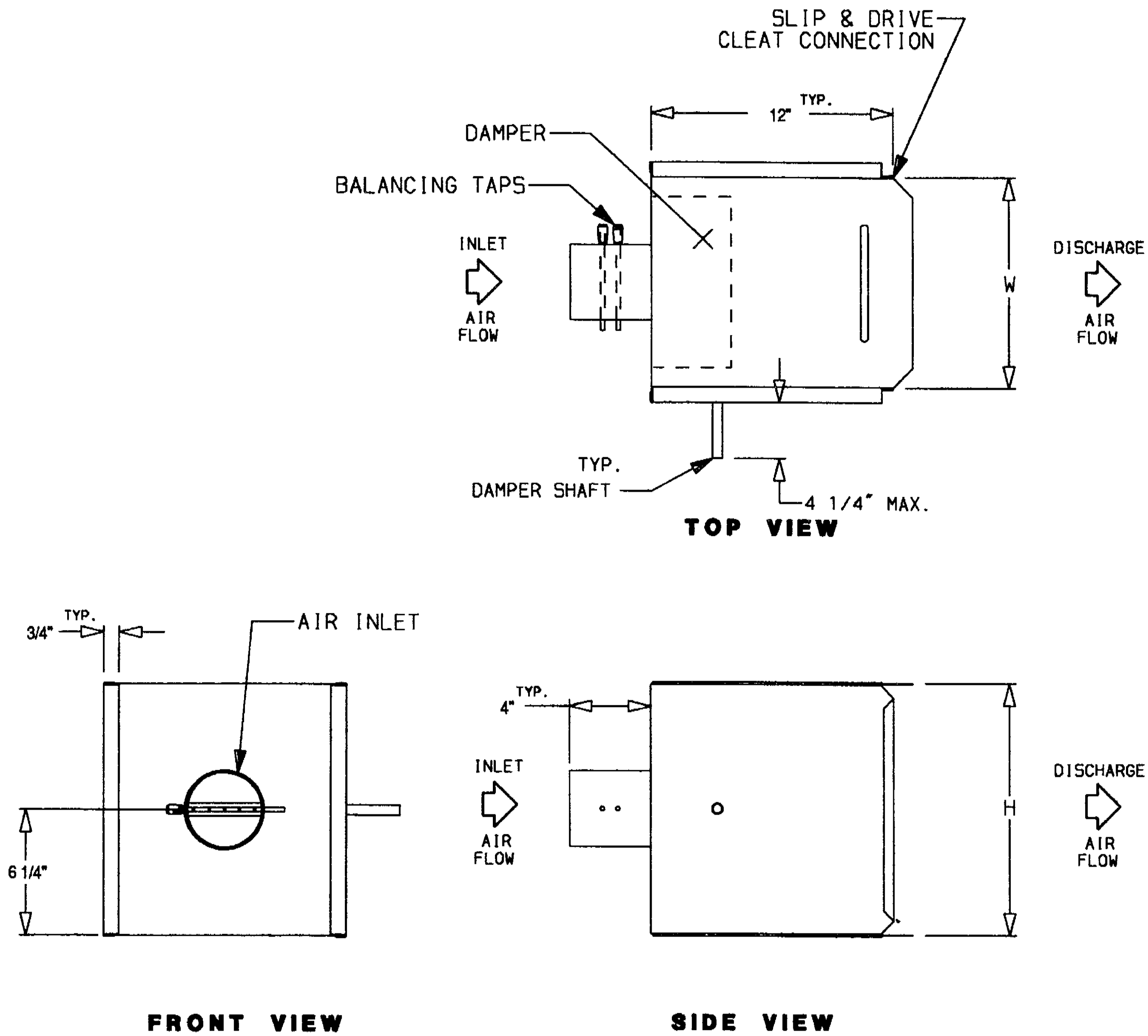
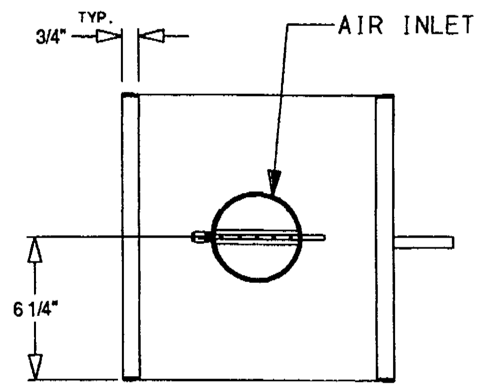
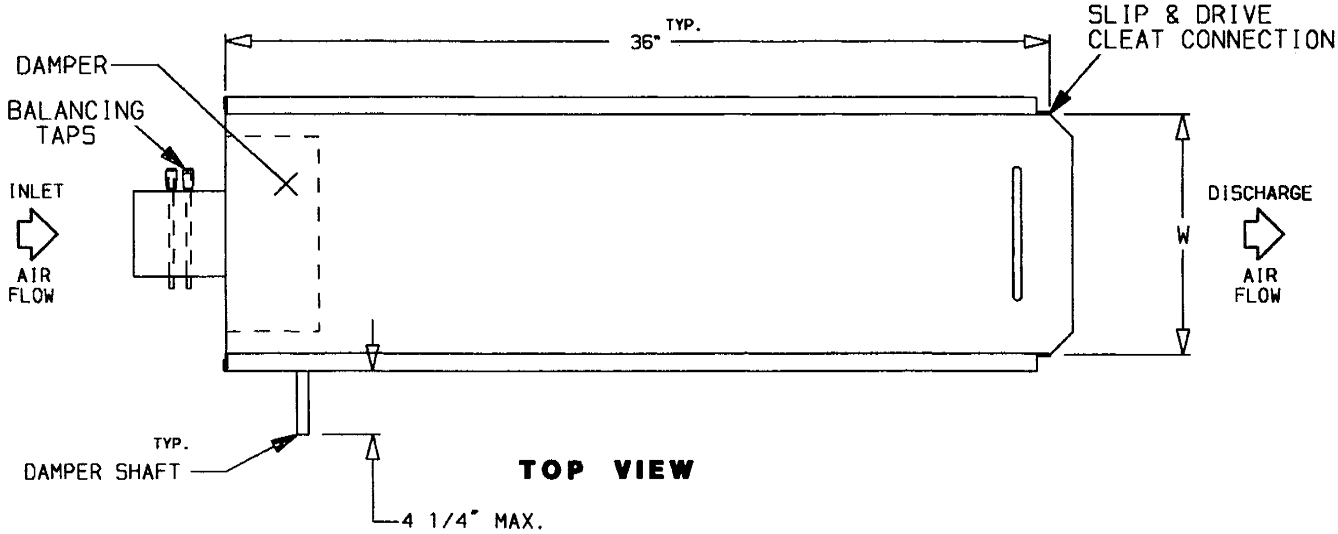


Fig. 11 — 35D Basic Damper Unit

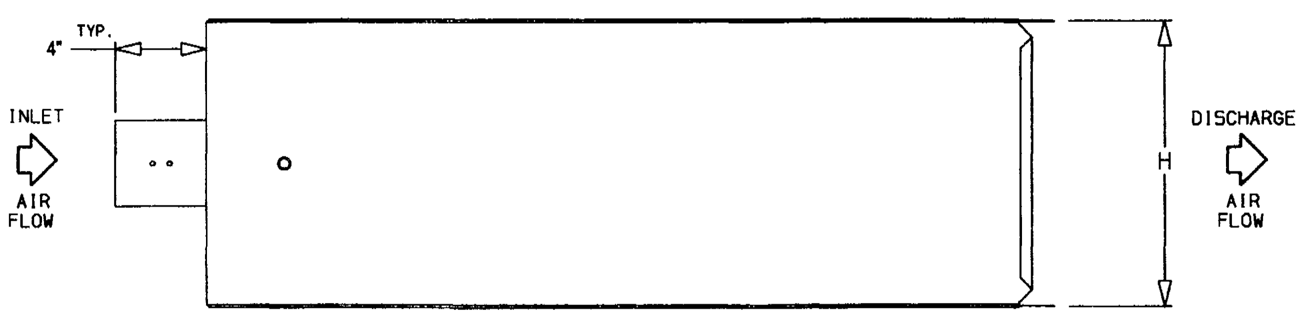
NOMINAL AIRFLOW (Cfm)	INLET SIZE (in.)	DIMENSIONS (in.)		
		Plenum Height (H)	Plenum Width (W)	Discharge (W) x (H)
200	4 Round	12½	10½	10½ x 12½
350	5 Round	12½	10½	10½ x 12½
500	6 Round	12½	10½	10½ x 12½
650	7 Round	12½	12½	12½ x 12½
800	8 Round	12½	12½	12½ x 12½
1050	9 Round	12½	14½	14½ x 12½
1300	10 Round	12½	14½	14½ x 12½
1900	12 Oval	12½	18½	18½ x 12½
2500	14 Oval	12½	21½	21½ x 12½
3000	16 Oval	12½	24½	24½ x 12½
4000	16 W x 14 H Rectangle	17½	21½	21½ x 17½



