ENGINEERING DATA

LPV Discharge Sound

.5" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	Discharge w/ 100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	46	42	39	33	28	21	-
		275	0.129	50	47	42	37	33	26	-
		350	0.209	52	50	45	40	36	30	-
		425	0.309	55	53	47	43	39	33	-
		500	0.427	56	55	49	45	42	35	-
208	8	400	0.065	54	52	46	42	38	32	-
		500	0.101	56	55	49	45	42	35	-
		600	0.145	58	58	51	47	44	38	-
		700	0.198	60	60	53	49	47	40	-
		800	0.259	61	62	54	51	49	42	-
424	24	800	0.237	59	57	53	47	45	38	-
		1000	0.371	60	57	54	48	46	40	-
		1200	0.534	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		1400	0.727	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		1600	0.950	N/A	N/A	N/A	N/A	N/A	N/A	N/A

See page 57 for notes

1" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	Discharge w/ 100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	51	47	44	38	33	26	-
		275	0.129	54	52	48	42	38	31	-
		350	0.209	57	55	51	46	41	34	-
		425	0.309	59	58	53	48	44	37	-
		500	0.427	61	61	55	50	47	40	-
208	8	400	0.065	58	57	52	47	43	36	-
		500	0.101	61	61	55	50	47	40	-
		600	0.145	63	63	57	52	49	42	22
		700	0.198	65	66	59	54	52	45	24
		800	0.259	66	68	60	56	54	47	24
424	24	800	0.237	65	64	60	56	51	46	-
		1000	0.371	66	64	61	57	53	48	20
		1200	0.534	67	65	62	58	54	49	21
		1400	0.727	68	65	63	59	56	50	22
		1600	0.950	69	66	63	60	57	51	22

See page 57 for notes

ENGINEERING DATA

LPV Discharge Sound

2" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	Discharge w/ 100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	56	52	50	44	38	30	-
		275	0.129	59	57	54	48	43	35	-
		350	0.209	62	61	56	51	47	39	-
		425	0.309	64	63	59	53	49	42	22
		500	0.427	65	66	60	55	52	44	25
208	8	400	0.065	63	63	58	52	48	41	21
		500	0.101	65	66	60	55	52	44	25
		600	0.145	67	68	63	58	54	47	28
		700	0.198	69	71	64	60	57	49	30
		800	0.259	71	73	66	61	59	51	30
424	24	800	0.237	71	71	67	65	58	53	28
		1000	0.371	72	71	68	66	59	55	29
		1200	0.534	73	72	69	67	61	57	29
		1400	0.727	74	72	69	68	62	58	30
		1600	0.950	75	73	70	69	63	59	30

See page 57 for notes

3" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	Discharge w/ 100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	58	55	53	47	41	33	-
		275	0.129	62	60	57	51	46	38	-
		350	0.209	64	64	60	54	49	41	22
		425	0.309	66	66	62	56	52	44	25
		500	0.427	68	69	64	58	55	47	28
208	8	400	0.065	66	66	61	55	51	43	24
		500	0.101	68	69	64	58	55	47	28
		600	0.145	70	72	66	61	57	49	31
		700	0.198	72	74	68	63	60	52	34
		800	0.259	73	76	69	64	62	54	34
424	24	800	0.237	74	75	71	70	61	58	33
		1000	0.371	75	75	72	71	63	60	34
		1200	0.534	76	76	73	72	65	61	34
		1400	0.727	77	76	73	73	66	62	35
		1600	0.950	78	77	74	74	67	63	35

