SINGLE DUCT TERMINALS

Nailor
Industries Inc.

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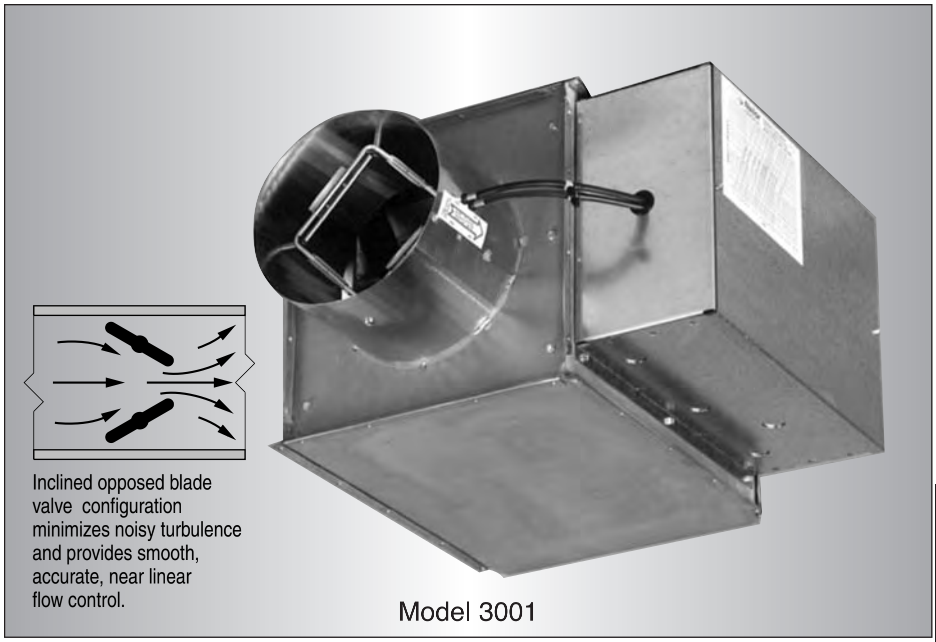
SINGLE DUCT VARIABLE OR CONSTANT AIR VOLUME

3000 SERIES

Models:

3001	**Cooling or Heating only**
30RW	**Cooling with Hot Water Reheat**
30RE	**Cooling with Electric Reheat**



Inclined opposed blade valve configuration minimizes noisy turbulence and provides smooth, accurate, near linear flow control.

Model 3001

Variable Air Volume Systems supply a constant temperature to an area and vary the volume as opposed to a conventional HVAC system which supplies a constant volume and varies the air temperature.

Operating costs are greatly reduced compared to the larger conventional HVAC systems by using less fan energy and less refrigeration energy. Variable Air Volume Systems also cut initial cost by taking advantage of building diversity. System capacity is determined by the instantaneous peak demand of all zones in lieu of the peak demand for the entire building.

The smaller components of a VAV system require less floor space and give the owner the flexibility to adapt to tenant changes as desired at any time during or after construction of the building.

With today's energy conservation and efficiency requirements, **Model Series 3000** air terminals are designed for and adaptable to any modern VAV requirements.

The latest in control components and options provides maximum flexibility with a wide scope for cost effective innovation.

FEATURES:

- 16 ga. (1.63) corrosion-resistant steel inclined opposed blade damper with seals. 45° rotation. 1/2" (13) dia. plated steel drive shaft. An indicator mark on the end of the shaft shows damper position. Tight close-off. Damper leakage is less than 2% of nominal flow at 3" w.g. (750 Pa).
- Inclined opposed blade valve is inherently more linear in its flow characteristics than the standard butterfly type damper. More accurate flow control is ensured, which reduces hysteresis for more stable control of the temperature in the zone.
- Available in 11 unit sizes to handle from 215 – 6435 cfm (101 – 3037 l/s).
- Compact low profile design to accommodate tight ceiling spaces. Maximum unit height is only 12 1/2" (318) for sizes 4 through 16 [up to 3730 cfm (1761 l/s)]. Unit sizes 4 through 10 feature round inlets and 12 through 16 feature flat oval equivalent inlets.
- Gauge taps provided for field calibration and balancing.
- Multi-point averaging Diamond Flow Sensor for pressure independent applications.
- 22 ga. (0.86) zinc coated steel casing, mechanically sealed, low leakage construction.
- Rectangular discharge with slip and drive cleat duct connection.
- 3/4" (19) dual density insulation maximizes acoustical and thermal performance. 4 lb. high density skin is treated to resist abrasion and erosion from airflow. Edges are coated. Meets requirements of NFPA 90A and UL 181.
- Single point electrical or pneumatic main air connection.
- Right-hand controls location is standard (shown) when looking in direction of airflow. Damper is CW to close. Optional left hand controls mounting is available, when damper is CCW to close.
- Independently tested and certified laboratory performance data.

Low-Leakage Casing

Inlet Size	Max. Leakage, cfm	
	1.0"∆Ps	2.0"∆Ps
4, 5, 6	4.0	5.5
7, 8	4.0	7.0
9, 10	4.0	7.0
12	4.0	7.6
14	4.5	8.0
16	4.5	8.1
24 x 16	4.5	8.1

Options:

- Various 'IAQ' linings are available.
- Hanger brackets.
- Low temperature construction
- 1" (25) 1 1/2 lb. density insulation 4.3 R value.

ARI PERFORMANCE CERTIFIED
ARI Standard 880

A Participating Corporation in the ARI 880 Certification program.