FRONT VIEW



TOP VIEW



SIDE VIEW

Fig. 12 — 35D with Attenuator

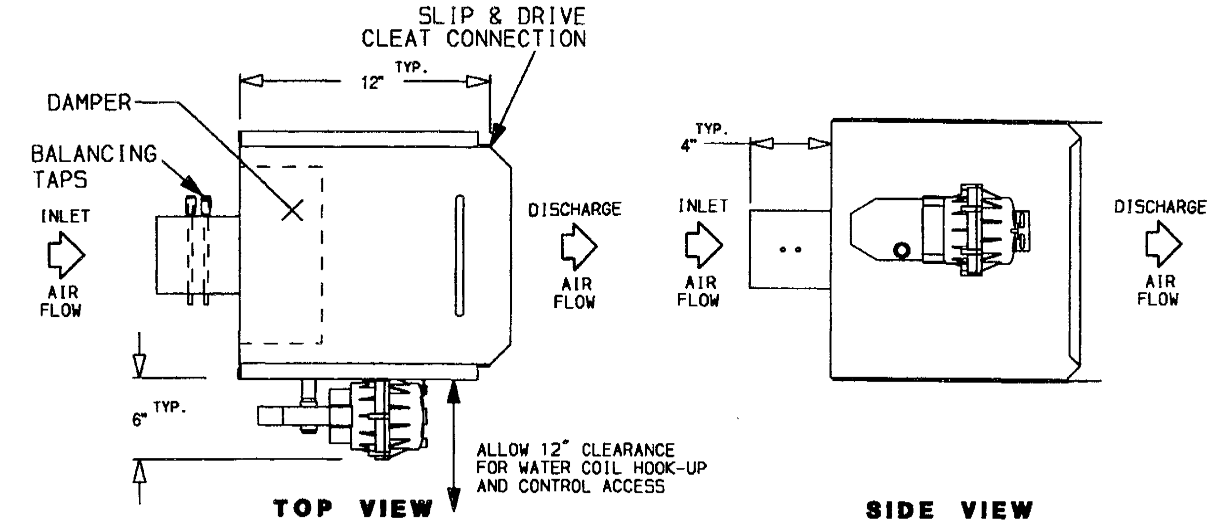


Fig. 13 — 35DP (Pneumatic) Control Dimensions

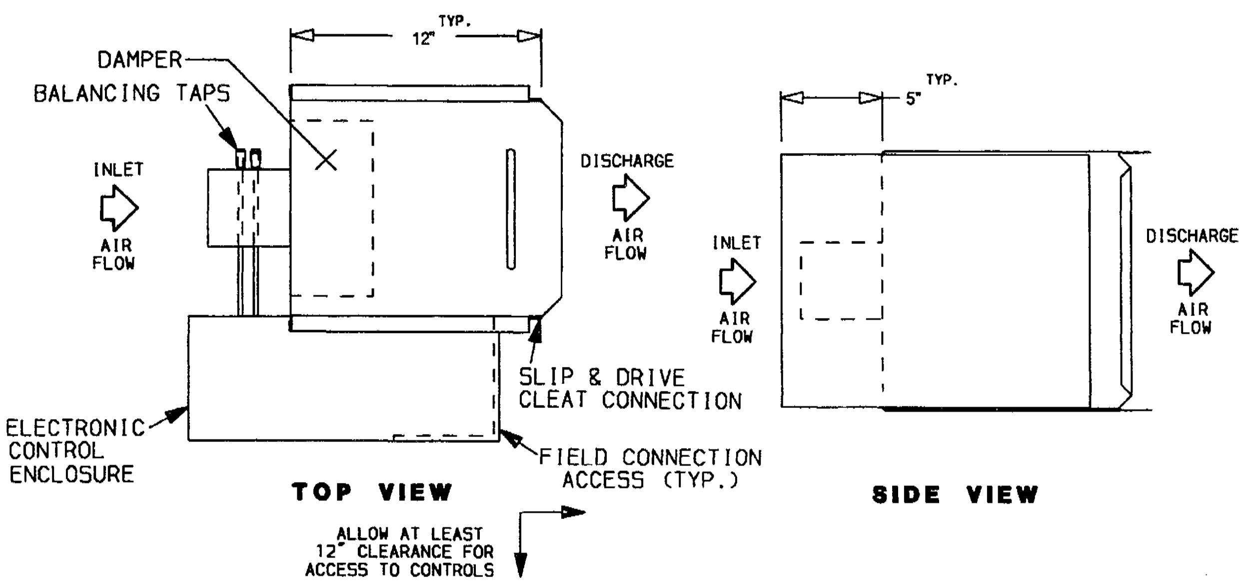


Fig. 14 — 35DA (Analog Electronic) and 35DC (PIC) Control Dimensions

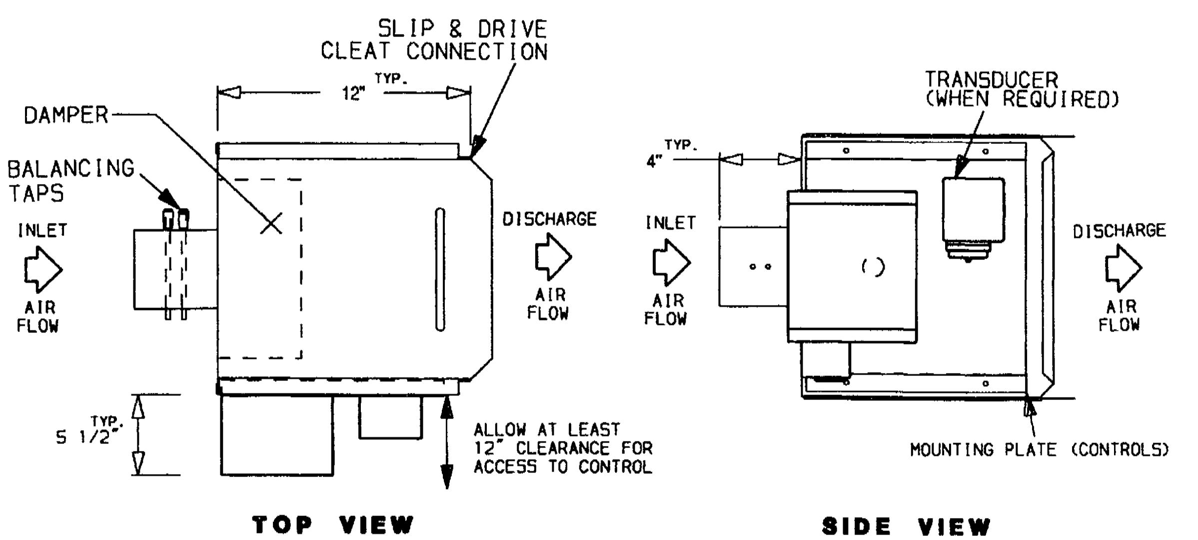


Fig. 15 — 35DV (VVT) Control Dimensions

NOMINAL AIRFLOW (Cfm)	INLET SIZE (in.)	DIMENSIONS (in.)						
		Plenum Height (H)	Plenum Width (W)	Discharge (W) x (H)	Overall Length			
					Rows			
					1	2	3	4
200	4 Round	12½	10½	10½ x 12½				
350	5 Round	12½	10½	10½ x 12½				
500	6 Round	12½	10½	10½ x 12½				
650	7 Round	12½	12½	12½ x 12½				
800	8 Round	12½	12½	12½ x 12½				
1050	9 Round	12½	14½	14½ x 12½	18	18	18	19.5
1300	10 Round	12½	14½	14½ x 12½				
1900	12 Oval	12½	18½	18½ x 12½				
2500	14 Oval	12½	21½	21½ x 12½				
3000	16 Oval	12½	24½	24½ x 12½				
4000	16 W x 14 H Rectangle	17½	21½	21½ x 17½				

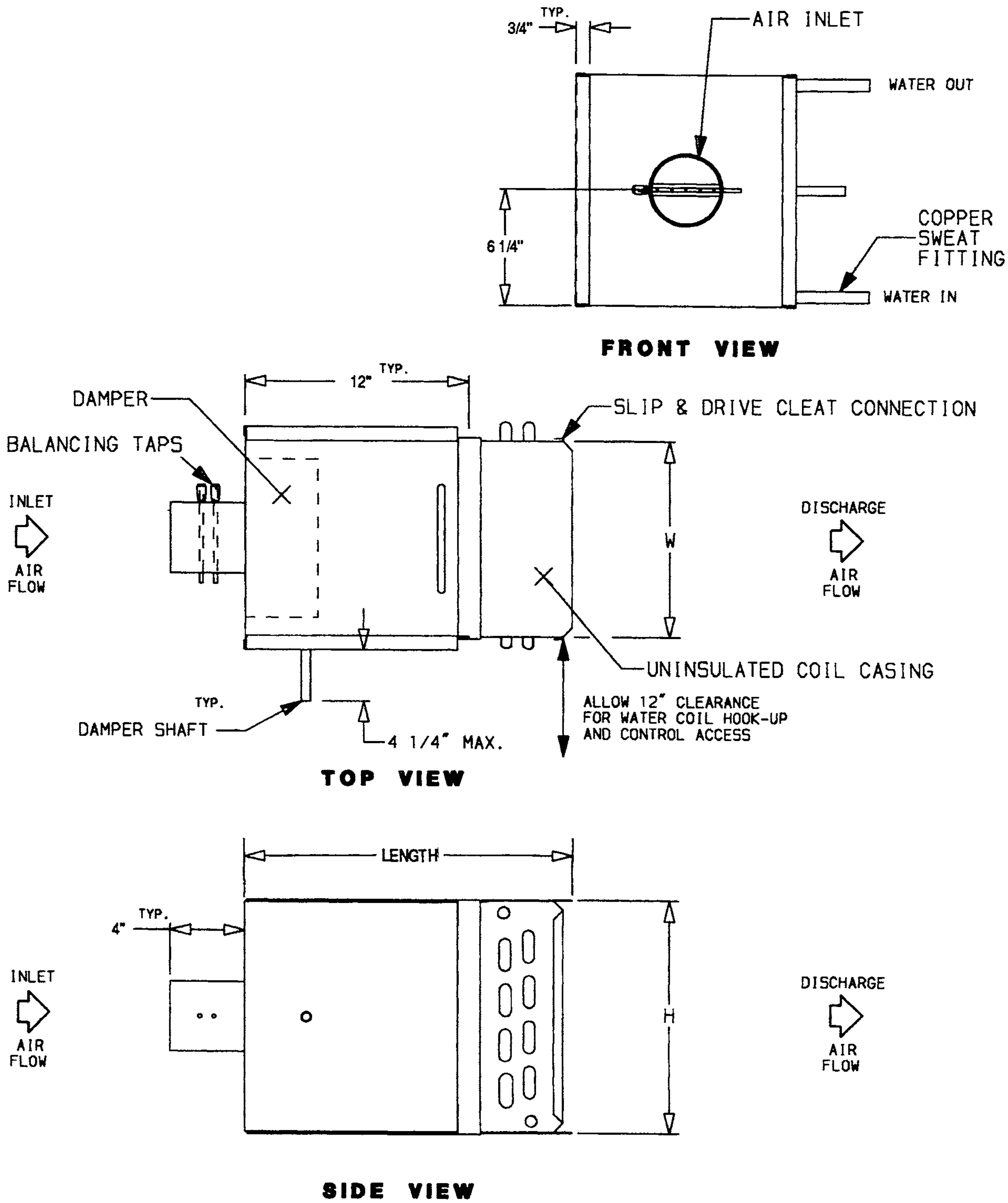
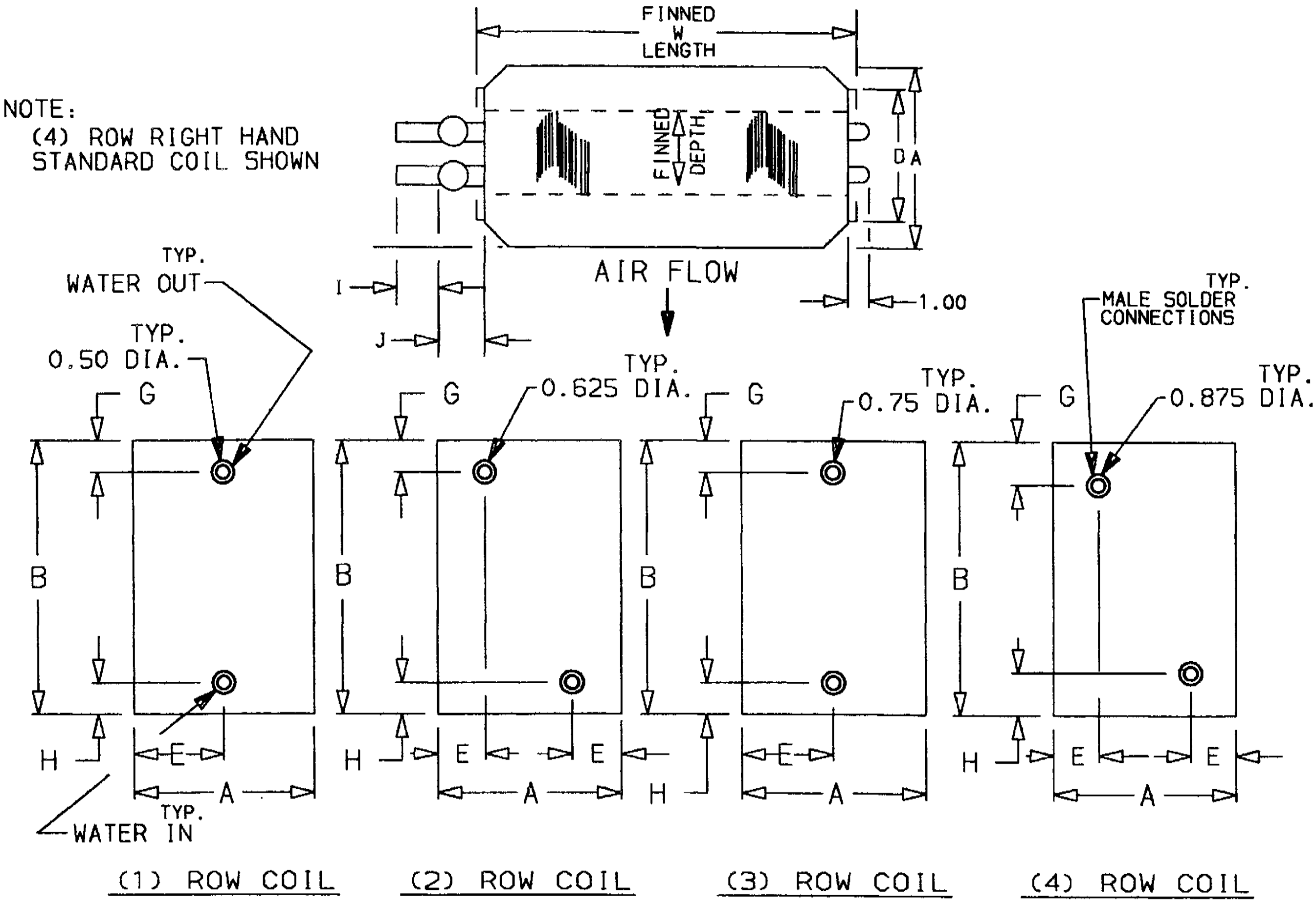


Fig. 16 — 35D Unit with Hot Water Heat



ROWS	CIRCUITS	DIMENSIONS (IN.)							
		A	CONN.*	D	E	G	H	I	J
1	1	6	1/2	5	3	5/16	15/16	3	N/A
2	2	6	5/8	5	2 7/16	5/16	5/16	1 7/16	1-9/16
3	3	6	3/4	5	3	15/16	15/16	2	3
4	4	7 1/2	7/8	6 1/2	2 7/16	1 5/8	1 5/8	2	2 1/2

*OD Male solder connection.