See page 57 for notes

ENGINEERING DATA

LPV Radiated Sound

.5" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	54	43	43	38	32	25	-
		275	0.129	57	47	45	41	35	28	-
		350	0.209	59	50	47	42	36	30	21
		425	0.309	61	52	49	44	38	32	23
		500	0.427	62	54	50	45	39	33	25
208	8	400	0.065	60	52	48	43	38	31	22
		500	0.101	62	54	50	45	39	33	25
		600	0.145	64	57	51	46	41	35	27
		700	0.198	65	58	53	48	42	36	29
		800	0.259	67	60	54	49	43	37	31
424	24	800	0.237	61	53	49	44	40	32	24
		1000	0.371	62	54	51	46	41	35	25
		1200	0.534	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		1400	0.727	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		1600	0.950	N/A	N/A	N/A	N/A	N/A	N/A	N/A

See page 57 for notes

1" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	56	47	46	40	35	29	-
		275	0.129	59	51	48	43	37	32	22
		350	0.209	62	53	50	45	39	34	24
		425	0.309	63	56	52	46	41	36	27
		500	0.427	65	58	53	47	42	37	29
208	8	400	0.065	63	55	51	46	40	35	26
		500	0.101	65	58	53	47	42	37	29
		600	0.145	67	60	54	49	44	39	31
		700	0.198	68	62	56	50	45	40	33
		800	0.259	69	64	57	51	46	41	34
424	24	800	0.237	65	58	55	51	46	41	30
		1000	0.371	67	59	56	53	47	43	31
		1200	0.534	68	60	57	55	48	45	32
		1400	0.727	68	61	58	57	49	46	33
		1600	0.950	69	61	59	59	50	48	34

See page 57 for notes

ENGINEERING DATA

LPV Radiated Sound

2" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	59	50	49	43	38	33	23
		275	0.129	62	54	51	45	40	36	26
		350	0.209	64	57	53	47	2	38	28
		425	0.309	66	59	55	48	44	39	30
		500	0.427	68	61	56	50	45	41	32
208	8	400	0.065	66	59	54	48	43	39	29
		500	0.101	68	61	56	50	45	41	32
		600	0.145	69	64	58	51	47	42	34
		700	0.198	71	65	59	52	48	44	36
		800	0.259	72	67	60	53	49	45	38
424	24	800	0.237	70	64	61	58	53	50	36
		1000	0.371	71	65	62	60	54	52	37
		1200	0.534	72	66	63	62	55	54	38
		1400	0.727	73	66	64	64	56	55	39
		1600	0.950	74	67	65	66	56	56	40

See page 57 for notes

3" Inlet Static Pressure

Case	Inlet Size	CFM	MIN OP. Press (in. wc)	100% Primary Octave Bands						Fan NC Level
				2	3	4	5	6	7	
206	6	200	0.068	61	52	51	44	39	35	25
		275	0.129	64	56	53	46	42	38	28
		350	0.209	66	59	55	48	44	40	30
		425	0.309	68	61	57	50	46	42	32
		500	0.427	69	63	59	51	47	43	34
208	8	400	0.065	67	61	56	49	45	41	31
		500	0.101	69	63	58	51	47	43	34
		600	0.145	71	66	59	52	48	45	36
		700	0.198	72	67	61	53	50	46	38
		800	0.259	74	69	62	54	51	47	40
424	24	800	0.237	73	67	61	62	57	55	39
		1000	0.371	74	68	65	65	58	57	41
		1200	0.534	75	69	66	67	59	59	42
		1400	0.727	76	70	67	68	60	60	43
		1600	0.950	76	70	68	70	60	61	44

See page 57 for notes

ARI CERTIFICATION DATA

LPV

Model or Size	Primary CFM	Fan CFM	Elecric Power Input (Watts)	Min. Operating Pressure (in WC)
LPV 206	400	620	360	0.20
LPV 208	700	700	360	0.29
LPV 424	1550	850	400	1.42

Radiated (dB)

	Fan Only						Fan and 100% Primary					
	0.125	0.25	0.5	1	2	4	0.125	0.25	0.5	1	2	4
LPV 206	69	63	63	59	52	43	64	59	54	47	41	35
LPV 208	69	63	63	59	52	43	69	63	56	50	46	41
LPV 424	72	67	67	63	56	47	70	63	61	60	52	50