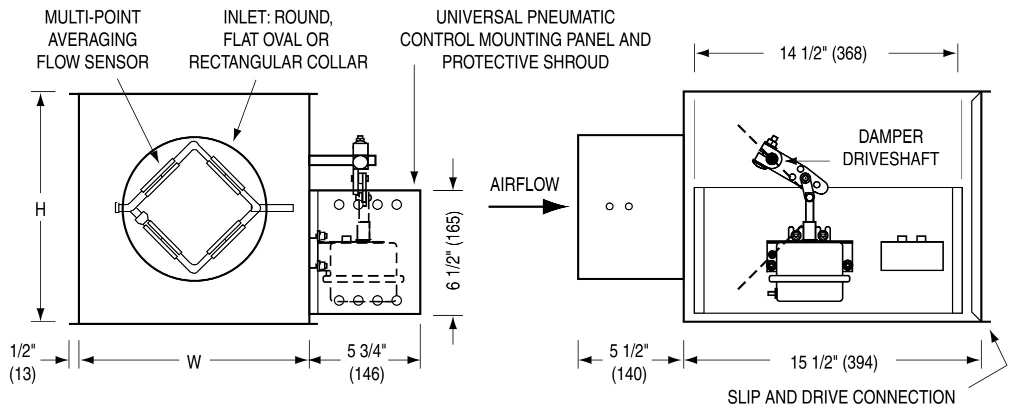
C ETL US INTERTEK LISTED

Dimensions

Model Series 3001 • Basic Unit with Controls

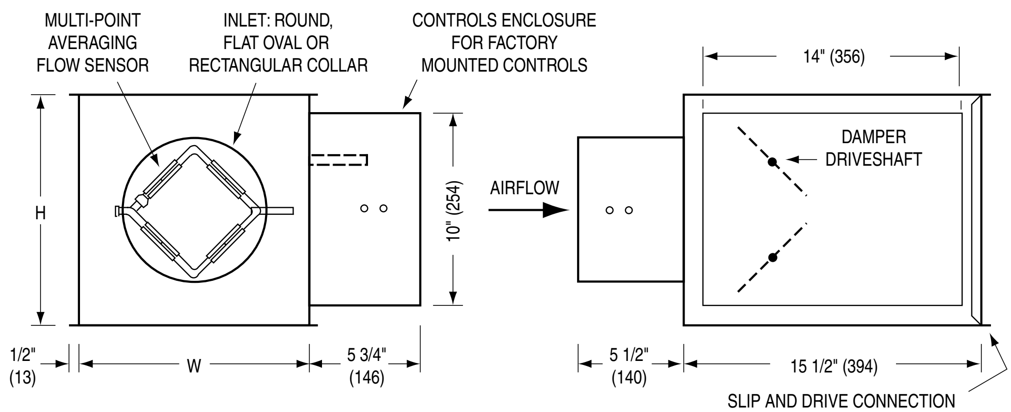
Pneumatic Controls

• Universal pneumatic control mounting panel features double wall stand-off construction for strength and rigidity. Controls mounting screws do not penetrate terminal casing.



Analog Electronic and Digital Controls

• A full NEMA 1 controls enclosure is provided for factory mounted controls. Optional for field mounted controls.



Dimensional Data

Imperial Units (inches)				
Unit Size	cfm Range	W	H	Inlet Size
4	0 – 215	10	10	3 ⅞ Round
5	0 – 310	10	10	4 ⅞ Round
6	0 – 500	10	10	5 ⅞ Round
7	0 – 710	12	12 ½	6 ⅞ Round
8	0 – 1000	12	12 ½	7 ⅞ Round
9	0 – 1300	14	12 ½	8 ⅞ Round
10	0 – 1435	14	12 ½	9 ⅞ Round
12	0 – 2185	18	12 ½	12 15/16 x 9 13/16 Oval
14	0 – 2745	24	12 ½	16 1/16 x 9 13/16 Oval
16	0 – 3730	28	12 ½	19 3/16 x 9 13/16 Oval
24 x 16	0 – 6435	38	18	23 ⅞ x 15 ⅞ Rect.

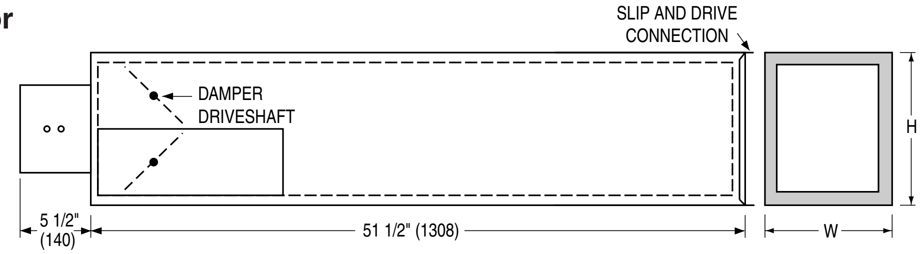
Metric Units (mm)				
Unit Size	l/s Range	W	H	Inlet Size
4	0 – 101	254	254	98 Round
5	0 – 146	254	254	124 Round
6	0 – 236	254	254	149 Round
7	0 – 335	305	318	175 Round
8	0 – 472	305	318	200 Round
9	0 – 614	356	318	225 Round
10	0 – 677	356	318	251 Round
12	0 – 1031	457	318	329 x 249 Oval
14	0 – 1296	610	318	408 x 249 Oval
16	0 – 1761	711	318	487 x 249 Oval
24 x 16	0 – 3037	965	457	606 x 403 Rect.

Dimensions

Model Series 3000 • Single Duct Accessories

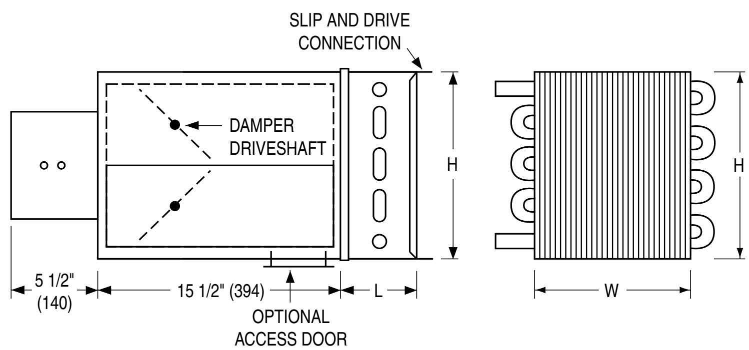
Integral Sound Attenuator

- Single continuous length terminal construction minimizes casing leakage.
- Continuous internal insulation reduces insulation seams and minimizes airflow disturbance.



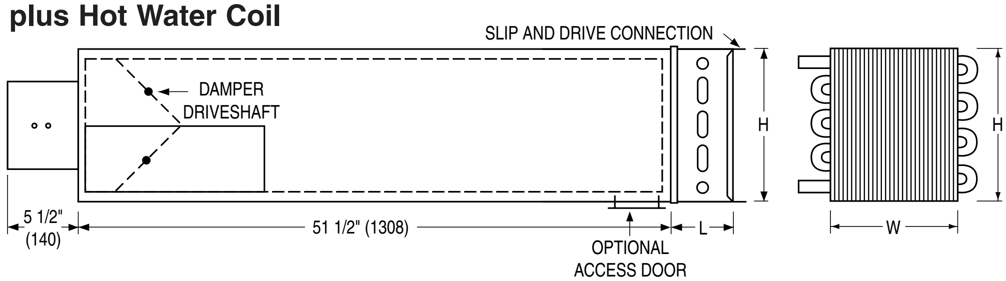
Hot Water Reheat Coils

- One, two, three and four row available.
- Hot water coils have copper tubes and aluminum ripple fins. Coils have 1/2" (13), 7/8" (22) or 1 3/8" (35) O.D. sweat connections. Right or left hand coil connection is determined by looking through the terminal inlet in the direction of airflow.
- Galvanized steel casing with slip and drive discharge duct connection.
- Optional low leakage gasketed access door is recommended for coil access and cleaning.
- ARI Certified.
- Coil Performance data on pages B19-B27.



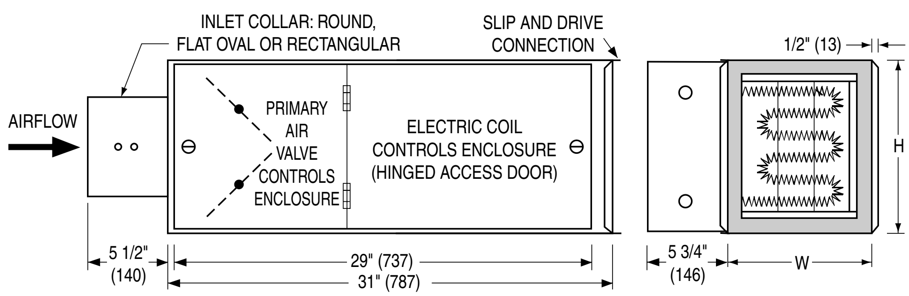
Integral Attenuator plus Hot Water Coil

- All the benefits of both the Integral Sound Attenuator and the Hot Water Coils shown above in one.
- Coil performance data on pages B19-B27.