NOTE: Dimensions I is stubout available for connection.

SIZE	W	B
04-06	10.5	12.5
07-08	12.5	12.5
09-10	14.5	12.5
12	18.5	12.5
14	21.5	12.5
16	24.5	12.5
18	21.5	17.5

Fig. 17 — Hot Water Coil Dimensions

NOMINAL AIRFLOW (Cfm)	INLET SIZE (in.)	DIMENSIONS (in.)		
		Plenum Height (H)	Plenum Width (W)	Discharge (W) x (H)
200	4 Round	12½	10½	10½ x 12½
350	5 Round	12½	10½	10½ x 12½
500	6 Round	12½	10½	10½ x 12½
650	7 Round	12½	12½	12½ x 12½
800	8 Round	12½	12½	12½ x 12½
1050	9 Round	12½	14½	14½ x 12½
1300	10 Round	12½	14½	14½ x 12½
1900	12 Oval	12½	18½	18½ x 12½
2500	14 Oval	12½	21½	21½ x 12½
3000	16 Oval	12½	24½	24½ x 12½
4000	16 W x 14 H Rectangle	17½	21½	21½ x 17½

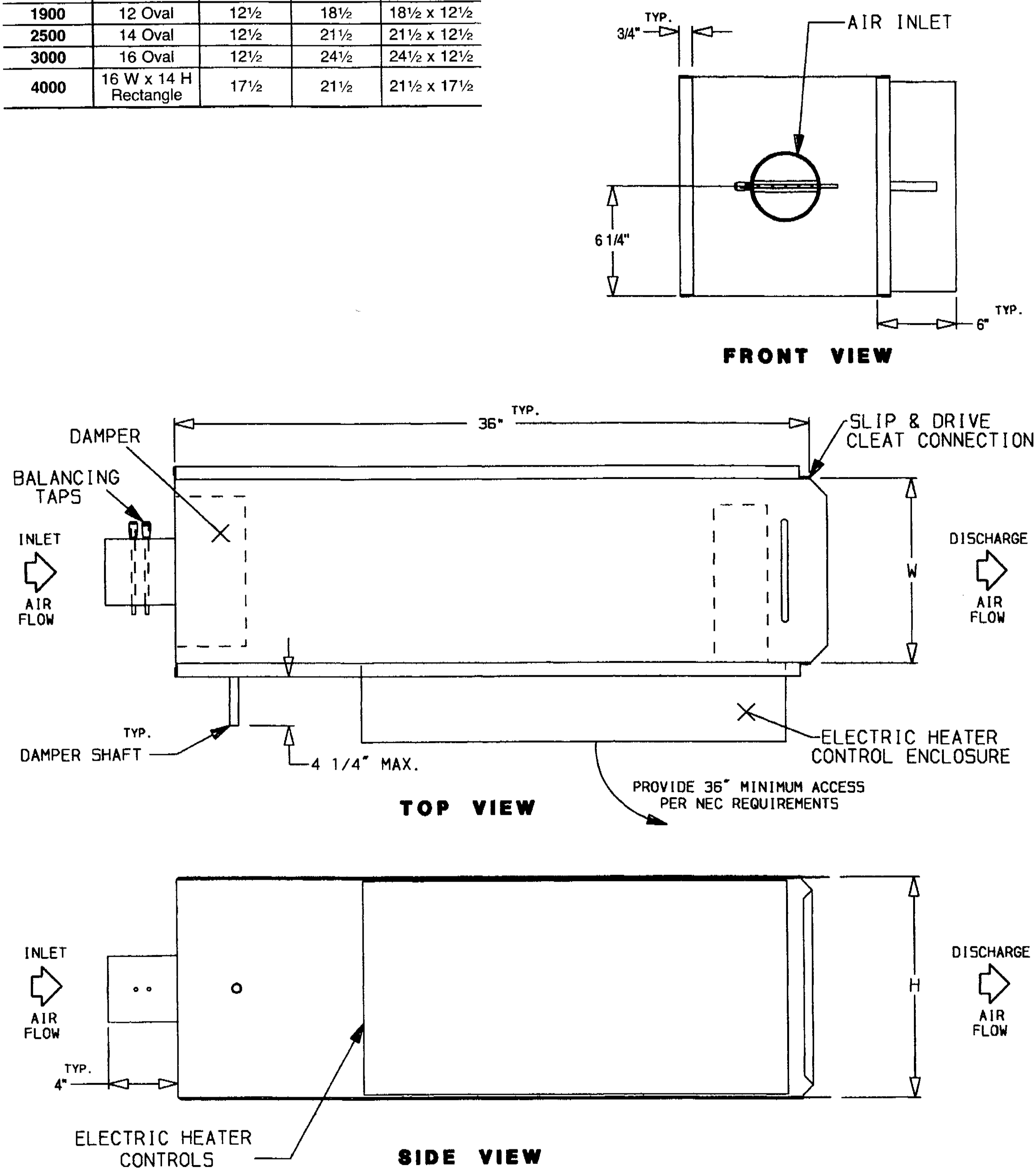
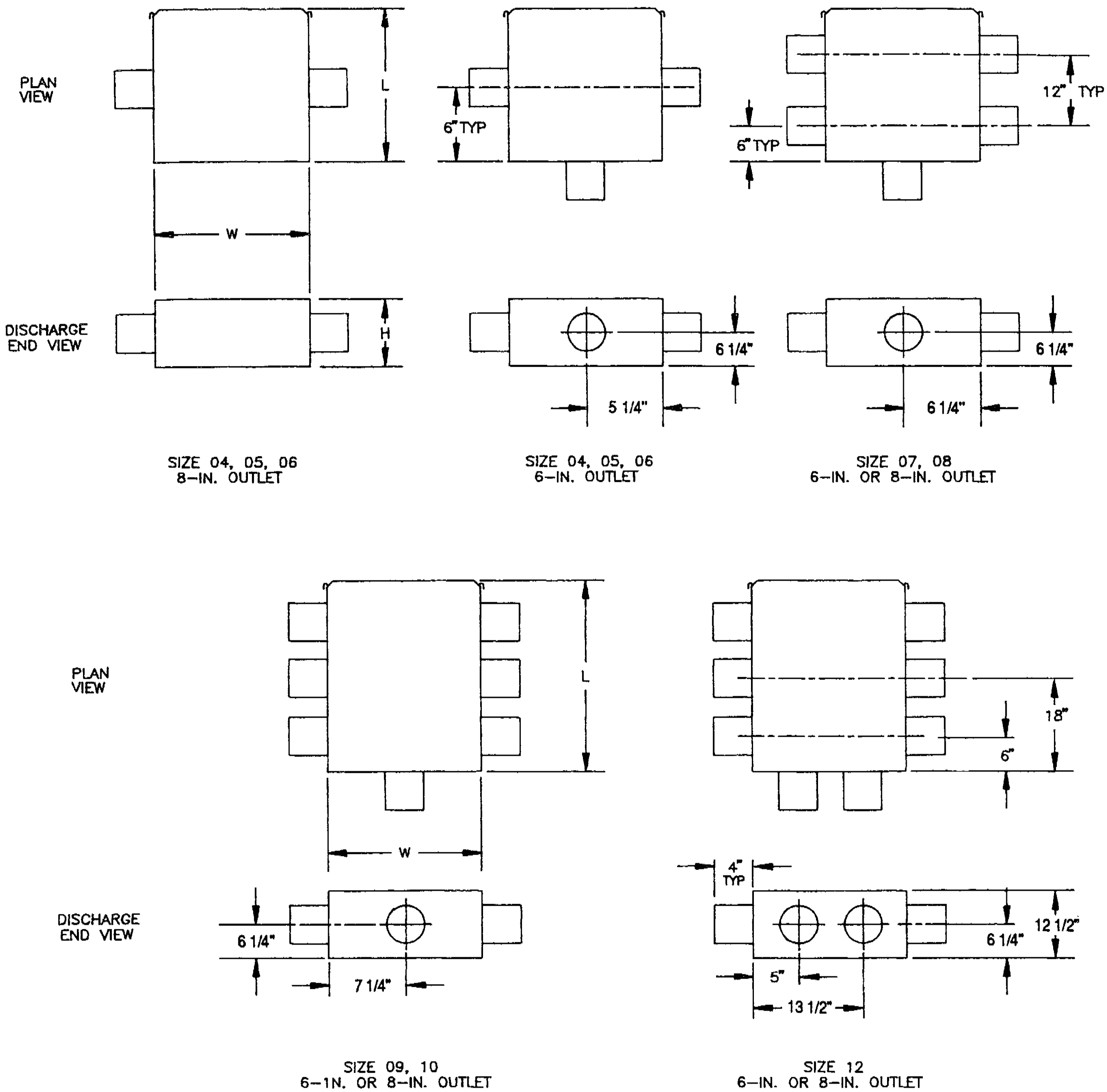


Fig. 18 — 35D with Electric Heat



UNIT SIZE*	DIMENSIONS (in.)			OUTLET DIAM (in.)	
				6	8
	H	W	L	No. of Outlets	
04	12½	10½	12	3	2
05	12½	10½	12	3	2
06	12½	10½	12	3	2
07	12½	12½	24	5	5
08	12½	12½	24	5	5
09	12½	14½	36	7	7
10	12½	14½	36	7	7
12	12½	18½	36	8	8

*Octopus is not available for sizes 14, 16 and 18.

NOTES:
1. Octopus available for base unit with hot water reheat coil or base unit with attenuator. Octopus is NOT available for units with electric heat.
2. Octopus is 22-gage galvanized steel and includes manual balancing dampers with locking screw.

Fig. 19 — Accessory Octopus

PACKAGING — Units are packaged on pallets according to individual jobs.

STORAGE — Units should not be stored in outdoor areas. Keep units covered and out of the weather.

HANDLING — Do not handle boxes by damper rod extension, tubing connections, or other external attachments. Be careful not to damage controls when removing boxes from shipping containers. Table 1 shows component weights.

INITIAL INSPECTIONS — Once items have been removed from the carton, check carefully for damage to duct connections, coils or controls. File damage claim immediately with transportation agency and notify Carrier.

UNIT IDENTIFICATION — Boxes are assembled as indicated on unit label. Each unit is supplied with an identification label, shown in Fig. 20.

INSTALLATION PRECAUTIONS — Check that construction debris does not enter unit or ductwork. Do not operate the central-station air handling fan without final or construction filters in place. Accumulated dust and construction debris distributed through the ductwork can adversely affect unit operation.

SERVICE ACCESS — Provide service clearance for unit access.

CODES — Install units in compliance with all applicable code requirements.

UNIT SUSPENSION — See Installation section for unit suspension details.

Warranty — All Carrier-furnished items carry the standard Carrier warranty. Control components and items furnished by others, whether or not installed at Carrier factory, are not warranted by Carrier.

Controls — Table 2 shows identification of control sequences available for 35D units. This book includes instructions for installation of 35D units with pneumatic, analog electronic, or VVT (variable volume and temperature) controls. For installation of units with Carrier Product Integrated Controls (PIC) refer to separate 35DC Installation Instructions. Control functions, diagrams, and operating sequences are found in 35D Application Data publications appropriate to the specific control.

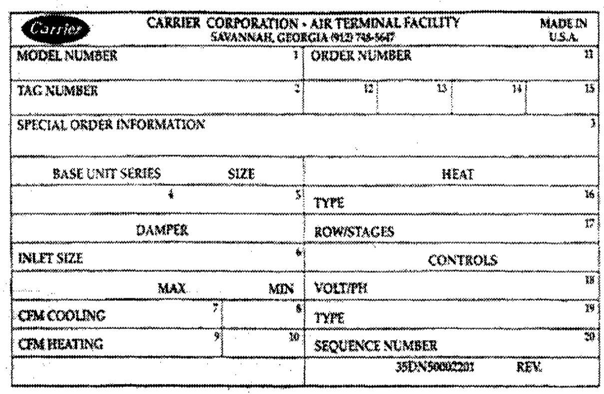


Fig. 20 — Unit Nameplate

Table 1 — Component Weights (lb)

35D UNIT SIZE		04	05	06	07	08	09	10	12	14	16	18
RATED CFM		200	350	500	650	800	1050	1350	1900	2500	3000	4000
BASE UNIT (NO CONTROL)		14	14	14	16	16	18	18	20	22	24	28
BASE UNIT WITH ATTENUATOR		23	23	23	27	27	30	30	36	39	42	50
BASE UNIT WITH ATTENUATOR AND ELECTRIC HEAT		46	46	46	55	55	62	62	76	87	99	119
HOT WATER COIL	ROW											
	1	6	6	6	7	7	8	8	9	10	11	12
	2	9	9	9	10	10	12	12	13	14	16	18
	3	11	11	11	13	13	15	15	17	19	21	24
	4	14	14	14	16	16	18	18	21	23	25	31
CONTROLS PNEUMATIC		5	5	5	5	5	5	5	5	5	5	5
ELECTRONIC*		10	10	10	10	10	10	10	10	10	10	10

*Includes Analog, PIC and VVT Controls.