Model or Size	Primary CFM	Fan CFM	Elecric Power Input (Watts)	Min. Operating Pressure (in WC)
LPV 206	400	620	360	0.20
LPV 208	700	700	360	0.29
LPV 424	1550	850	400	1.42

Discharge (dB)

	Fan Only						Fan and 100% Primary					
	0.125	0.25	0.5	1	2	4	0.125	0.25	0.5	1	2	4
LPV 206	72	71	69	67	63	62	61	60	56	50	46	39
LPV 208	72	71	69	67	63	62	67	69	62	57	55	47
LPV 424	73	72	70	70	66	67	72	69	67	64	60	55

ARI PERFORMANCE CERTIFIED ™
ARI Standard 880
VAV Terminal
www.aridirectory.org

TUTTLE & BAILEY®
The First Name In Air Distribution

Performance Data Notes:

1. Test were conducted in accordance with standard ARI 880-94.
2. Sound power levels are referenced to 10-12 watt.
3. Octave bands 2-7 correspond to 125 Hz to 4000 Hz.
4. For ARI Certification data:
   a. The "Fan Only" test is conducted with the fan operating at the specified airflow and no primary inlet airflow (100% delivered through the induction inlet) with 0.25 in. WC downstream static pressure.

   b. The "Fan & 100% Primary" test is conducted with the fan operating at the specified airflow with 100% of the airflow being supplied through the primary inlet with 0.25 in. WC downstream static pressure.
5. At ARI Certification test points:
   a. The "Fan Only" test is conducted at the maximum fan airflow capacity (high tap/speed control set at high) with no primary inlet airflow and 0.25 in. WC. downstream static pressure.

   b. The "Fan & 100% Primary" test is conducted with the fan operating at the maximum fan airflow capacity (high tap/speed control set at high) with a primary inlet airflow corresponding to the max fan airflow or 2000 fpm air velocity, whichever is less. The operating pressure is 1.5 in. WC. with a downstream static pressure of 0.25 in. WC.

   c. The electric power is measured during the "Fan Only" test.

   d. The minimum operating pressure test is conducted with the fan operating at the maximum fan airflow capacity (high tap/speed control set at high) with a primary inlet airflow corresponding to the max fan airflow or 2000 fpm air velocity, whichever is less. The downstream static pressure is 0.25 in. WC.

Noise Criteria (NC) Notes:

1. A hyphen (-) indicates the NC is lower than 15.

2. Noise Criteria (NC) were found using standard ARI 885-98 Appendix E (2002 Addendum):

   a. Radiated NC were found using the type 2 ceiling (mineral fiber) condition.
   b. Discharge NC were found using the large terminal condition due to the multitude of possible dischargeduct sizes.

3. Standard ARI 885-98 Appendix E, Table E1. Typical Sound Attenuation Values, dB:

RADIATED	Octave Bands					
	2	3	4	5	6	7
Environmental Effect	2	1	0	0	0	0
Ceiling/Space Effect	16	18	20	26	31	36
Total dB Reduction	18	19	20	26	31	36