Integral Electric Reheat

- Electric coil is factory mounted in an integral extended plenum section.
- Perforated diffuser plate minimizes air stratification.
- Full details and selection guide on page B28.



Dimensional Data

Imperial Units (inches)

Unit Size	W	H	Hot Water Coil L (1 & 2 row)	Hot Water Coil L (3 & 4 row)
4, 5, 6	10	10	5	7 ½
7, 8	12	12 ½	5	7 ½
9, 10	14	12 ½	5	7 ½
12	18	12 ½	5	7 ½
14	24	12 ½	5	7 ½
16	28	12 ½	5	7 ½
24 x 16	38	18	5	7 ½

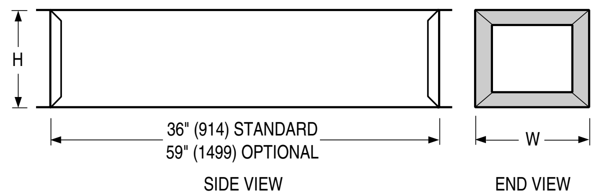
Metric Units (mm)

Unit Size	W	H	Hot Water Coil L (1 & 2 row)	Hot Water Coil L (3 & 4 row)
4, 5, 6	254	254	127	191
7, 8	305	318	127	191
9, 10	356	318	127	191
12	457	318	127	191
14	610	318	127	191
16	711	318	127	191
24 x 16	965	457	127	191

Dimensions

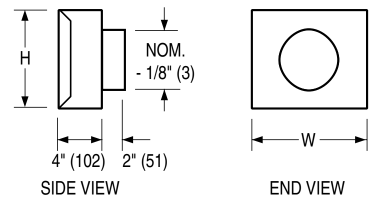
Model Series 3000 • Single Duct Accessories

AT Discharge Sound Attenuator

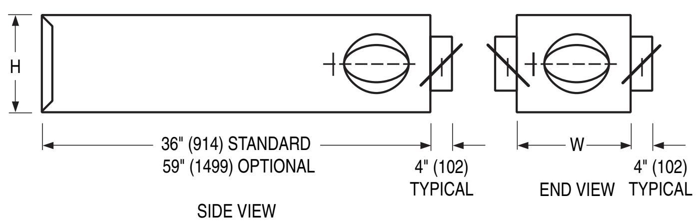


- Shipped loose for field attachment.
- Slip and drive connection.
- Supplied as standard with same liner as basic unit.

FF Round Discharge Collar



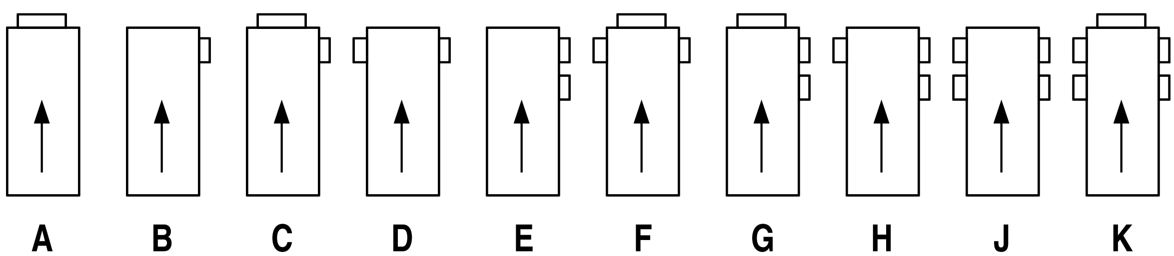
MOA Multi-Outlet Attenuator



Unit Size	M.O.A. Outlets
4, 5, 6 (102, 127, 152)	3 @ 6" (152)
7, 8 (178, 203)	5 @ 6" (152) 5 @ 8" (203)
9, 10 (229, 254)	5 @ 8" (203) 4 @ 10" (254)
12 (305)	5 @ 8" (203) 5 @ 10" (254)
14, 16 (356, 406)	5 @ 10" (254)

- Only one outlet size to be specified per M.O.A. No mixing of outlet sizes on the same unit. Number and size of outlets on M.O.A. not to exceed the limits listed in table, both maximum quantity of outlets and maximum size of outlet.
- All round outlets c/w manual dampers with hand locking quadrant.
- 3/4" (19) dual density insulation.
- Denotes inlet airflow direction. ⟶
- For special outlet sizes and arrangements, consult your Nailor representative.

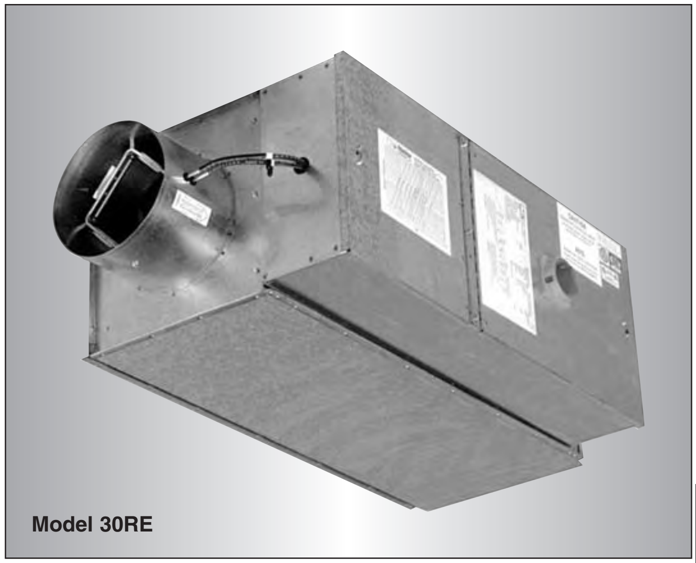
Standard Outlet Arrangements



Dimensional Data

	Imperial Units			Metric Units		
Unit Size	W	H	FF Outlet Size	W	H	FF Outlet Size
4, 5, 6	10	10	4, 5, 6	254	254	102, 127, 152
7, 8	12	12 ½	7, 8	305	318	178, 203
9, 10	14	12 ½	9, 10	356	318	229, 254
12	18	12 ½	12	457	318	305
14	24	12 ½	14	610	318	356
16	28	12 ½	16	711	318	406
24 x 16	38	18	–	965	457	–

Recommended Airflow Ranges For Single Duct VAV Terminal Units



Model 30RE

The recommended airflow ranges below are for terminal units with pressure independent controls and are based upon controller sensitivity limits as shown for each control type. For a given unit size, the minimum, auxiliary minimum (where applicable) and the maximum flow settings must be within the range limits to ensure pressure independent operation, accuracy and repeatability. The high end of the tabulated Total Airflow Range represents the Diamond Flow Sensor's differential pressure reading at 1" w.g. (250 Pa). This is a common high limit for many VAV controllers, whether pneumatic or analog/DDC transducers. For these reasons, factory settings will not be made outside these ranges. A minimum setting of zero (shut-off) is also available. Where an auxiliary setting is specified, the value must be greater than the minimum setting.