Table 2 — 35D Control Sequence Identification

35DA ANALOG CONTROLS (HOFFMAN)
1100 — Cooling Only, Direct Acting 1101 — Cooling Only, Damper Override 1102 — Cooling Only, With Cooling Offset 1103 — Cooling/Heating With Auto Changeover
1104 — Cooling With 3-Stage Electric Heat 1105 — Cooling With On/Off Hot Water Heat 1106 — Cooling With 3-Stage Electric Heat and Offset 1107 — Cooling With On/Off Hot Water Heat and Offset 1108 — Cooling With 3-Stage Electric Heat and Dual Minimum Cfm 1109 — Cooling With On/Off Hot Water Heat and Dual Minimum Cfm 1110 — Cooling With 3-Stage Electric Heat, Dual Minimum Cfm and Offset 1111 — Cooling With On/Off Hot Water Heat, Dual Minimum Cfm and Offset 1112 — Cooling With 3-Stage Electric Heat, Offset and Damper Override 1113 — Cooling With On/Off Hot Water Heat, Offset and Damper Override 1114 — Cooling With 3-Stage Electric Heat and Damper Override 1115 — Cooling With On/Off Hot Water Heat and Damper Override 1116 — Cooling With 3-Stage Electric Heat, Dual Minimum Cfm and Damper Override 1117 — Cooling With On/Off Hot Water Heat, Dual Minimum Cfm and Damper Override
1118 — Cooling With Time Proportioning Hot Water Heat 1119 — Cooling With Time Proportioning Hot Water Heat and Offset 1120 — Cooling With Time Proportioning Hot Water Heat and Dual Minimum Cfm 1121 — Cooling With Time Proportioning Hot Water Heat, Dual Minimum Cfm and Offset 1122 — Cooling With Time Proportioning Hot Water Heat and Damper Override
1123 — Cooling With 6 to 9 vdc Output Hot Water Heat 1124 — Cooling With 6 to 9 vdc Output Hot Water Heat and Offset 1125 — Cooling With 6 to 9 vdc Output Hot Water Heat and Dual Minimum Cfm 1126 — Cooling With 6 to 9 vdc Output Hot Water Heat, Dual Minimum Cfm and Offset 1127 — Cooling With 6 to 9 vdc Output Hot Water, Dual Minimum Cfm, Offset and Damper Override
35DC PIC (PRODUCT INTEGRATED CONTROLS) FOR USE ON CCN (CARRIER COMFORT NETWORK)
4100, 4110* — Cooling Only 4101, 4111* — Cooling With 3-Stage Electric Heat 4102, 4112* — Cooling With On/Off Hot Water Heat 4103, 4113* — Cooling With Proportional Hot Water Heat
4110 — Cooling Only 4111 — Cooling With 3-Stage Electric Heat 4112 — Cooling With On/Off Hot Water Heat 4113 — Cooling With Proportional Hot Water Heat
35DP PNEUMATIC CONTROLS (KREUTER)
6100 — DA, NC VAV Pressure Dependent Cooling With Sequenced Heat 6101 — RA, NO VAV Pressure Dependent Cooling With Sequenced Heat 6102 — DA, NO VAV Pressure Independent Cooling With Sequenced Heat 6103 — DA, NC VAV Pressure Independent Cooling With Sequenced Heat 6104 — RA, NC VAV Pressure Independent Cooling With Sequenced Heat 6105 — RA, NO VAV Pressure Independent Cooling With Sequenced Heat
6106 — Constant Volume Cooling Only, NO Damper 6107 — Constant Volume Cooling Only, NC Damper
35DV VVT (VARIABLE VOLUME AND TEMPERATURE) CONTROLS
8100 — VAV Pressure Dependent Cooling Only 8101 — VAV Pressure Dependent Cooling With 2-Stage Electric Reheat 8102 — VAV Pressure Dependent Cooling With On/Off Hot Water Reheat 8103 — VAV Pressure Independent Cooling Only: 0.5 in. wg Transducer 8104 — VAV Pressure Independent Cooling With 2-Stage Electric Heat; 0.5 in. wg Transducer 8105 — VAV Pressure Independent Cooling With On/Off Hot Water Heat; 0.5 in. wg Transducer 8106 — VAV Pressure Independent Cooling Only: 2.0 in. wg Transducer 8107 — VAV Pressure Independent Cooling With 2-Stage Electric Heat; 2.0 in. wg Transducer 8108 — VAV Pressure Independent Cooling With On/Off Hot Water Heat; 2.0 in. wg Transducer 8109 — VAV Pressure Dependent Unit Control Zone (Monitor) 8110 — Bypass Controller With 2.0 in. wg Transducer

*Includes set point adjustment capability on space temperature sensor.

LEGEND

DA — Direct Acting
NC — Normally Closed
NO — Normally Open
RA — Reverse Acting
VAV — Variable Air Volume

Step 1 — Install Volume Control Box

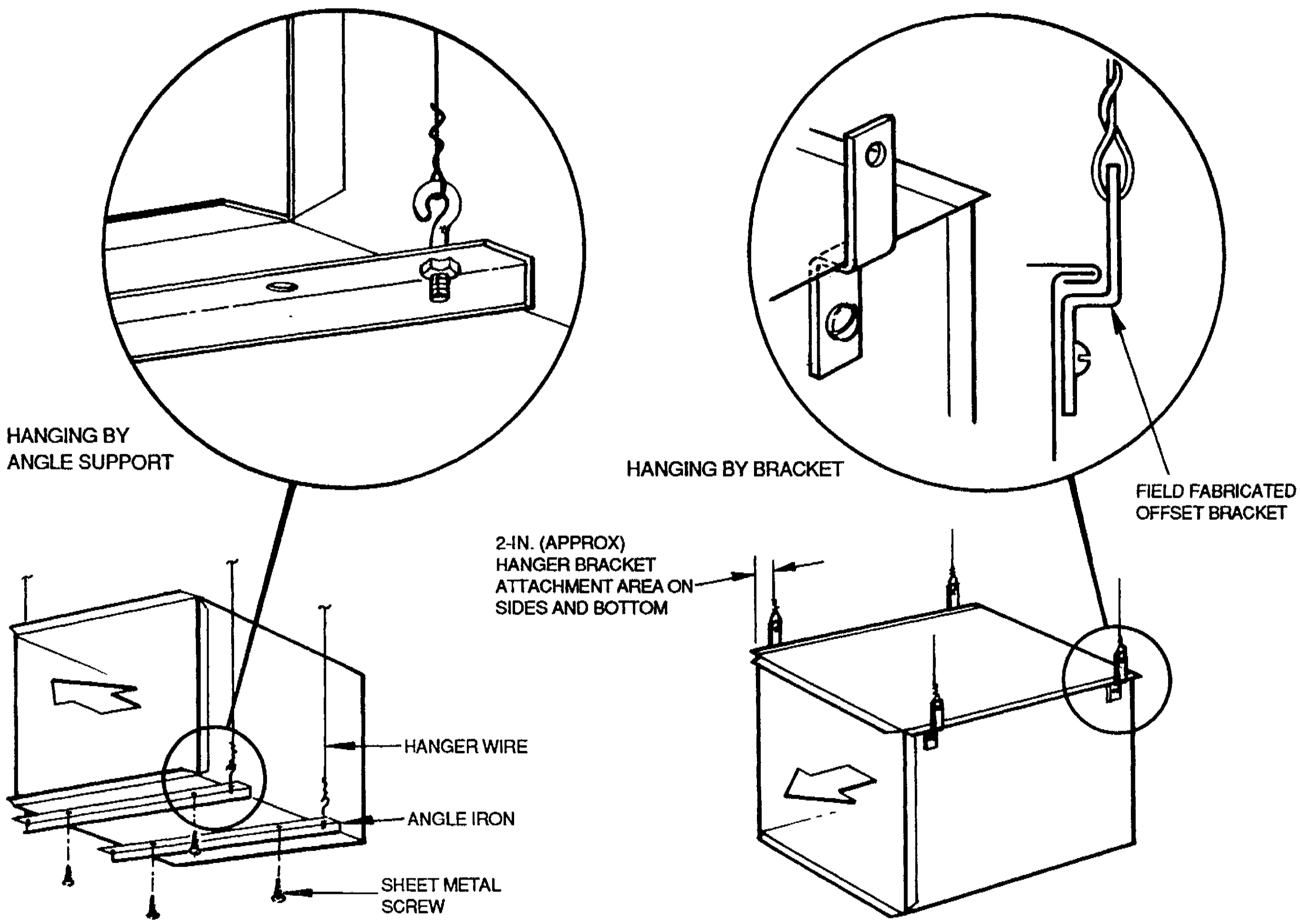
1. Move unit to installation area. Remove unit from shipping package. Do not handle by controls or damper extension rod.
2. Install field-supplied eye bolts or hanger brackets on unit with sheet metal screws as shown in Fig. 21. Mount brackets to avoid interference with internal parts.
3. Suspend units from building structure with straps or hanger wires. Secure the unit and level it in each direction. Note that reheat coil is in heavy end of unit.

Step 2 — Make Duct Connections

1. Install supply ductwork on unit inlet collar. Check that air supply duct connections are airtight and follow all accepted medium-pressure duct installation procedures.
2. Install the discharge duct. Where an octopus connector is used on the box, connect appropriately sized ductwork to the octopus outlets. Use adapter caps to seal unused outlets. Attach field-supplied duct to the octopus collars and provide balancing dampers as required. Fully open all balancing dampers as required.

   To ensure use of common-diameter air duct, coordinate diameters of box outlet and octopus collars. Insulate duct as required.

3. Straight length of inlet duct is not required but 90 degree elbows or tight radius flexible duct immediately upstream of inlet collar are to be avoided.



NOTE: For units with controls enclosure, allow 6-in. clearance for control panel removal.

Fig. 21 — Unit Suspension Details (Typical)

Step 3 — Make Electrical Connections

35DA UNITS (ANALOG ELECTRONIC CONTROLS) AND 35DV UNITS (VVT CONTROLS) FOR COOLING ONLY OR COOLING WITH HOT WATER HEAT

1. If a transformer is specified and ordered, the transformer is factory mounted on the unit side with secondary 24 v wired to the electronic flow control. Primary voltage is then brought to the transformer. See Fig. 22 for typical wiring. Refer to actual unit wiring label for specific details.
2. If factory-mounted transformer is not ordered with unit, a field-supplied 30-va transformer may be used. Transformer must be wired the same as the factory-installed transformer shown in Fig. 22.
3. If the control voltage (24 v) is distributed through the building, no transformer is required; the voltage can be connected directly to the flow control terminals as shown in Fig. 22.

35DA UNITS (ANALOG ELECTRONIC CONTROLS) AND 35DV UNITS (VVT CONTROLS) AND ELECTRIC HEAT — The 35D electric heat terminal is supplied with single point wiring connection. All power necessary to electric heat, the volume controller and the actuator is supplied in one electrical connection. Transformers for control are furnished as a part of the electric heat assembly.

Figures 23 and 24 show typical power and control wiring connections for units with electric heat. Figure 25 details 3-phase circuiting and Fig. 26 shows single-phase connections.

In providing power to the 35D with electric heat, follow all local and state codes.

Wiring and fuse sizes are shown in Table 3. Wiring for 480-v, 3-phase, 60-Hz heaters should be 4-wire, wye-connected power.