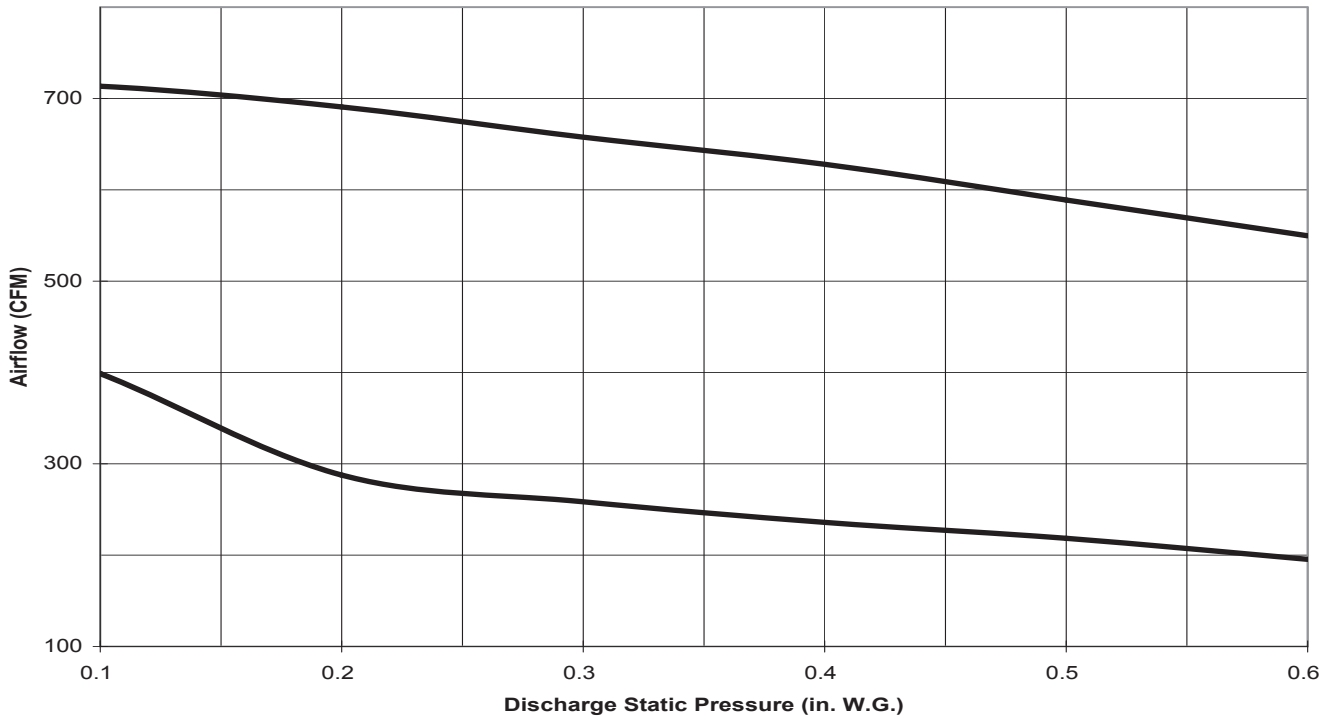
Discharge Sound	Octave Bands					
	2	3	4	5	6	7
Environmnetal Effect	2	1	0	0	0	0
Duct Lining	2	6	12	25	29	18
End Relfection	9	5	2	0	0	0
Flex Duct	6	10	18	20	21	12
Space Effect	5	6	7	8	9	10
Total dB Reduction	24	28	39	53	59	40