ARI Standard 880 "Air Terminal Units" is the method of test for the certification program. The "standard rating condition" (certification rating point) airflow volumes for each terminal unit size are tabulated below. These air volumes equate to an approximate inlet velocity of 2000 fpm (10.2 m/s)

When digital or other controls are mounted by Nailor, but supplied by others, these values are guidelines only, based upon experience with the majority of controls currently available. Controls supplied by others for factory mounting are configured and calibrated in the field.

Imperial Units, Cubic Feet per Minute

Unit Size	Total Airflow Range cfm	Airflow at 2000 fpm Inlet Velocity (nom.) cfm	Range of Minimum and Maximum Settings, cfm		
			Pneumatic 3000 Controller	Analog Electronic Controls	Digital Controls
			Min. – Max.	Min. – Max.	Min. – Max.
4	0 – 215	150	30 – 215	25 – 215	25 – 215
5	0 – 310	250	55 – 310	45 – 310	45 – 310
6	0 – 500	400	85 – 500	70 – 500	70 – 500
7	0 – 710	550	125 – 710	100 – 710	100 – 710
8	0 – 1000	700	180 – 1000	150 – 1000	150 – 1000
9	0 – 1300	900	210 – 1300	170 – 1300	170 – 1300
10	0 – 1435	1100	250 – 1435	205 – 1435	205 – 1435
12	0 – 2185	1600	320 – 2185	260 – 2185	260 – 2185
14	0 – 2745	2100	470 – 2745	380 – 2745	380 – 2745
16	0 – 3730	2800	590 – 3730	480 – 3730	480 – 3730
24 x 16	0 – 6435	5350	1005 – 6435	810 – 6435	810 – 6435

Metric Units, Liters per Second

Unit Size	Total Airflow Range l/s	Airflow at 10.2 m/s Inlet Velocity (nom.) l/s	Range of Minimum and Maximum Settings, l/s		
			Pneumatic 3000 Controller	Analog Electronic Controls	Digital Controls
			Min. – Max.	Min. – Max.	Min. – Max.
4	0 – 101	71	14 – 101	12 – 101	12 – 101
5	0 – 146	118	26 – 146	21 – 146	21 – 146
6	0 – 236	189	40 – 236	33 – 236	33 – 236
7	0 – 335	260	59 – 335	47 – 335	47 – 335
8	0 – 472	330	85 – 472	71 – 472	71 – 472
9	0 – 614	425	99 – 614	80 – 614	80 – 614
10	0 – 677	519	118 – 677	97 – 677	97 – 677
12	0 – 1031	755	151 – 1031	123 – 1031	123 – 1031
14	0 – 1296	991	222 – 1296	179 – 1296	179 – 1296
16	0 – 1761	1322	278 – 1761	227 – 1761	227 – 1761
24 x 16	0 – 3037	2525	474 – 3037	382 – 3037	382 – 3037

Performance Data • NC Level Application Guide

Model Series 3000

Inlet Size	Airflow cfm	Airflow l/s	Min. inlet ΔPs "w.g.	Min. inlet ΔPs Pa	DISCHARGE (basic assembly) Min. ΔPs	DISCHARGE 0.5" w.g. 125 Pa	DISCHARGE 1.0" w.g. 250 Pa	DISCHARGE 1.5" w.g. 375 Pa	DISCHARGE 2.0" w.g. 500 Pa	DISCHARGE 3.0" w.g. 750 Pa	DISCHARGE w/ 36" (914) attenuator Min. ΔPs	ATTEN. 0.5" w.g. 125 Pa	ATTEN. 1.0" w.g. 250 Pa	ATTEN. 1.5" w.g. 375 Pa	ATTEN. 2.0" w.g. 500 Pa	ATTEN. 3.0" w.g. 750 Pa	RADIATED Min. ΔPs	RADIATED 0.5" w.g. 125 Pa	RADIATED 1.0" w.g. 250 Pa	RADIATED 1.5" w.g. 375 Pa	RADIATED 2.0" w.g. 500 Pa	RADIATED 3.0" w.g. 750 Pa
	200	94	0.11	27	-	-	-	21	23	25	-	-	-	-	-	-	-	-	-	21	24	27
	150	71	0.06	15	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	21	22	22
4	100	47	0.03	7	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	20	24
	75	35	0.01	2	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	20
	50	24	0.01	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	300	142	0.04	10	-	-	21	22	25	29	-	-	-	-	20	23	-	-	-	21	23	27
	250	118	0.03	7	-	-	20	22	25	25	-	-	-	-	-	20	-	-	-	-	22	25
5	200	94	0.02	5	-	-	-	-	21	22	-	-	-	-	-	-	-	-	-	-	20	22
	125	59	0.01	2	-	-	-	-	-	22	-	-	-	-	-	-	-	-	-	-	-	-
	100	47	0.01	2	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-
	450	212	0.09	22	-	-	21	25	30	31	-	-	-	-	22	23	-	-	-	22	24	29
	400	189	0.07	17	-	-	20	25	25	30	-	-	-	-	-	21	-	-	-	21	23	29
6	300	142	0.04	10	-	-	-	20	22	25	-	-	-	-	-	-	-	-	-	-	21	25
	200	94	0.02	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
	100	47	0.01	2	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-
	650	307	0.01	2	-	-	-	25	27	30	-	-	-	20	23	-	-	-	21	24	28	34
	550	260	0.01	2	-	-	-	22	25	30	-	-	-	-	-	23	-	-	-	23	27	32
7	335	158	0.01	2	-	-	-	-	20	23	-	-	-	-	-	-	-	-	-	20	22	25
	225	106	0.01	2	-	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-	-
	110	52	0.01	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	800	378	0.03	7	-	-	20	22	25	29	-	-	-	-	-	21	-	-	22	24	27	30
	700	330	0.02	5	-	-	-	21	25	29	-	-	-	-	-	21	-	-	21	24	25	31
8	600	283	0.02	5	-	-	-	21	24	27	-	-	-	-	-	20	-	-	-	23	25	31
	400	189	0.01	2	-	-	-	-	20	22	-	-	-	-	-	-	-	-	-	20	21	25
	175	83	0.01	2	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-
	1050	496	0.01	2	-	21	25	29	31	35	-	-	-	-	20	24	-	20	21	24	27	32
	900	425	0.01	2	-	-	22	25	29	34	-	-	-	-	-	-	-	-	-	23	27	32
9	675	319	0.01	2	-	-	20	25	27	30	-	-	-	-	-	-	-	-	-	22	25	26
	450	212	0.01	2	-	-	-	-	20	25	-	-	-	-	-	-	-	-	-	-	20	22
	225	106	0.01	2	-	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-	-
	1350	637	0.01	2	-	20	25	27	30	35	-	-	20	20	21	24	-	20	24	27	29	32
	1100	519	0.01	2	-	-	21	25	29	32	-	-	-	-	20	21	-	-	21	24	25	31
10	825	389	0.01	2	-	-	-	22	25	27	-	-	-	-	-	-	-	-	-	21	23	27
	550	260	0.01	2	-	-	-	-	20	25	-	-	-	-	-	-	-	-	-	-	-	22
	275	130	0.01	2	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	-
	2000	944	0.01	2	-	23	26	29	30	35	-	-	21	23	23	28	23	25	29	31	33	37
	1600	755	0.01	2	-	-	23	26	29	32	-	-	-	20	21	25	-	20	25	27	30	35
12	1200	566	0.01	2	-	-	-	22	25	30	-	-	-	-	-	22	-	-	20	24	27	31
	800	378	0.01	2	-	-	-	20	21	25	-	-	-	-	-	22	-	-	-	20	21	25
	400	189	0.01	2	-	-	-	-	22	27	-	-	-	-	-	-	-	-	-	-	-	-
	2700	1274	0.01	2	-	25	25	30	31	35	-	-	24	25	25	30	24	26	30	34	37	40
	2100	991	0.01	2	-	-	23	26	29	32	-	-	20	21	22	25	-	21	26	31	34	37
14	1550	543	0.01	2	-	-	-	23	25	27	-	-	-	-	-	21	-	21	24	28	30	34
	1050	496	0.01	2	-	-	-	-	20	25	-	-	-	-	-	-	-	-	-	24	27	27
	525	248	0.01	2	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-
	3500	1652	0.01	2	-	23	27	31	32	35	-	-	26	27	27	30	27	30	33	36	39	42
	2800	1322	0.01	2	-	-	25	27	30	35	-	-	23	24	25	29	23	25	29	34	36	40
16	2100	991	0.01	2	-	-	20	25	25	30	-	-	-	21	21	25	-	-	26	30	34	36
	1400	661	0.01	2	-	-	-	20	23	26	-	-	-	-	-	-	-	-	21	26	29	31
	700	300	0.01	2	-	-	-	-	22	26	-	-	-	-	-	-	-	-	-	-	-	21
	8000	3776	0.62	154	31	39	41	43	46	49	31	31	40	40	45	47	40	43	48	51	54	57
24	7000	3304	0.47	117	27	37	40	42	45	47	26	25	39	40	43	46	39	40	47	49	51	55
x	6000	2832	0.35	87	26	35	39	40	43	46	25	25	38	39	42	45	36	38	45	47	49	53
16	5000	2360	0.24	60	21	34	36	38	40	44	20	20	35	38	40	42	31	36	42	45	47	50
	4000	1888	0.15	37	-	31	35	37	38	40	-	-	35	37	37	40	24	35	39	42	45	47