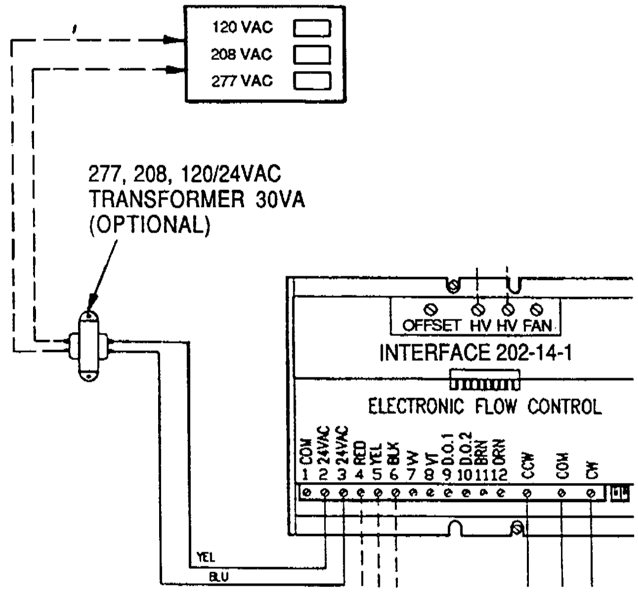
Electric heat units are designed to stay on line with no overload trip at 75 cfm/kW or above; airflow should not be adjusted in the field to values below this limit.

35DP UNITS (PNEUMATIC CONTROLS) AND ELECTRIC HEAT — Figure 23 shows typical power wiring connections for units with electric heat.

In providing power to the 35D with electric heat, follow all local and state codes.

Wiring and fuse sizes are shown in Table 3. Wiring for 480-v, 3-phase, 60-Hz heaters should be 4-wire, wye-connected power.

Electric heat units are designed to stay on line with no overload trip at 75 cfm/kW or above; airflow should not be adjusted in the field to values below this.

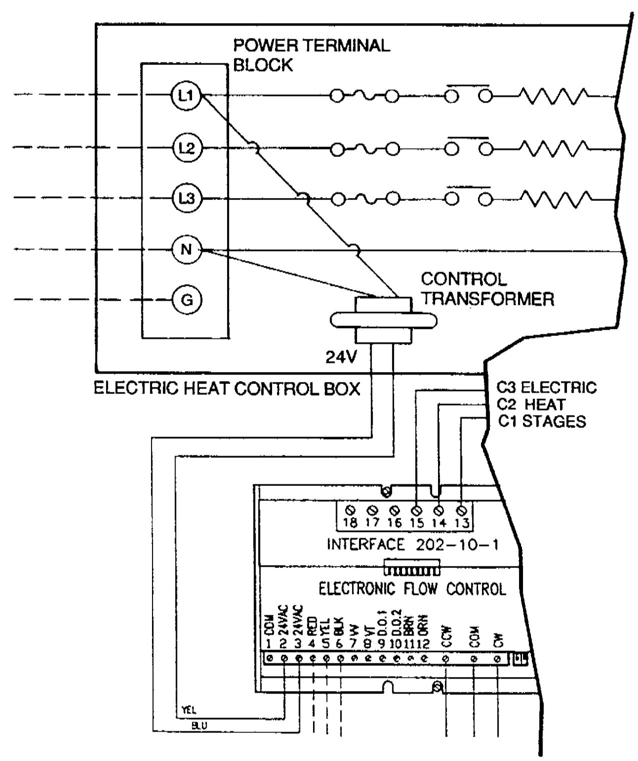


LEGEND

- - - - Field Wiring
——— Factory Wiring

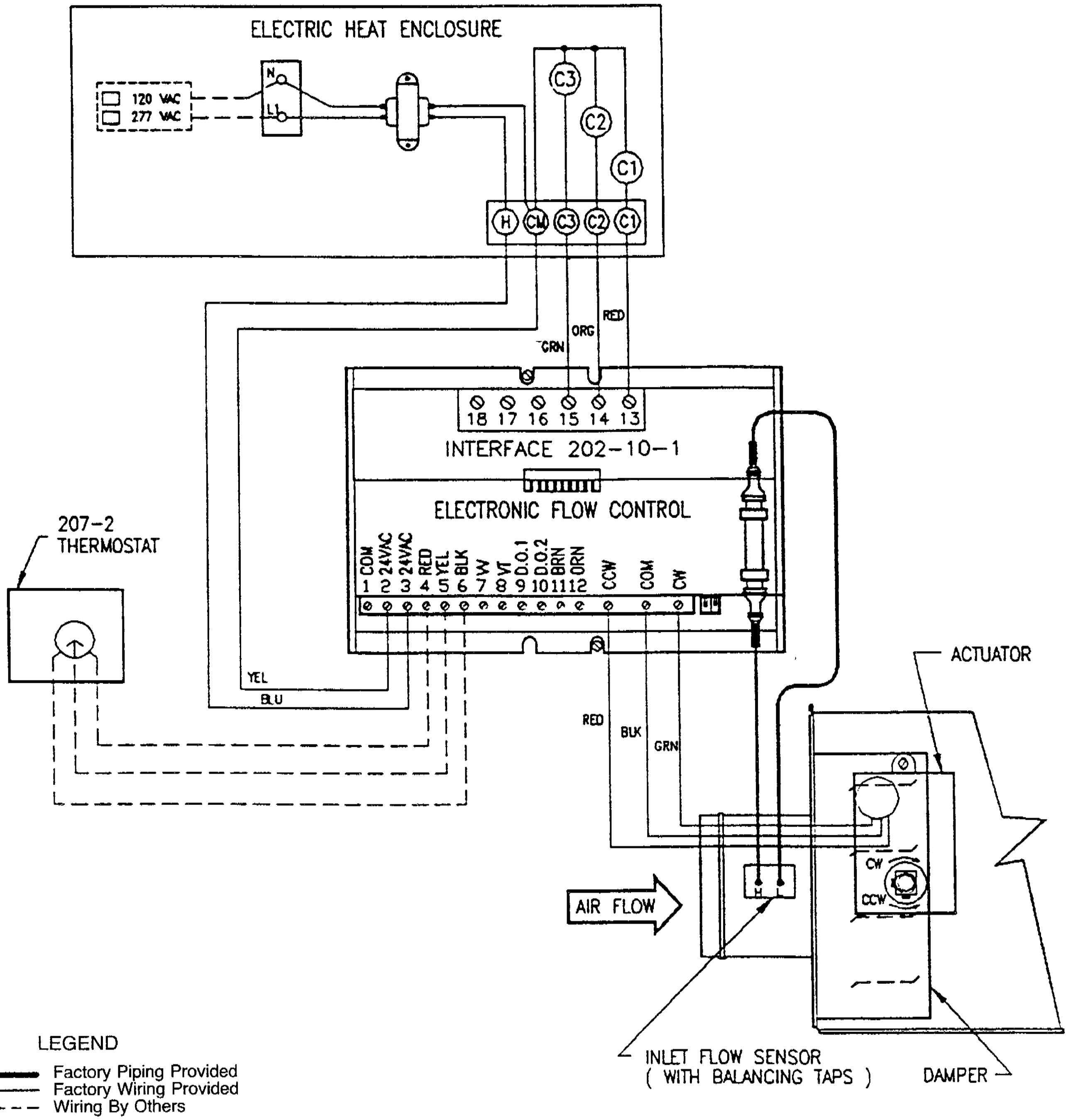
NOTE: Drawing is typical — refer to actual unit wiring diagram for details.

Fig. 22 — Wiring of Factory-Mounted Transformer



NOTE: Drawing is typical — refer to actual unit wiring diagram for details.

Fig. 23 — Typical Power Connections for 35D with Electric Heat (35DA Shown)



LEGEND

- Factory Piping Provided
- Factory Wiring Provided
- Wiring By Others

NOTE:

1. Drawing is typical. Refer to actual unit wiring diagram for details.
2. For typical electric heat diagram, see Fig. 25 and 26.

Fig. 24 — 35D With 3-Stages of Electric Heat-Control Diagram (35DA Shown)

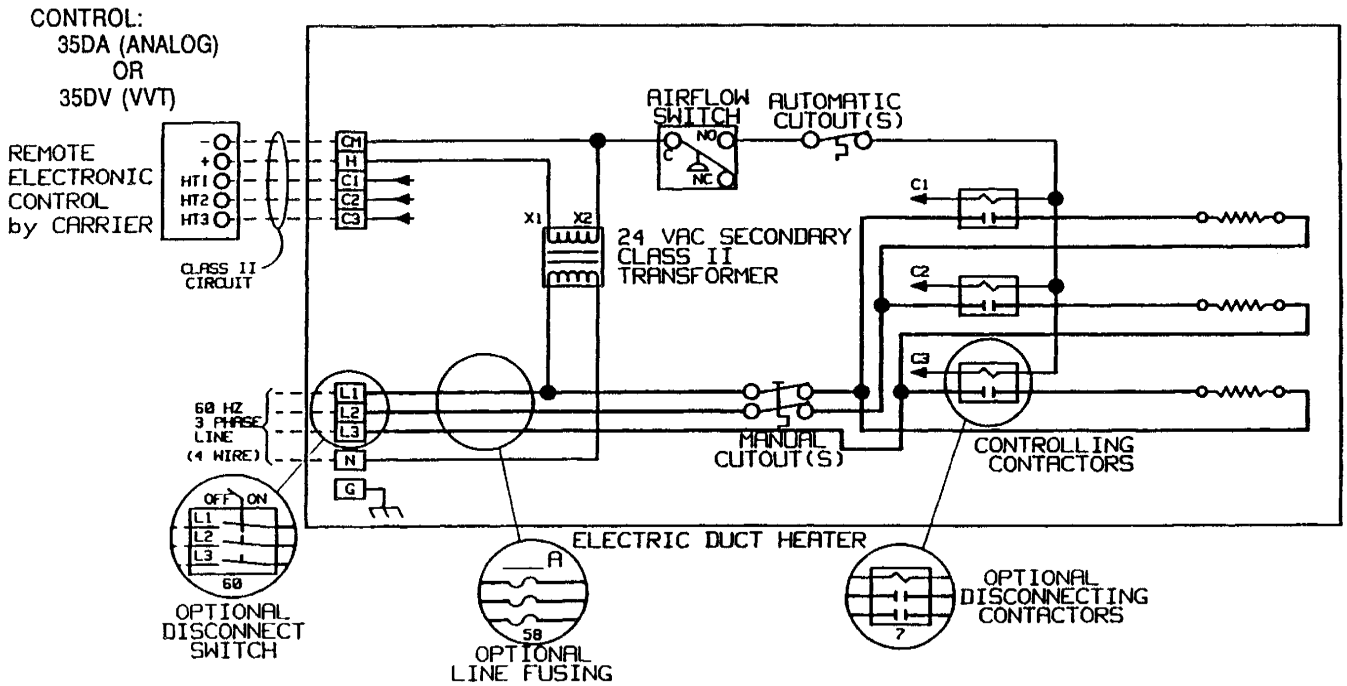


Fig. 25 — 35D With 3 Stages of Electric Heat; Electric Heat Diagram — 480-3-60

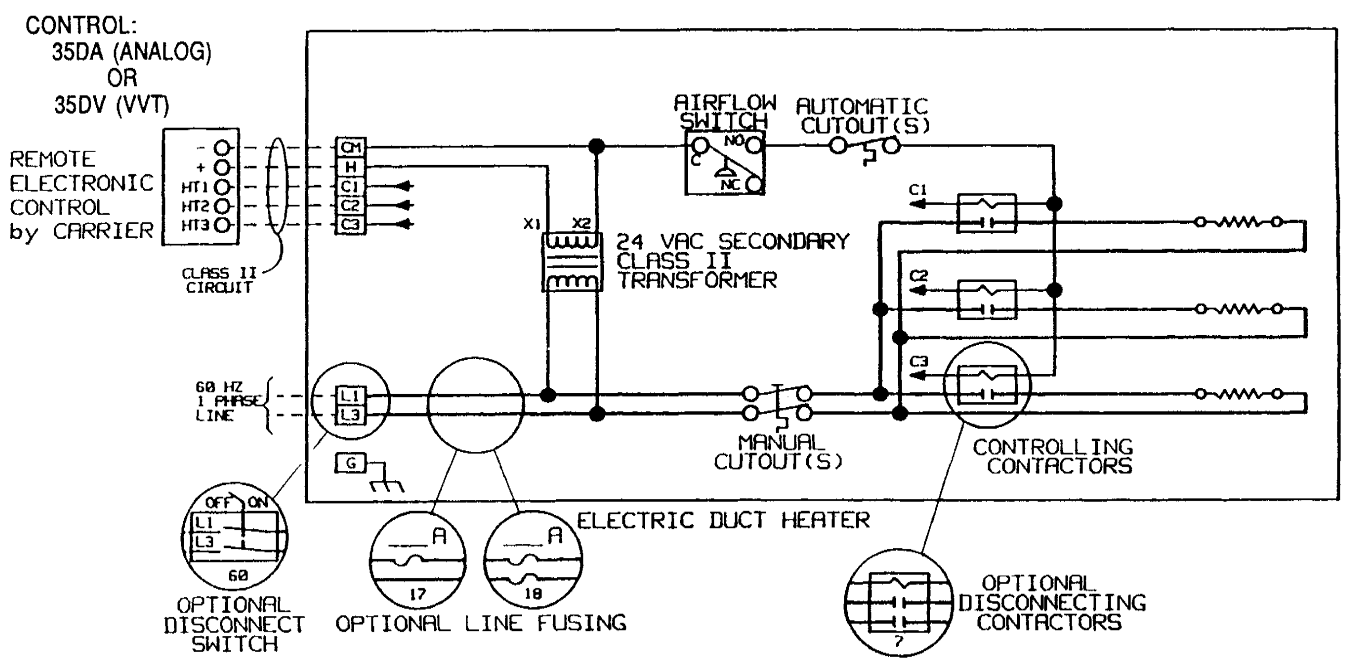


Fig. 26 — 35DA With 3 Stages of Electric Heat; Electric Heat Diagram — 120/277-1-60