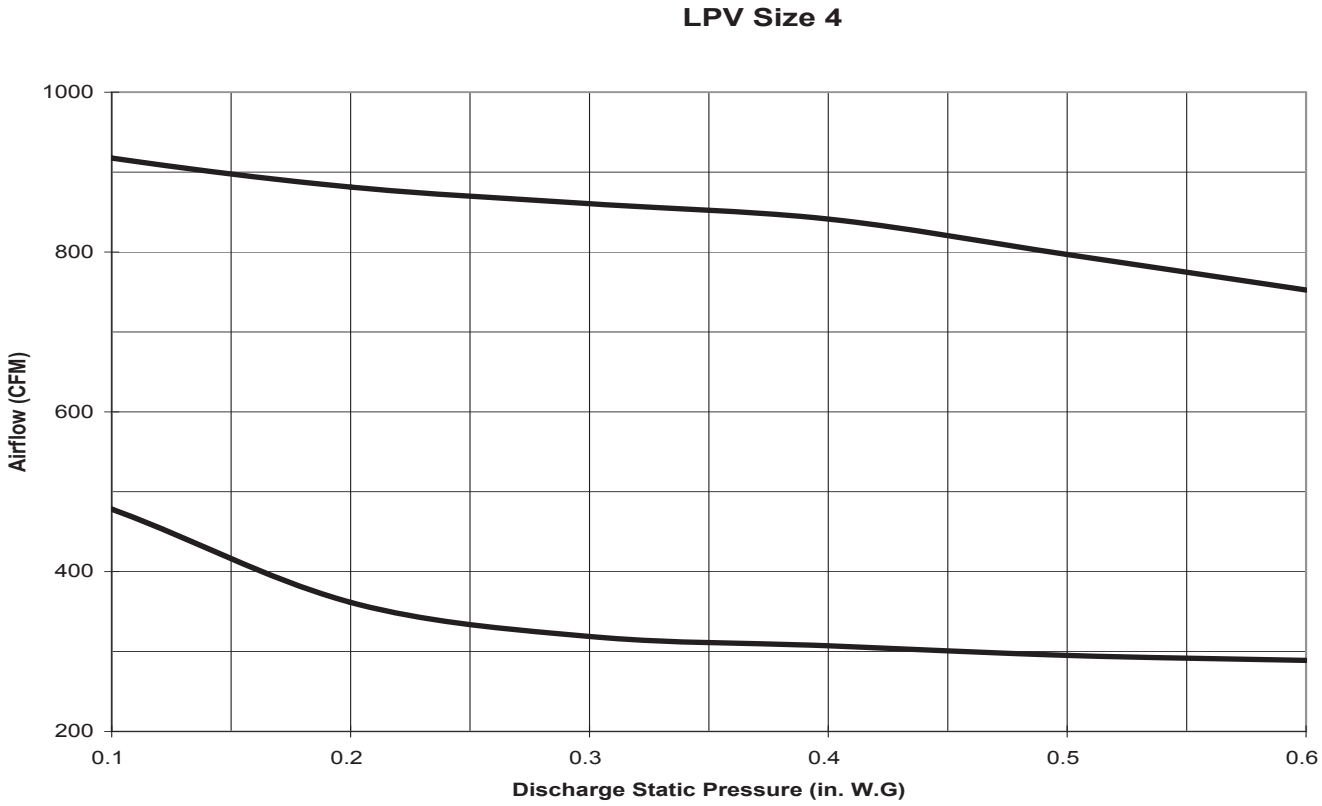
dB Adjustments	Octave Bands					
	2	3	4	5	6	7
300-700 cfm	2	1	1	-2	-5	-1
Over 700 cfm	4	3	2	-2	-7	-1

FAN CURVES

Size 2 & 3

LPV Size 2




LPV Size 4
1000
800
600
400
200
Airflow (CFM)
0.1
0.2
0.3
0.4
0.5
0.6
Discharge Static Pressure (in. W.G)

ENGINEERING DATA

Hot Water Reheat Coil Size 2

1 Row Coil

GPM	CFM								Water Side Head Loss
	300	350	400	450	500	550	600	650	
	Heating Capacity (MBH)								
1.0	9.2	9.7	10.3	10.8	11.2	11.7	12.1	12.4	0.10
2.0	10.3	11	11.7	12.4	13	13.6	14.1	14.6	0.35
4.0	11	11.8	12.7	13.5	14.2	14.9	15.6	16.2	1.18
6.0	11.2	12.1	13.0	13.9	14.7	15.4	16.1	16.8	2.42
Air Side Pressure Drop (in W.G.)									
	0.06	0.08	0.1	0.12	0.15	0.17	0.2	0.23	

2 Row Coil

GPM	CFM								Water Side Head Loss
	300	350	400	450	500	550	600	650	
	Heating Capacity (MBH)								
1.0	15.9	17.1	18.1	19.1	19.9	20.7	21.3	21.9	0.23
2.0	18.1	19.7	21.2	22.6	23.8	24.9	26	26.9	0.77
4.0	19.4	21.4	23.2	24.9	26.4	27.8	29.1	30.4	2.63
6.0	20.0	22.1	24.0	25.8	27.4	29	30.4	31.8	5.4
Air Side Pressure Drop (in W.G.)									
	0.06	0.08	0.10	0.12	0.15	0.17	0.20	0.23	