NC Levels @ Inlet Pressure (ΔPs) shown

Performance Notes:
1. NC Levels are calculated based on procedures as documented on page B9.
2. Dash (-) in space indicates a NC less than 20.

Performance Data Explanation

Sound Power Levels vs. NC Levels

The **Nailor 3000 Series** single duct terminal unit performance data is presented in two forms.

The laboratory obtained discharge and radiated sound power levels in octave bands 2 through 7 (125 through 4000 Hz) center frequency for each unit size at various flow rates and inlet static pressures is presented. This data is derived in accordance with ANSI/ASHRAE Standard 130-1996 and ARI Standard 880-98. This data is "raw" with no attenuation deductions and includes ARI Certification standard rating points.

Nailor also provides an "NC Level" table as an application aid in terminal selection, which include attenuation allowances as explained below. The suggested attenuation allowances are typical and are not representative of specific job site conditions. It is recommended that the sound power level data be used and a detailed NC calculation be performed using the procedures outlined in ARI 885-98 for accurate space sound levels.

Explanation of NC Levels

Tabulated NC levels are based on attenuation values as outlined in ARI Standard 885-98 "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets". ARI Standard 885-98, Appendix E provides typical sound attenuation values for air terminal discharge sound and air terminal radiated sound.

As stated in ARI-885-98, Appendix E, "These values can be used as a quick method of estimating space sound levels when a detailed evaluation is not available. The typical attenuation values are recommended for use by manufacturers to estimate application sound levels. In product catalogs, the end use environments are not known and the following factors are provided as typical attenuation values. Use of these values will allow better comparison between manufacturers and give the end user a value which will be expected to be applicable for many types of space."

Please refer to the Performance Data Caveat on page A17 of this catalog.

Radiated Sound

Table E1 of Appendix E provides typical radiated sound attenuation values for three types of ceiling: Type 1 – Glass Fiber; Type 2 – Mineral Fiber; Type 3 – Solid Gypsum Board.

Since Mineral Fiber tile ceilings are the most common construction used in commercial buildings, these values have been used to tabulate Radiated NC levels.

The following table provides the calculation method for the radiated sound total attenuation values based on ARI Standard 885-98.

	Octave Band					
	2	**3**	**4**	**5**	**6**	**7**
Environmental Effect	2	1	0	0	0	0
Ceiling/Space Effect	16	18	20	26	31	36
Total Attenuation Deduction	**18**	**19**	**20**	**26**	**31**	**36**

The ceiling/space effect assumes the following conditions:
1. 5/8" (16) tile, 20 lb/ft^3 (313 kg/m^3) density.
2. The plenum is at least 3 feet (914) deep.
3. The plenum space is either wide (over 30 feet [9 m]) or lined with insulation.
4. The ceiling has no significant penetration directly under the unit.

Discharge Sound

Table E1 of Appendix E provides typical discharge sound attenuation values for three sizes of terminal unit.
1. Small box; Less than 300 cfm (142 l/s) (Discharge Duct 8" x 8" [203 x 203]).
2. Medium box; 300 – 700 cfm (142 - 330 l/s) (Discharge Duct 12" x 12" [305 x 305]).
3. Large box; Greater than 700 cfm (330 l/s) (Discharge Duct 15" x 15" [381 x 381]).

These attenuation values have been used to tabulate Discharge NC levels applied against the terminal airflow volume and not terminal unit size.

The following tables provide the calculation method for the discharge sound total attenuation values based on ARI Standard 885-98.

Small Box	Octave Band					
< 300 cfm	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Effect	2	1	0	0	0	0
5 ft. (1.5 m) 1" (25) Duct Lining	2	6	12	25	29	18
Branch Power Division (1 outlet)	0	0	0	0	0	0
5 ft. (1.5 m), 8 in. dia. (200) Flex Duct	6	10	18	20	21	12
End Reflection	9	5	2	0	0	0
Space Effect	5	6	7	8	9	10
Total Attenuation Deduction	**24**	**28**	**39**	**53**	**59**	**40**

Medium Box	Octave Band					
300 – 700 cfm	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Effect	2	1	0	0	0	0
5 ft. (1.5 m) 1" (25) Duct Lining	2	4	10	20	20	14
Branch Power Division (2 outlets)	3	3	3	3	3	3
5 ft. (1.5 m), 8 in. dia. (200) Flex Duct	6	10	18	20	21	12
End Reflection	9	5	2	0	0	0
Space Effect	5	6	7	8	9	10
Total Attenuation Deduction	**27**	**29**	**40**	**51**	**53**	**39**

Large Box	Octave Band					
>700 cfm	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Effect	2	1	0	0	0	0
5 ft. (1.5 m) 1" (25) Duct Lining	2	3	9	18	17	12
Branch Power Division (3 outlets)	5	5	5	5	5	5
5 ft. (1.5 m), 8 in. dia. (200) Flex Duct	6	10	18	20	21	12
End Reflection	9	5	2	0	0	0
Space Effect	5	6	7	8	9	10
Total Attenuation Deduction	**29**	**30**	**41**	**51**	**52**	**39**

1. Flexible duct is non-metallic with 1" (25) insulation.
2. Space effect (room size and receiver location) 2500 ft.^{3} (69 m^3) and 5 ft. (1.5 m) distance from source.