Table 3 — 35D Heater Power Wiring and Fuse Sizing

HEATER SIZE (kW)	BTUH	SINGLE PHASE, 60 HZ								
		120 v			208/240 v			277 v		
		Heater FLA	AWG*	Fuse Amps	Heater FLA	Wire Size AWG*	Fuse Amps	Heater FLA	Wire Size AWG*	Fuse Amps
0.5	1,707	4.2	14	15	2.1	14	15	1.8	14	15
1.0	3,413	8.3	14	15	4.2	14	15	3.6	14	15
2.0	6,826	16.7	10	30	8.3	14	15	7.2	14	15
3.0	10,239	25.0	8	50	12.5	12	20	10.8	14	15
4.0	13,652	33.3	8	50	16.7	10	30	14.4	12	20
5.0	17,065	41.7	6	65	20.8	10	30	18.1	10	30
6.0	20,478	50.0	6	65	25.0	8	50	21.7	10	30
7.0	23,898	58.3	4	85	29.2	8	50	25.3	8	50
8.0	27,304	66.7	4	85	33.3	8	50	28.9	8	50
9.0	30,717	75.0	3	160	37.5	6	65	32.5	8	50
10.0	34,130	83.3	2	115	41.7	6	65	36.1	6	50
11.0	37,543	91.7	2	115	45.8	6	65	39.7	6	65
12.0	40,956	100.0	1	130	50.0	6	65	43.3	6	65
13.0	44,369	108.3	1/0	150	54.7	4	85	46.9	6	65
14.0	47,782	116.7	1/0	150	58.3	4	85	50.5	6	65
15.0	51,195	125.0	2/0	175	62.5	4	85	54.2	4	85
16.0	54,608	133.3	2/0	175	66.7	4	85	57.8	4	85
17.0	58,021	141.7	3/0	200	70.8	3	100	61.4	4	85
18.0	61,434	150.0	3/0	200	75.0	3	100	65.0	4	85
19.0	64,847	158.3	3/0	200	79.2	3	100	68.6	3	100
20.0	68,260	166.7	4/0	230	83.3	2	115	72.2	3	100
21.0	71,673	175.0	4/0	230	87.5	2	115	75.8	3	100
22.0	75,086	183.3	4/0	230	91.7	2	115	79.4	3	100
23.0	78,499	191.7	250 kcm	255	95.8	1	180	83.0	2	115
24.0	81,912	200.0	250 kcm	255	100.0	1	180	86.6	2	115

HEATER SIZE (kW)	BTUH	3 PHASE, 60 HZ					
		208 v			480 v		
		Heater FLA	Wire Size AWG*	Fuse Amps	Heater FLA	Wire Size AWG*	Fuse Amps
0.5	1,707	1.4	14	15	0.6	14	15
1.0	3,413	2.8	14	15	1.2	14	15
2.0	6,826	5.6	14	15	2.4	14	15
3.0	10,239	8.3	14	15	3.6	14	15
4.0	13,652	11.1	14	15	4.8	14	15
5.0	17,065	13.9	12	20	6.0	14	15
6.0	20,478	16.7	10	30	7.2	14	15
7.0	23,898	19.4	10	30	8.4	14	15
8.0	27,304	22.2	10	30	9.6	14	15
9.0	30,717	25.0	8	50	10.8	14	15
10.0	34,130	27.8	8	50	12.0	14	15
11.0	37,543	30.5	8	50	13.2	12	20
12.0	40,956	33.3	8	50	14.4	12	20
13.0	44,369	36.1	6	65	15.8	12	20
14.0	47,782	38.8	6	65	16.8	10	30
15.0	51,195	41.6	6	65	18.0	10	30
16.0	54,608	44.4	6	65	19.2	10	30
17.0	58,021	47.2	6	65	20.4	10	30
18.0	61,434	50.0	6	65	21.6	10	30
19.0	64,847	52.7	4	85	22.8	10	30
20.0	68,260	55.5	4	85	24.0	10	30
21.0	71,673	58.3	4	85	25.2	8	50
22.0	75,086	61.1	4	85	26.4	8	50
23.0	78,499	63.8	4	85	27.6	8	50
24.0	81,912	66.6	4	85	28.8	8	50

*Values based on 75 C copper wire.

LEGEND

AWG — American Wire Gage
FLA — Full Load Amps

BALANCING

General — The 35D single duct VAV terminal is designed to supply a varying quantity of cold primary air to a space in response to a thermostat demand. Some units have reheat options to provide heating demand requirements as well. Most VAV terminals are equipped with pressure compensating controls to regulate the response to the thermostat independent of the pressure in the supply ductwork.

To balance the unit it is necessary to set both the maximum and minimum set points of the controller. The many types of control options available each have specific procedures required for balancing the unit. These instructions provide information for balancing units with pneumatic and analog electronic controls. For PIC units, see separate Installation Instructions. For balancing of units with VVT controls, see Reference and Troubleshooting Guides for VVT.

Factory Set Points — Maximum and minimum airflow set points are normally specified for the job and ordered for each unit on the job. Each unit is tested at the factory and the cfm settings made at this time. Where maximum and minimum airflow levels are not specified on the order, default values are applied. These default values are shown in Table 4.

All units arrive at the jobsite set to either specified or default maximum and minimum cfm levels. The values are shown on the unit nameplate. See Fig. 20.

Where other levels of airflow for a given unit are desired, field setting of cfm is necessary. Refer to Table 5 for minimum cooling and heating airflow requirements.

Field Adjustment of Minimum and Maximum Airflow Set Points — Each 35D is equipped with a flow probe (see Fig. 27) which measures a differential pressure proportional to the airflow. The relationship between flow probe pressures and cfm is shown in the airflow chart in Fig. 28. This chart is attached to each unit.

35DP UNITS (PNEUMATIC CONTROLS) (ALL 6000 SERIES CONTROL SEQUENCES) — The 35DP units are available in 8 basic arrangements (shown in Table 2). Pneumatic controls require a minimum of 15 psig and a maximum of 25 psig main pressure for satisfactory operation.

Table 4 — Cfm Default Values

35D UNIT SIZE	MAX CFM	MINIMUM CFM	
		Cooling or Cooling With Hot Water Heat	Cooling With Electric Heat
04	200	0	75 cfm/ton
05	350	0	75 cfm/ton
06	500	0	75 cfm/ton
07	650	0	75 cfm/ton
08	800	0	75 cfm/ton
09	1050	0	75 cfm/ton
10	1350	0	75 cfm/ton
12	1900	0	75 cfm/ton
14	2500	0	75 cfm/ton
16	3000	0	75 cfm/ton
18	4000	0	75 cfm/ton

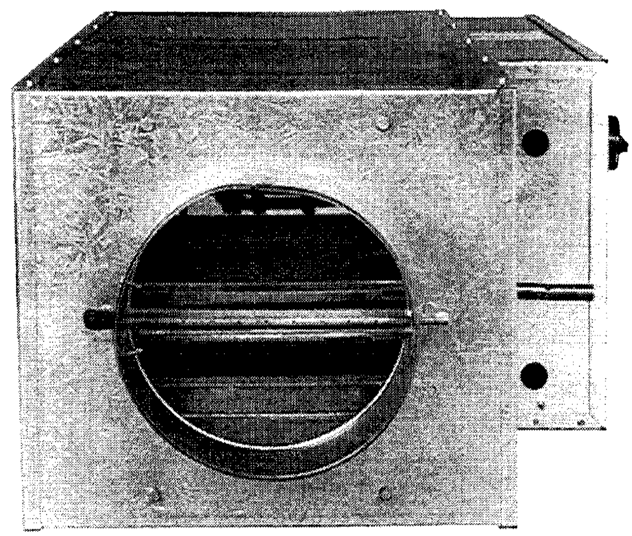


Fig. 27 — Flow Probe

Table 5 — 35D Box Flow Data

UNIT SIZE	BOX CFM	MINIMUM AIRFLOW (CFM)*: Cooling Only or Cooling with Hot Water Heat	MINIMUM AIRFLOW (CFM)*: Cooling with Electric Heat	MINIMUM INLET STATIC PRESSURE (in. wg) (UNIT AND HEAT PRESSURE DROP)†: Unit Only	Hot Water Coil: 1-Row	Hot Water Coil: 2-Row	Hot Water Coil: 3-Row	Hot Water Coil: 4-Row	Electric Heat
04 (0.083 sq ft)	50	37 or 0	75 cfm/ kW	0.03	0.03	0.03	0.03	0.03	0.03
	100			0.10	0.10	0.10	0.10	0.10	0.10
	150			0.23	0.23	0.23	0.23	0.23	0.23
	200			0.40	0.40	0.40	0.40	0.40	0.40
05 (0.130 sq ft)	100	58 or 0		0.03	0.03	0.03	0.03	0.03	0.03
	175			0.10	0.10	0.10	0.10	0.10	0.10
	225			0.17	0.17	0.17	0.17	0.17	0.17
	350			0.42	0.42	0.42	0.42	0.42	0.42
06 (0.186 sq ft)	125	82 or 0		0.01	0.01	0.01	0.02	0.01	0.01
	250			0.04	0.04	0.04	0.07	0.09	0.04
	375			0.10	0.10	0.10	0.15	0.20	0.10
	500			0.17	0.17	0.17	0.27	0.35	0.17
07 (0.253 sq ft)	200	112 or 0		0.02	0.02	0.02	0.03	0.04	0.02
	325			0.05	0.05	0.05	0.07	0.10	0.05
	475			0.11	0.11	0.11	0.16	0.21	0.11
	650			0.21	0.21	0.21	0.29	0.39	0.21
08 (0.331 sq ft)	200	147 or 0		0.01	0.01	0.02	0.03	0.04	0.01
	400			0.04	0.04	0.07	0.11	0.15	0.04
	600			0.08	0.09	0.17	0.25	0.33	0.08
	800			0.15	0.16	0.30	0.45	0.59	0.15
09 (0.419 sq ft)	250	186 or 0		0.00	0.01	0.02	0.03	0.04	0.01
	525			0.02	0.05	0.09	0.14	0.18	0.06
	750			0.04	0.10	0.19	0.28	0.37	0.12
	1050			0.07	0.20	0.37	0.56	0.73	0.23
10 (0.518 sq ft)	325	230 or 0		0.00	0.02	0.04	0.05	0.07	0.00
	650			0.01	0.08	0.14	0.21	0.28	0.01
	975			0.02	0.17	0.32	0.48	0.63	0.02
	1300			0.04	0.30	0.57	0.85	1.12	0.04
12 (0.731 sq ft)	475	324 or 0		0.00	0.02	0.04	0.07	0.09	0.00
	950			0.02	0.09	0.18	0.26	0.35	0.02
	1425			0.04	0.21	0.40	0.59	0.78	0.04
	1900			0.07	0.37	0.71	1.06	1.39	0.07
14 (0.943 sq ft)	625	418 or 0		0.01	0.03	0.06	0.08	0.11	0.01
	1250			0.02	0.12	0.22	0.34	0.44	0.02
	1875			0.05	0.26	0.50	0.76	1.00	0.05
	2500			0.10	0.47	0.90	1.35	1.78	0.10
16 (1.156 sq ft)	750	513 or 0		0.01	0.03	0.06	0.09	0.12	0.01
	1500			0.03	0.13	0.26	0.37	0.49	0.03
	2250			0.06	0.30	0.58	0.83	1.10	0.06
	3000			0.11	0.54	1.03	1.47	1.95	0.11
18 (1.550 sq ft)	1000	513 or 0		0.01	0.06	0.11	0.16	0.22	0.01
	2000			0.03	0.24	0.46	0.65	0.87	0.03
	3000			0.07	0.54	1.03	1.47	1.95	0.07
	4000			0.13	0.95	1.82	2.62	3.47	0.13

*Minimum airflow for cooling or cooling with hot water heat is the minimum flow rate controllable by the unit volume controller; shutoff or zero is also acceptable.