- Hot water capacities are in MBH.
- Data are based upon 180°F entering water and 65°F entering air.
- HD (head) loss is in feet of water.
- Tables are based upon a temperature diff erence of 115°F between entering air and entering water.
- For other temperature diff erences, multiply MBH values by factors below.
- Air temperature rise = 927 x MBH/cfm.
- Water temperature drop = 2.04 x MBH/GPM.
- Connections: All coils are ½-inch O.D. male solder.
- Coils are not for steam application.
- Water enters at lower coil connection to prevent air entrapment.

Correction factors for other entering conditions:

ΔT	50	60	70	80	90	100	115	125	140	150
Factor	0.52	0.62	0.69	0.78	.87	0.96	1.08	1.15	1.28	1.38

1 Row Coil

GPM	CFM								Water Side Head Loss
	450	500	550	600	650	700	750	800	
	Heating Capacity (MBH)								
1.0	10.8	11.2	11.7	12.1	12.4	12.8	13.1	13.6	0.10
2.0	12.4	13.0	13.6	14.1	14.6	15.1	15.5	16.0	0.35
4.0	12.5	14.2	14.9	15.6	16.2	16.7	17.3	17.8	1.18
6.0	13.9	14.7	15.4	16.1	16.8	17.4	18.0	18.6	2.42
Air Side Pressure Drop (in W.G.)									
	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	

2 Row Coil

GPM	CFM								Water Side Head Loss
	450	500	550	600	650	700	750	800	
	Heating Capacity (MBH)								
1.0	19.1	19.9	20.7	21.3	21.9	22.5	23.0	23.5	0.23
2.0	22.6	23.8	24.9	26.0	26.9	27.8	28.7	29.4	0.77
4.0	24.9	26.4	27.8	29.1	30.4	31.6	32.7	33.7	2.63
6.0	25.8	27.4	29.0	30.4	31.8	33.1	34.3	35.5	5.40
Air Side Pressure Drop (in W.G.)									
	0.12	0.15	0.17	0.20	0.23	0.26	0.30	0.34	

- Hot water capacities are in MBH.
- Data are based upon 180°F entering water and 65°F entering air.
- HD (head) loss is in feet of water.
- Tables are based upon a temperature diff erence of 115°F between entering air and entering water.
- For other temperature diff erences, multiply MBH values by factors below.
- Air temperature rise = 927 x MBH/cfm.
- Water temperature drop = 2.04 x MBH/GPM.
- Connections: All coils are ½-inch O.D. male solder.
- Coils are not for steam application.
- Water enters at lower coil connection to prevent air entrapment.

Correction factors for other entering conditions:

ΔT	50	60	70	80	90	100	115	125	140	150
Factor	0.52	0.62	0.69	0.78	.87	0.96	1.08	1.15	1.28	1.38

ENGINEERING DATA

LPV Hot Water Reheat Coil

General Notes for All Hot Water Coils:

1. All coils are 10 FPI (fins per inch).
2. All coils are copper tubes with aluminum fins.
3. All fins have a thickness of 0.0045”.
4. Copper tubing has a thickness of 0.016”.
5. Copper tubing is 0.5” O.D.
6. Entering air is 65º F. For other temperature values, refer to ToolBox selection software.
7. Entering water is 180º F. For other temperature values, refer to ToolBox selection software.
8. Altitude is 0 feet.
9. Coils with 1 or 2 rows have 2 circuits.