For a complete explanation of the attenuation factors and the procedures for calculating room NC levels, please refer to the acoustical engineering guidelines at the back of this catalog and ARI Standard 885-98.

B

SINGLE DUCT TERMINAL UNITS

Performance Data • Discharge Sound Power Levels

Model Series 3000 • Basic Unit

A Participating Corporation in the ARI 880 Certification program.

ARI PERFORMANCE CERTIFIED ARI Standard 880

Inlet Size	Airflow cfm	l/s	Min. inlet ΔPs "w.g.	Pa	Sound Power Octave Bands @ Inlet Pressure ΔPs shown																																			
					Minimum ΔPs						0.5" w.g. (125Pa) ΔPs						1.0" w.g. (250Pa) ΔPs						1.5" w.g. (375Pa) ΔPs						2.0" w.g. (500Pa) ΔPs						3.0" w.g. (750Pa) ΔPs					
					2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	200	94	.11	27	-	46	52	57	48	43	52	56	58	57	49	44	58	50	62	59	53	49	59	62	63	61	56	53	60	63	65	63	58	55	59	64	68	67	62	58
	150	71	.06	15	-	41	46	49	39	35	51	52	54	50	44	38	55	56	57	55	50	47	57	59	60	58	54	51	56	59	63	62	56	53	55	59	66	70	63	58
	100	47	.03	7	-	-	37	37	27	-	47	47	47	46	41	35	49	51	55	53	47	43	49	52	60	60	53	48	48	52	62	65	58	53	46	50	61	68	66	60
	75	35	.01	2	-	-	31	28	-	-	-	45	45	43	37	31	-	46	56	56	49	42	-	46	58	62	56	49	-	45	58	64	62	55	-	45	58	65	66	62
	50	24	.01	2	-	-	-	-	-	-	-	43	49	48	40	31	-	42	56	60	55	46	-	41	57	63	60	53	-	40	55	58	60	55	-	40	55	59	58	56
5	300	142	.04	10	48	55	53	57	49	47	55	59	60	59	51	48	47	63	63	61	53	50	60	64	65	64	56	53	62	67	67	65	59	56	62	69	69	67	62	59
	250	118	.03	7	-	46	48	51	42	40	53	57	56	55	46	42	56	61	60	58	51	48	64	63	62	61	54	51	64	64	63	61	56	53	59	66	66	65	60	57
	200	94	.02	5	-	41	43	44	34	32	51	53	52	50	42	37	54	57	56	54	47	44	56	60	59	57	51	49	56	62	61	60	54	52	57	63	65	55	59	56
	125	59	.01	2	-	-	32	30	-	-	-	46	45	43	36	31	49	53	52	50	43	40	49	54	58	57	51	46	49	54	60	63	56	51	47	52	61	68	64	59
	100	47	.01	2	-	-	29	25	-	-	-	45	42	40	33	30	-	51	54	52	46	40	-	51	58	60	53	47	-	51	59	65	59	53	-	47	58	67	66	60
6	450	212	.09	22	49	51	52	59	48	45	57	60	61	63	53	48	62	63	65	65	64	51	64	65	67	67	58	54	67	70	72	73	64	60	68	71	73	73	71	61
	400	189	.07	17	47	48	48	54	44	40	58	59	60	61	51	46	61	62	63	62	62	50	63	65	66	66	57	54	65	67	68	68	59	56	67	70	70	70	62	60
	300	142	.04	10	-	42	40	46	35	31	56	55	53	53	44	39	59	59	59	58	50	47	61	62	61	61	53	51	62	64	63	63	55	53	63	66	67	66	59	57
	200	94	.02	5	-	-	29	32	-	-	50	48	47	46	38	34	55	54	53	52	45	43	56	57	57	55	49	48	56	58	59	58	52	50	56	59	63	66	58	56
	100	47	.01	2	-	-	-	-	-	-	-	43	41	39	33	31	-	47	53	52	55	43	-	48	56	59	52	48	-	48	58	64	58	53	-	48	58	68	65	60
7	650	307	.01	2	52	55	62	59	51	48	56	58	61	59	52	48	60	61	64	62	57	54	65	65	68	66	61	59	68	68	70	68	63	61	70	70	71	69	65	63
	550	260	.01	2	50	51	56	53	46	42	54	55	56	54	49	44	60	59	62	60	55	52	65	64	66	64	60	57	66	67	68	66	62	59	68	70	72	69	66	63
	335	158	.01	2	46	39	41	38	29	22	52	50	52	50	45	41	57	57	57	56	52	49	58	60	61	59	55	53	59	62	64	61	58	56	60	63	67	65	62	59
	225	106	.01	2	-	-	30	26	-	-	49	46	47	45	41	36	53	54	55	52	48	46	53	56	58	56	52	50	58	56	60	59	55	54	54	57	59	61	59	59
	110	52	.01	2	-	-	-	-	-	-	-	41	41	38	34	30	-	47	47	46	45	43	-	48	51	49	49	47	-	48	52	52	51	51	-	48	54	55	55	56
8	800	378	.03	7	52	53	59	58	51	44	57	60	62	60	52	47	61	63	64	63	57	53	65	65	66	65	60	56	66	66	68	67	62	59	69	70	71	70	66	63
	700	330	.02	5	51	51	56	56	48	40	55	58	59	57	50	45	59	61	62	61	55	52	63	63	65	64	59	56	65	65	66	66	61	59	67	69	70	69	65	62
	600	283	.02	5	49	48	51	50	42	32	55	57	57	56	49	47	59	60	61	60	54	51	62	63	64	63	58	55	64	65	66	65	60	57	66	68	69	68	63	61
	400	189	.01	2	-	38	40	38	29	-	51	50	51	49	42	40	56	56	56	54	50	47	59	60	59	58	54	52	60	62	62	60	56	55	60	64	66	65	60	58
	175	83	.01	2	-	-	-	-	-	-	-	44	42	40	37	34	-	50	50	48	44	40	48	52	54	53	49	47	48	51	56	64	52	52	48	51	57	58	57	57
9	1050	496	.01	2	53	54	60	59	54	48	60	64	64	63	56	51	63	67	67	66	60	56	67	70	69	69	63	59	70	72	71	71	66	62	73	75	75	75	70	66