†Minimum inlet static pressure is the pressure drop for unit only (with wide open damper) or for unit with hot water coil or electric heat; for example, a size 10 unit at 975 cfm has a minimum pressure drop of 0.02 in. wg; with a 3-row coil, the unit and coil pressure drop is 0.48 in. wg. Data is based on tests conducted in accordance with ARI Standard 880-89.

NOTES:

1. Where electric heat is added to the 35D unit, minimum cfm must be at least 75 cfm per installed kW of power. Thus, a 4.3 kW heater on a size 10 unit requires a minimum cfm of 4.3 x 7.5, or 322.5 cfm.
2. Electric heat units equipped with an airflow switch require a minimum of 0.05 in. wg static pressure at discharge end of box.

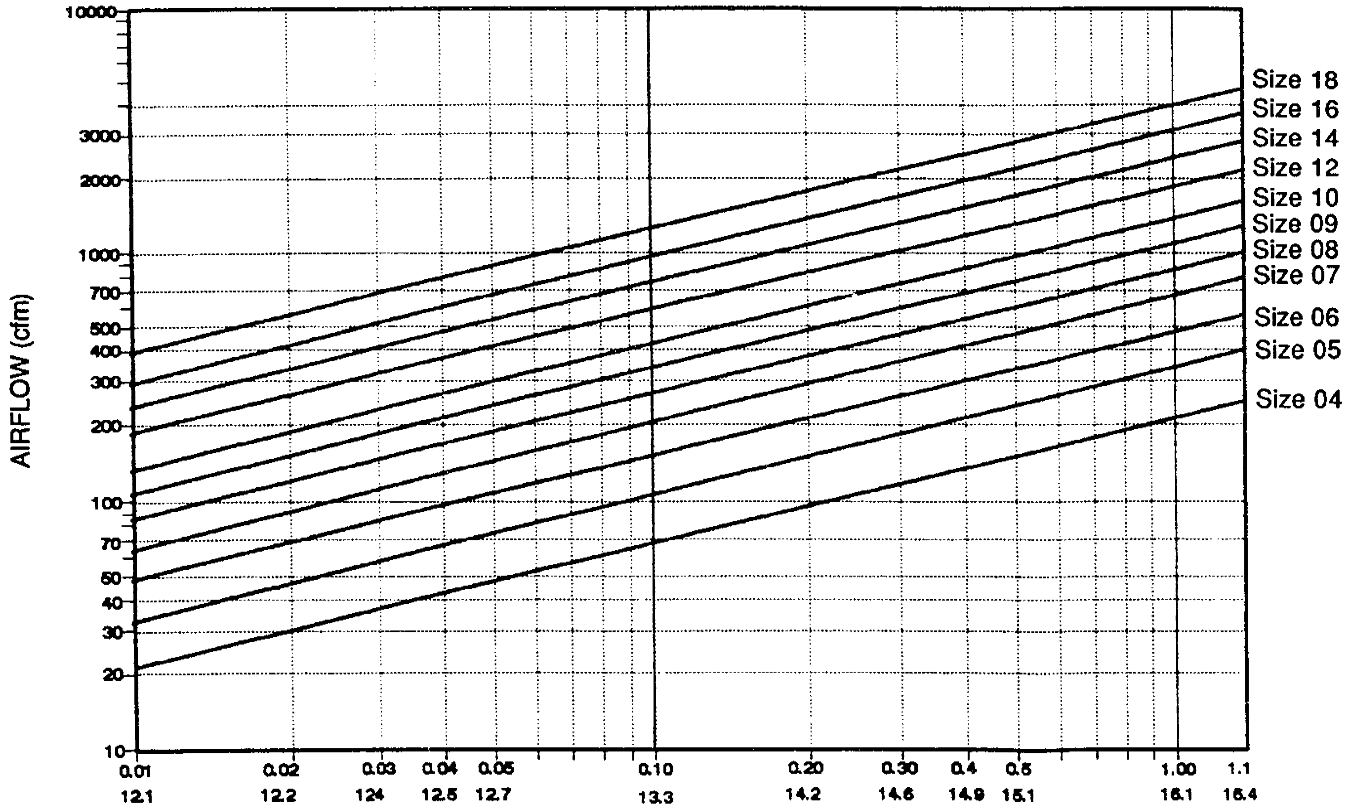


Fig. 28 — Linear Averaging Probe Chart

Preparation for Balancing

1. Inspect all pneumatic connections to assure tight fit and proper location.
2. Verify that the thermostat being used is compatible with the control sequence provided (direct acting or reverse acting).
3. Check main air pressure at the controller(s). The main air pressure must be between 15 psi and 25 psi. (If dual or switched-main air pressure is used, check the pressure at both high and low settings.) The difference between "high" pressure main and "low" pressure main should be at least 4 psi, unless otherwise noted, and the "low" setting difference should exceed 15 psi.
4. Check that the unit damper will fail to the proper position when main air pressure is lost. Disconnect the pneumatic actuator line from the velocity controller and observe the VAV damper position. The damper should fail to either a normally open position (indicator mark on shaft end is horizontal) or a normally closed position (indicator mark on shaft end is vertical).
5. Check that there is primary airflow in the inlet duct.
6. See Fig. 29. Connect a Magnehelic gage, inclined manometer or other differential pressure measuring device to the balancing taps provided in the velocity probe sensor lines. The manometer should have a full scale reading of 0.0 to 1.0 in. wg. The high pressure signal is delivered from the front sensor tap (away from the valve), and the low pressure signal is delivered from the back line (near the valve). The pressure differential between high and low represents the amplified velocity pressure in the inlet duct.

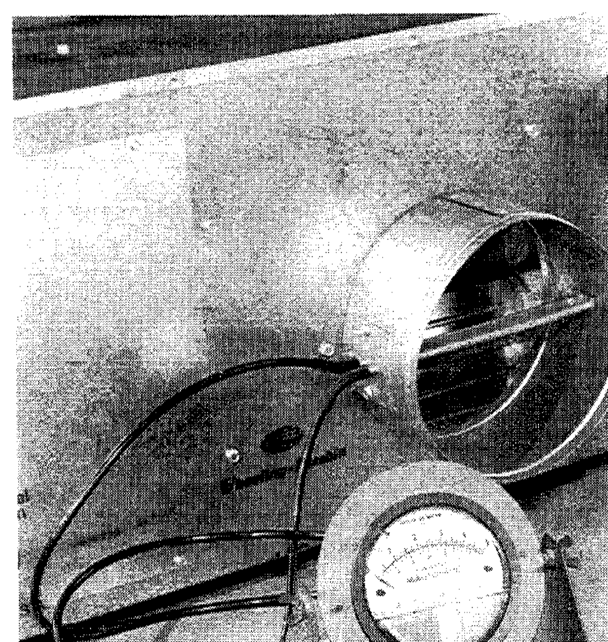


Fig. 29 — Measuring Differential Pressure

Table 6 — Pneumatic Volume Controller Identification

CONTROL SEQUENCE	FUNCTION ARRANGEMENT IDENTIFICATION	CARRIER PART NO.	FIG. NO.	KREUTER PART NO.
6102	DA, NO	35DP50000201	30	CSC-2003
6105	RA, NO			
6103	DA, NC	35DP50000701	31	CSC-2004
6104	RA, NC			
6106	CV, NO	35DP50000201	30	CSC-2003
6107	CV, NC	35DP50000701	31	CSC-2004

LEGEND

CV — Constant Volume
DA — Direct Acting
NC — Normally Closed
NO — Normally Open
RA — Reverse Acting

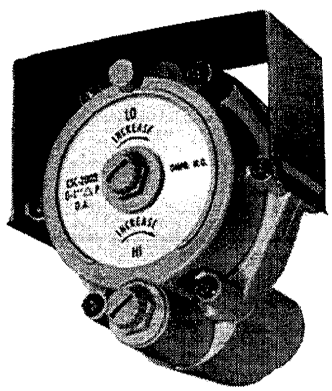


Fig. 30 — Pneumatic Volume Controller (Normally Open) for 35DP Unit

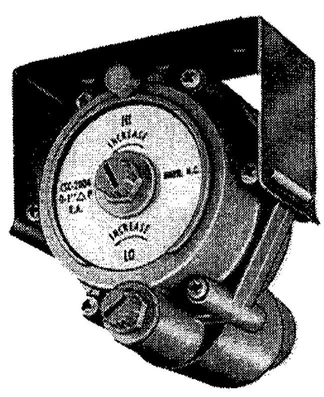


Fig. 31 — Pneumatic Volume Controller (Normally Closed) for 35DP Unit

7. Read the differential pressure and enter the Linear Averaging Probe Chart to determine the airflow in the terminal unit. This chart is shown in Fig. 28 and is also attached to the side of each unit. For example, a differential pressure of 0.10 in. wg for a size 8 unit yields an airflow of 275 cfm.

Volume controllers for 35DP units are shown in Fig. 30 and Fig. 31. Identification for each controller is shown in Table 6.

Balancing Procedure

Direct Acting Thermostat, Normally Open Damper (Control Sequence 6102) — Refer to Fig. 30.

1. Minimum Volume Setting
   a. Disconnect the thermostat line from the volume controller.
   b. Adjust the minimum volume control knob (marked "LO" and located in the center of the controller) to achieve the required minimum flow. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   c. Reconnect the thermostat line.
2. Maximum Volume Setting
   a. Disconnect the thermostat line from the volume controller.
   b. Apply 15+ psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   c. Adjust the maximum volume control knob (marked "HI" and located at the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   d. Reconnect the thermostat line.

Reverse Acting Thermostat, Normally Open Damper (Control Sequence 6105) — Refer to Fig. 30.

1. Minimum Volume Setting
   a. Disconnect the thermostat line from the reversing relay.
   b. Apply 15+ psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   c. Adjust the minimum volume control knob (marked "LO" and located in the center of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   d. Reconnect the thermostat line.
2. Maximum Volume Setting
   a. Disconnect the thermostat line from the volume controller.
   b. Adjust the maximum volume control knob (marked "HI" and located on the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   c. Reconnect the thermostat line.

Direct Acting Thermostat, Normally Closed Damper (Control Sequence 6103) — Refer to Fig. 31.

1. Maximum Volume Setting.
   a. Disconnect the thermostat line from the volume controller.
   b. Adjust the maximum volume control knob (marked "HI" and located in the center of the controller) to achieve the required minimum flow. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   c. Reconnect the thermostat line.
2. Minimum Volume Setting.
   a. Disconnect the thermostat line from the volume controller.
   b. Apply 15+ psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   c. Adjust the minimum volume control knob (marked "LO" and located on the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   d. Reconnect the thermostat line.

Reverse Acting Thermostat, Normally Closed Damper (Control Sequence 6104) — Refer to Fig. 31.

1. Maximum Volume Setting.
   a. Disconnect the thermostat line from the velocity controller.
   b. Adjust the maximum volume control knob (marked "HI" and located in the center of the controller) to achieve the required minimum flow. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   c. Reconnect the thermostat line.
2. Minimum Volume Setting.
   a. Disconnect the thermostat line from the velocity controller.
   b. Apply 15+ psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   c. Adjust the minimum volume control knob (marked "LO" and located on the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 5 and the Linear Averaging Probe Chart provided on the side of the VAV unit and in Fig. 28.
   d. Reconnect the thermostat line.