Standard Features
- 80/20 NiCr element wire
- Flanged duct connection
- Airflow switch
- Automatic reset thermal cutout switch
- Magnetic contactor (1 per stage)
- Control transformer (except pneumatic controls)
- NEMA 1 enclosure for electric heat controls
- Single point power connection

Optional Features
- Mercury contactors
- Fused door interlocking disconnect
- Fusing
- Non-fused door interlocking disconnect
- Manual reset thermal cutout
- Up to three stages of control

208V/1Φ

Unit Size	kW Min	kW Max
2	1	6
4	1	9

240V/1Φ

Unit Size	kW Min	kW Max
2	1	6
4	1	9

277V/1Φ

Unit Size	kW Min	kW Max
2	1	6
4	1	11.5

208V/3Φ

Unit Size	kW Min	kW Max
2	1.5	6
4	1.5	14

480V/3Φ

Unit Size	kW Min	kW Max
2	2.5	6
4	2.5	14

General Notes on Electric Heat Availability:
1. Minimum 1/2 kW per step
2. Maximum 100°F leaving air temperature
3. For single phase heaters, the motor voltage is equal to the heater voltage
4. For 208V / 3ϕ heaters, the motor voltage is 208V / 1ϕ
5. For 480V / 3ϕ heaters, the motor voltage is 277V / 1ϕ

Selection Guidelines

Electric heat kW ranges are shown in Table 1. In all cases, the leaving air temperature of the unit must not exceed 100°F.

Validate Leaving Air Temperature (LAT) - Leaving air must not exceed 100°F

$$LAT = \frac{kW \times 3160}{CFM} + EAT$$

LAT = Leaving air temperature in °F
kW = Electric heat capacity in kW
CFM = Fan airflow in CFM
EAT = Entering air temperature in °F (Note: this is mixture of plenum and primary air)

Determining Mixed Air Temperature

$$EAT_{Total} = EAT_{Primary} \times (CFM_{Primary} / CFM_{Fan}) + EAT_{Plen} \times ((CFM_{Fan} - CFM_{Primary}) / CFM_{Fan})$$

LAT = leaving air temp in °F
$CFM_{Primary}$ = Airflow from inlet in heating mode in CFM
CFM_{Fan} = Airflow from fan in CFM - for FPC this is also the total CFM
EAT_{Total} = Entering air to the heater in °F
$EAT_{Primary}$ = Primary entering air temperature for the heating mode in °F
EAT_{Plen} = Plenum entering air temperature in °F

Minimum Circuit Ampacity (MCA)*

MCA = (Motor Current + Heater Current) x 1.25

Maximum Overcurrent Protection (MOP)*

MOP = (2.25 x Motor Current of largest motor) + Sum of other motor current + Heater current

MOP Rules

1. If MOP is less than 15, MOP shall be set to 15
2. If MOP is greater than the MCA and is between standard fuse sizes, round down to the next standard fuse size
   a. Exception - If the next lower fuse size is less than 125% of the current rating of the electric heater load, round up to next standard fuse size
3. If MOP is less than the MCA, the MOP shall be set equal to MCA and then rounded up to the next standard fuse size.