	900	425	.01	2	50	52	54	54	48	41	58	61	60	59	53	48	63	65	64	63	58	54	67	68	67	67	62	58	74	70	70	69	64	61	71	74	73	72	68	65
	675	319	.01	2	-	44	46	45	39	30	56	57	55	55	49	44	62	62	61	60	55	52	66	67	64	64	60	57	67	68	67	66	62	59	66	70	70	69	65	63
	450	212	.01	2	-	-	33	30	-	-	-	55	51	49	49	44	56	60	59	56	51	48	59	61	60	59	52	52	59	62	63	61	57	55	58	63	66	66	62	60
	225	106	.01	2	-	-	-	-	-	-	-	47	44	43	38	35	50	52	53	51	47	44	50	53	56	55	52	50	54	52	56	57	55	54	48	51	57	60	59	59
10	1350	637	.01	2	51	53	59	59	54	51	62	63	64	64	58	54	65	67	68	67	61	57	67	69	70	70	64	60	74	71	72	72	67	63	71	75	75	75	71	67
	1100	519	.01	2	48	47	52	52	47	43	59	61	60	59	54	49	62	64	64	64	58	54	66	67	67	67	62	58	68	70	69	70	65	61	69	73	72	73	69	66
	825	389	.01	2	-	41	45	44	38	33	55	57	55	54	49	43	61	61	61	60	55	52	64	65	64	64	59	56	65	68	66	66	62	59	66	69	70	69	67	63
	550	260	.01	2	-	-	31	28	-	-	53	51	50	47	44	40	57	58	56	56	52	49	59	61	60	60	56	55	60	62	62	62	59	56	59	62	65	66	62	60
	275	130	.01	2	-	-	-	-	-	-	-	45	43	42	38	34	47	49	50	50	58	44	47	49	52	52	54	51	47	48	53	55	57	56	48	49	55	58	60	60
12	2000	944	.01	2	57	57	62	61	56	53	64	65	66	66	60	55	67	68	69	70	64	59	69	70	72	72	66	61	71	71	73	74	68	63	74	75	76	78	73	69
	1600	755	.01	2	52	49	54	53	48	44	61	61	61	61	55	49	65	65	65	65	59	54	68	68	69	69	64	59	69	70	70	72	66	62	71	73	74	74	70	67
	1200	566	.01	2	47	43	46	44	38	34	57	57	56	55	49	44	62	62	62	62	56	52	65	65	65	66	60	57	66	68	67	68	63	60	69	71	72	71	68	64
	800	378	.01	2	44	36	36	33	28	-	54	53	52	51	45	40	60	59	58	58	53	50	62	63	62	62	58	54	63	64	65	64	61	57	63	66	68	68	65	62
	400	189	.01	2	-	-	-	-	-	-	48	47	46	44	39	36	51	51	52	52	49	45	51	52	55	56	55	52	51	51	56	59	59	58	51	51	57	60	63	64
14	2700	1274	.01	2	60	59	66	64	60	54	66	66	69	69	63	57	70	68	71	70	65	59	72	71	73	72	73	65	74	72	74	74	69	67	77	76	77	77	73	70
	2100	991	.01	2	54	55	58	55	51	44	63	61	62	62	56	50	67	65	66	65	60	59	70	68	68	68	63	63	71	70	70	70	65	64	74	73	74	73	70	68
	1550	543	.01	2	48	43	48	46	41	33	58	55	55	54	49	43	63	61	61	60	55	55	66	64	64	63	60	59	68	67	67	66	63	61	69	69	71	69	66	64
	1050	496	.01	2	-	35	36	32	27	-	53	51	50	48	44	40	59	57	56	56	53	51	60	60	60	59	56	54	62	62	63	62	59	57	63	64	66	66	63	61
	525	248	.01	2	-	-	-	-	-	-	49	45	44	43	40	37	52	50	51	50	48	45	51	50	54	54	53	51	54	53	56	57	56	55	54	54	58	60	60	60
16	3500	1652	.01	2	60	59	66	64	60	54	65	65	70	70	64	58	71	69	72	72	66	59	73	72	73	74	68	64	74	73	75	75	70	66	77	76	77	78	73	70
	2800	1322	.01	2	56	54	56	58	54	48	64	62	64	65	58	53	67	66	67	66	61	56	70	69	70	69	64	61	72	71	72	71	67	63	76	75	75	75	71	68
	2100	991	.01	2	50	46	51	49	44	38	59	57	58	57	51	46	64	63	62	62	57	54	68	67	66	66	61	59	70	68	68	68	60	58	72	71	72	72	69	66
	1400	661	.01	2	-	37	39	35	30	-	54	57	51	50	45	42	60	59	57	57	53	51	63	62	61	61	58	56	64	65	65	64	61	59	66	67	69	68	65	63
	700	330	.01	2	-	-	25	23	-	-	50	46	45	45	42	42	53	52	53	52	50	48	54	54	56	56	55	54	56	56	59	59	58	58	58	57	62	63	62	62
24 x 16	8000	3776	.62	154	75	72	72	67	66	62	81	78	76	71	70	66	84	81	80	76	75	71	86	82	82	78	77	73	88	85	84	81	80	76	90	87	87	84	83	78
	7000	3304	.47	117	72	69	71	65	64	60	80	77	75	71	69	65	83	80	79	76	74	70	84	82	81	78	76	72	86	84	84	81	79	74	88	86	86	84	82	77
	6000	2832	.35	87	69	68	67	62	61	56	78	75	74	70	68	64	81	79	78	75	73	69	82	81	79	77	75	71	84	83	82	80	78	73	86	85	85	83	81	76
	5000	2360	.24	60	67	64	62	57	56	51	76	74	73	69	66	63	79	77	77	74	71	67	80	79	78	76	73	69	82	81	81	79	76	72	84	83	84	82	79	75
	4000	1888	.15	37	65	59	58	51	50	45	73	72	71	67	65	61	77	76	76	72	70	65	78	78	78	74	72	67	80	79	80	77	75	70	82	81	82	80	78	73

For performance table notes, see page B13.

Performance Data • Discharge Sound Power Levels

Model Series 3000 • With 3 ft. (914) Integral Attenuator

A Participating Corporation in the ARI 880 Certification program.