35DA UNITS (ANALOG ELECTRONIC CONTROLS) ALL 1000 SERIES CONTROLS — The 35DA uses the Hoffman 200-2B Controller and the 207 thermostat; additional interface circuits are provided when additional functions are required.

Figure 32 shows the controller/actuator on the 35DA.

Balancing Procedure

1. Turn off power to unit if disconnect is available, or carefully remove 24 vac wire from external transformer.
2. Using a digital voltmeter set at 20 vdc, attach the red probe to terminal no. 8 on the controller (see Fig. 33).
3. Make sure that all wiring to the controller and interface (if required) is properly connected according to the control package diagram.
4. Observe that the proper hookup of the airflow sensing tubing between the controller and the flow probe has been made. Note that the front or high-pressure tube of the flow probe is connected to the "HI" port of the controller board and the inside tube to the "LO" port.
5. Apply power to the unit.
6. Using the Analog Flow Probe Chart (Fig. 34), determine the voltage required for a given unit size to achieve minimum airflow. For example, a size 8 unit with minimum flow of 175 cfm requires a voltage of 12.5 dc.
7. Set thermostat to maximum temperature.
8. Place black voltmeter probe on terminal no. 4 of the controller and observe voltage reading.
9. Adjust minimum flow potentiometer with ⅛-blade screwdriver until proper voltage is achieved.
10. Adjust thermostat to minimum temperature.
11. Determine from Fig. 34 the voltage required to achieve maximum flow. For example, a size 8 unit at 600 cfm maximum would require a voltage of 15.3 dc.
12. With black probe again on terminal no. 4, adjust the maximum flow potentiometer to achieve proper voltage.

The controller is now balanced.

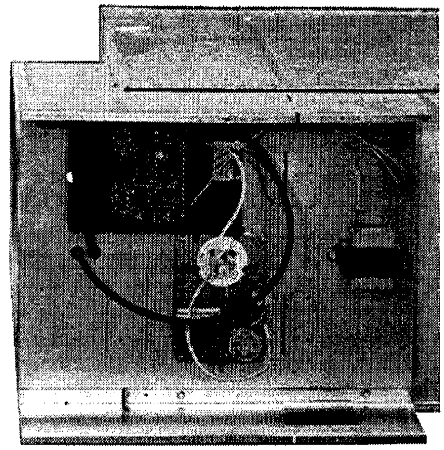


Fig. 32 — 35DA Analog Electronic Control

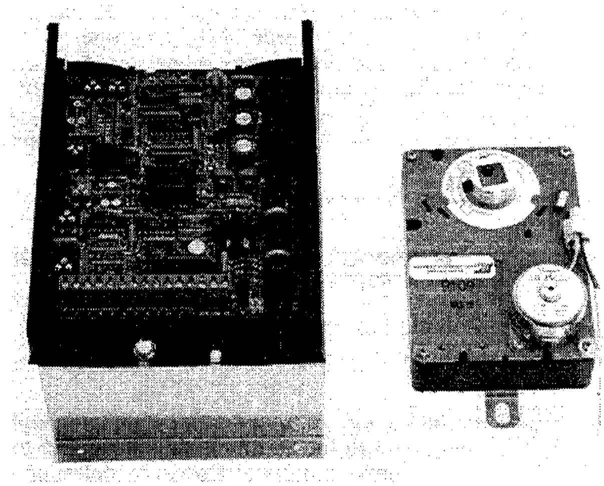


Fig. 33 — Analog Volume Controller

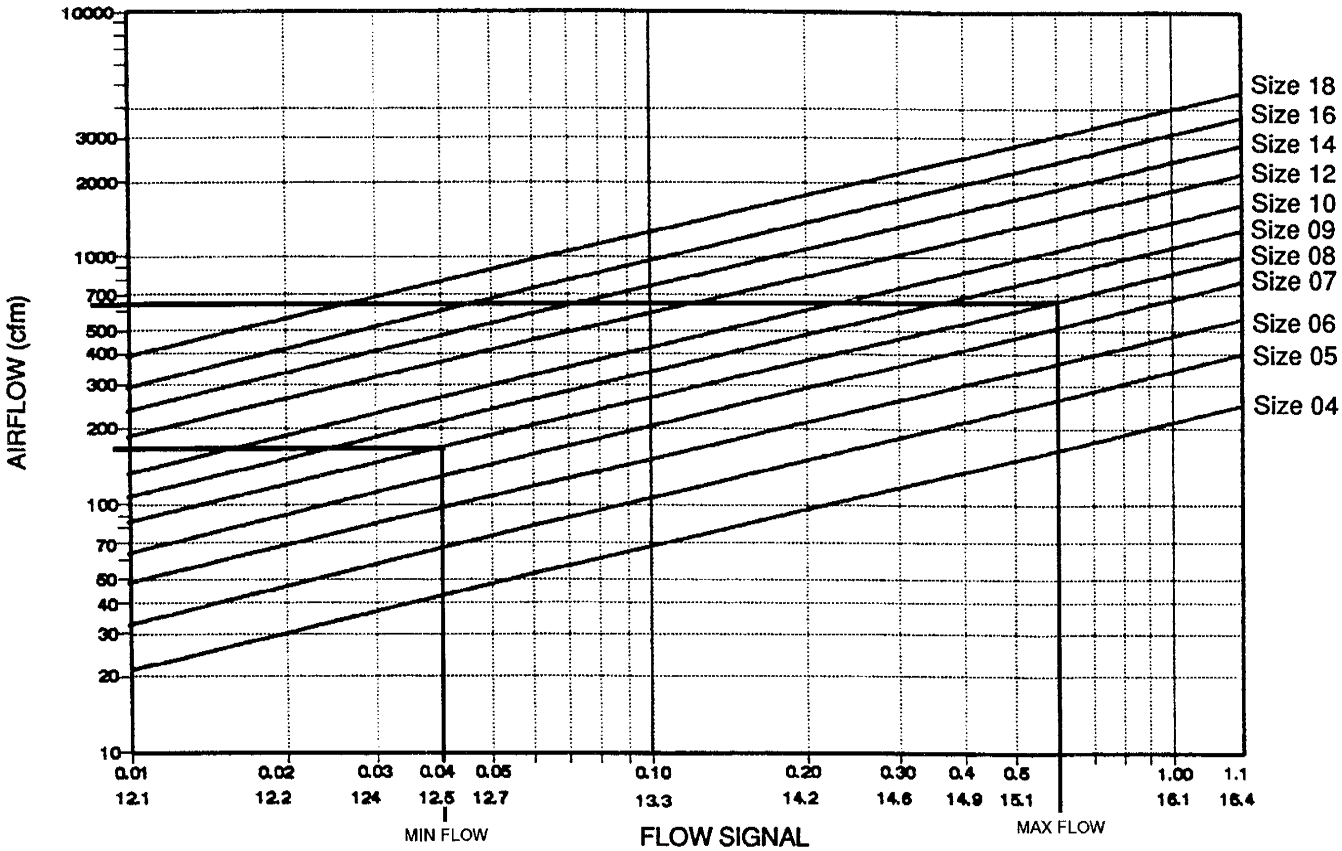


Fig. 34 — Analog Flow Probe Chart

CONTROL TROUBLESHOOTING

35DA Units (Analog Electronic Controls)

GENERAL — This procedure should be used to troubleshoot the 1000 Series direct acting (cooling) controller when used with factory-supplied thermostat. A digital voltmeter with a range of 0 to 20 vdc is required.

PRE-TROUBLESHOOTING PROCEDURE

1. Determine if a 24 vac power supply, –15%, +20%, is wired to Terminals 2 and 3 on the controller.
2. Determine if the controller has been installed properly on the terminal box.
3. Determine if the minimum and maximum flow limits have been properly set.
4. Determine if the thermostat is wired correctly.
5. Space temperature must be between 70 to 80 F.

TO DETERMINE IF PRIMARY AIR STATIC PRESSURE IS SUFFICIENT TO OPERATE THE CONTROLLER:

1. Check sensing tube hook-up to verify that it matches control package drawing and information in balancing procedure.
2. Place red voltmeter probe on terminal no. 8 of controller.
3. Place black voltmeter probe on terminal no. 4 and record the voltmeter reading.
4. Remove red probe from terminal no. 8 and attach to terminal no. 7.
5. Place black probe on terminal no. 4 and record voltage reading.
6. If voltage of Step 5 is 0.3 v or less than the reading of Step 3, the primary air static pressure is insufficient to operate the unit. Raise the duct pressure.

MOTOR ROTATION

1. If the voltage of Step 6 above is significantly more than 0.3 vdc, there is a possibility that the motor is wired to produce a reverse rotation.
2. To check motor direction, place a temporary jumper between terminals no. 4 and no. 10 on the controller. If motor rotation wiring is correct, this action should drive the damper fully closed. Remove the jumper.
3. If damper is driven open, the red and green wires must be switched at the CCW and CW terminals of the controller.

TROUBLESHOOTING THERMOSTAT CIRCUIT

1. Apply 24 vac power to controller.
2. No airflow needed.
3. Measure voltage between Terminals 4 (−) RED and 5(+) YELLOW on the controller.

   Reading should be 20 vdc ± .2 vdc (power supply to thermostat). If not, replace controller.
4. Turn set point on thermostat to 65 F. Measure voltage between Terminals 4 (−) and 6 (+) on the controller.

   Reading should be 9.75 vdc or less. If not, proceed to steps 5 and 6.
5. Turn set point on thermostat to 85 F. Measure voltage between Terminals 4 (−) and 6 (+) on the controller.

   Reading should be 10.0 vdc or more. If not, proceed to Step 6.
6. If either or both voltages in Step 4 or 5 are not correct, the following voltages should be checked at the thermostat.
   a. Voltage between RED (−) test post and YELLOW (+) thermostat post should be 20 vdc ± .2 vdc.
   b. Turn set point at thermostat to 65 F.

      Voltage between RED (−) test post and BLACK (+) lead should be 9.75 vdc or less.
   c. Turn set point at thermostat to 85 F.

      Voltage between Red (−) test post and BLACK (+) lead should be 10.0 vdc or more.
   d. If any of these voltages are not correct, check wiring between thermostat and controller for correct installation or shorts. If wiring is proper, replace the thermostat.

TROUBLESHOOTING TEMPERATURE AND VELOCITY CIRCUITS — (This procedure should follow the troubleshooting of the thermostat circuit.)

If the air volume requirement through the terminal box is between the minimum and maximum flow limits, and the terminal box is under control, the Vt and Vv voltages will be equal to within ± .2 vdc. These voltages are measured between Terminals 4 (−) and 7 (+) Vv or 8 (+) Vt and should be between 11.1 and 16.5 vdc. If Vt and Vv voltages are not approximately equal check the following:

1. Airflow needed.
2. If Vv voltage is above 17 vdc, replace controller.
3. Turn set point on thermostat to 65 F; Vt should go to its high limit. If not, replace controller.
4. Turn set point on thermostat to 85 F; Vt should go to its low limit. If not, replace controller.
5. If air damper is fully open and Vv is below Vt, determine if there is enough air volume coming to the terminal box to satisfy the need.
6. Check the tubing between the velocity pickup in the duct and velocity sensor for leaks, kinks and plugging. If the tubing needs replacing, do not remove tubing from velocity sensor. Cut tubing and splice with coupling.
7. Check damper coupling to determine if it is loose on damper shaft. If loose, reposition damper to give full travel between mechanical stops and tighten set screws.
8. If performing Steps 5, 6 or 7 does not correct the problem, replace the controller.

TROUBLESHOOTING ACTUATOR CIRCUIT

1. Air box reversed from expected action.
   a. Adjust thermostat to 65 F.
   b. If the damper closes instead of opens, reverse CW and CCW leads to the controller terminals.
2. Damper shaft not coupled to actuator.
   a. Close damper.
   b. Adjust thermostat to 85 F to put actuator in closed damper position.
   c. Tighten screws on coupling to damper shaft.
3. Actuator turns for one direction only.
   a. Decouple damper shaft from actuator.
   b. Set thermostat at 65 F.

      Does the actuator move to the open damper position? If not, replace the controller.
   c. Set thermostat at 85 F.

      Does actuator move to the closed damper position? If not, replace the controller.
   d. If the actuator works as described in b and c above, disconnect its CW and CCW leads from the controller and put one at a time to terminal 3.
      1) Does motor turn CW or CCW? If not, replace actuator.
      2) If it does, then the problem probably is a misadjusted damper.
      3) Readjust according to Step 2.