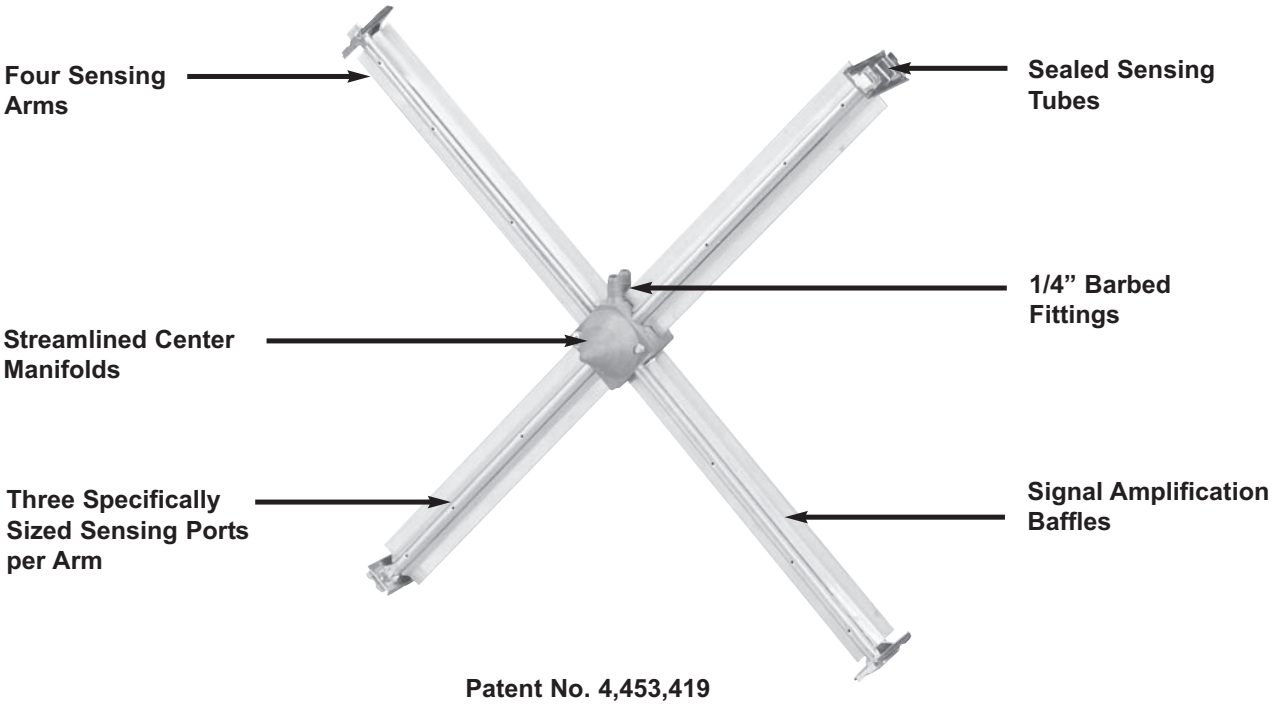
Helpful Equations

$$kW = \frac{MBH}{3.414}$$

$$\text{Single Phase Amperage Draw} = \frac{kW \times 1000}{Voltage}$$

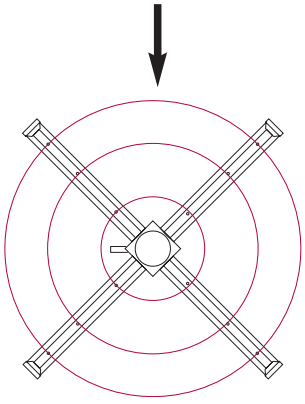
$$\text{Three Phase Amperage Draw} = \frac{kW \times 1000}{Voltage \times 1.732}$$

*MCA and MOP equations and rules are intended as an aid in design. See UL 1995 for Heating and Cooling Equipment for complete requirements.



Patent No. 4,453,419

Upstream and Downstream Concentric Ring Sensing Port Configuration



- Patented Flo-Cross® (Patent No. 4,453,419) is accurate to ±5% throughout the cataloged operating range
- Sensing arms sample the inlet cross section mitigating turbulent flow effects
- Barbed fittings positively lock plastic tubing
- 24 total sensing ports provide a differential pressure (ΔP) output proportional to the average duct velocity
- Amplification baffles strengthen ΔP signals to levels three times higher than standard Pitot tube readings
- Center manifolds average velocity profiles and reduce pulsations from dynamic ΔP signals
- Sensing tube constructions eliminates signal loss due to leakage
- Concentric ring sensing port configuration imitates major flow testing standards by locating them at the center of equal areas
- Corrosion resistant aluminum construction

Flo-Cross® Sensor Performance Parameters/Formulas

Size	Area (ft^2)	CV
0	.1883	462
08	0.3382	817
24	0.7778	1922

- Flow (CFM) = $C_v \times \sqrt{\Delta P}$
- FPM = $\frac{CFM}{Area\ (sq.ft)}$
- 500 to 3000 FPM Nominal Velocity Range