ARI PERFORMANCE CERTIFIED ARI Standard 880

Inlet Size	Airflow cfm	Airflow l/s	Min. inlet ΔPs "w.g.	Min. inlet ΔPs Pa	Minimum ΔPs						0.5" w.g. (125Pa) ΔPs						1.0" w.g. (250Pa) ΔPs						1.5" w.g. (375Pa) ΔPs						2.0" w.g. (500Pa) ΔPs						3.0" w.g. (750Pa) ΔPs					
					2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
	200	94	.11	27	-	37	43	43	31	31	46	47	49	43	32	32	54	43	54	45	32	33	56	56	57	47	34	35	58	58	58	48	34	35	57	59	61	52	35	36
	150	71	.06	15	-	-	37	35	22	23	45	43	45	36	27	26	51	49	49	41	39	31	54	53	53	44	32	33	54	54	56	47	32	33	53	54	59	55	36	36
4	100	47	.03	7	-	-	28	23	-	-	41	38	38	32	24	23	45	44	47	39	26	27	46	46	53	46	31	30	46	47	55	50	34	33	44	45	54	53	39	38
	75	35	.01	2	-	-	-	-	-	-	-	36	36	29	20	-	-	39	48	42	28	26	-	40	51	48	34	31	-	40	51	49	38	35	-	40	51	50	39	40
	50	24	.01	2	-	-	-	-	-	-	-	34	40	34	23	-	-	35	48	46	34	30	-	35	50	49	38	35	-	35	48	43	36	35	-	35	48	44	31	34
	300	142	.04	10	45	50	48	43	-	-	52	54	55	45	-	-	44	58	58	48	27	27	57	59	60	50	30	30	59	62	62	51	33	34	59	64	63	53	36	37
	250	118	.03	7	-	41	43	37	-	-	50	52	51	41	-	-	53	56	55	45	25	25	61	58	57	47	28	28	61	59	58	47	30	31	56	61	60	51	34	35
5	200	94	.02	5	-	36	38	30	-	-	48	48	47	36	-	-	51	52	51	41	21	21	53	55	54	43	25	26	53	57	56	46	28	30	54	58	59	41	33	34
	125	59	.01	2	-	-	27	-	-	-	-	41	40	29	-	-	46	48	47	37	-	-	46	49	53	43	25	23	46	49	55	49	30	29	44	47	55	54	38	37
	100	47	.01	2	-	-	24	-	-	-	-	40	37	26	-	-	-	46	49	39	20	-	-	46	53	46	27	24	-	46	54	51	33	31	-	42	52	53	40	38
	450	212	.09	22	46	47	48	46	-	-	54	56	57	50	-	-	59	58	60	53	39	30	60	60	62	55	34	32	63	64	67	61	40	38	64	64	68	61	47	39
	400	189	.07	17	44	44	44	41	-	-	55	55	56	48	-	-	58	57	58	50	37	29	59	60	61	54	33	32	61	61	63	56	35	34	63	63	65	58	38	38
6	300	142	.04	10	-	38	36	33	-	-	53	51	49	40	-	-	56	54	54	46	25	26	57	57	56	49	29	29	58	58	58	51	31	31	59	59	62	54	35	35
	200	94	.02	5	-	-	25	-	-	-	47	44	43	33	-	-	52	49	48	40	20	22	52	52	52	43	35	26	52	52	54	46	28	28	52	52	58	54	34	34
	100	47	.01	2	-	-	-	-	-	-	-	39	37	26	-	-	-	42	48	40	30	22	-	43	51	47	28	26	-	42	53	52	34	31	-	41	53	56	41	38
	650	307	.01	2	47	50	57	48	30	30	51	53	56	48	31	30	55	56	58	50	35	36	59	59	61	54	39	42	62	62	63	56	41	44	64	64	63	56	43	46
	550	260	.01	2	45	46	51	42	25	24	49	50	51	43	28	26	55	54	56	48	33	34	59	58	59	52	38	40	60	61	61	54	40	42	62	64	64	56	44	46
7	335	158	.01	2	41	34	36	27	-	-	47	41	42	39	24	23	52	52	51	44	30	31	52	54	54	47	33	36	53	56	57	49	36	39	54	57	59	52	40	42
	225	106	.01	2	-	-	25	-	-	-	44	41	42	34	20	-	48	49	49	40	26	28	47	50	51	44	30	33	52	50	53	47	33	37	48	51	51	48	37	42
	110	52	.01	2	-	-	-	-	-	-	-	36	36	27	-	-	-	41	41	34	23	25	-	42	44	37	27	30	-	42	45	40	29	34	-	42	46	42	33	39
	800	378	.03	7	48	49	55	48	37	27	53	56	58	50	38	30	57	58	59	53	41	36	60	59	60	55	43	38	61	60	62	57	44	41	64	64	64	60	47	45
	700	330	.02	5	47	47	52	46	34	23	51	54	55	47	36	28	55	56	57	51	39	36	58	57	59	54	42	38	60	59	60	56	43	41	62	63	63	59	46	44
8	600	283	.02	5	45	44	47	40	28	-	51	53	53	46	35	30	55	55	56	50	38	35	57	57	58	53	41	37	59	59	60	55	42	39	61	62	62	58	44	43
	400	189	.01	2	-	34	36	28	-	-	47	46	47	39	28	23	52	51	51	44	34	31	54	54	53	48	37	34	55	56	56	50	38	37	55	58	59	55	41	40
	175	83	.01	2	-	-	-	-	-	-	-	40	38	30	23	-	-	45	45	38	28	24	43	46	48	43	32	29	43	45	50	54	34	34	43	45	50	48	38	39
	1050	496	.01	2	50	50	57	50	37	34	57	60	61	54	39	27	59	61	63	56	42	42	62	62	64	58	45	44	64	63	65	59	48	47	67	66	68	63	51	51
	900	425	.01	2	47	48	51	45	31	27	55	57	57	50	36	34	59	59	60	53	40	40	62	60	62	56	44	43	68	61	64	57	46	46	65	65	66	60	49	50
9	675	319	.01	2	-	40	43	36	22	-	53	53	52	46	32	30	58	56	57	50	37	38	61	59	59	53	42	42	61	59	61	54	44	44	60	61	63	57	46	48
	450	212	.01	2	-	-	30	21	-	-	-	51	48	40	32	30	52	54	55	46	33	34	54	53	55	48	44	37	53	53	57	49	39	40	52	54	59	54	43	45
	225	106	.01	2	-	-	-	-	-	-	-	43	41	34	21	21	46	46	49	41	29	30	45	45	51	44	44	35	48	43	50	45	37	39	42	42	50	48	40	44
	1350	637	.01	2	49	51	57	50	38	39	60	61	62	55	42	42	62	63	64	58	46	44	63	63	64	62	50	48	70	64	67	64	53	51	66	66	70	68	57	54
	1100	519	.01	2	46	45	50	43	31	31	57	59	58	50	38	37	59	60	60	55	43	41	62	61	61	59	48	46	64	63	64	62	51	49	64	64	67	66	55	53
10	825	389	.01	2	-	39	43	35	22	21	53	55	53	45	33	31	58	57	57	51	40	39	60	59	58	56	45	44	61	61	61	58	48	47	61	60	65	62	53	50
	550	260	.01	2	-	-	29	-	-	-	51	49	41	38	28	28	54	54	52	47	37	36	55	55	54	52	42	43	56	55	57	54	45	44	54	53	60	59	48	47
	275	130	.01	2	-	-	-	-	-	-	-	43	41	33	22	22	43	45	46	41	43	31	43	43	46	44	40	39	43	41	48	47	43	44	43	40	50	51	46	47
	2000	944	.01	2	54	54	57	50	42	41	61	62	61	55	46	44	63	64	64	60	50	48	64	65	67	62	52	50	66	65	68	64	54	52	69	69	71	68	59	58
	1600	755	.01	2	49	46	49	41	34	33	58	58	56	50	41	38	61	61	60	55	45	43	63	63	64	59	50	48	64	64	65	62	52	51	66	67	69	64	56	56
12	1200	566	.01	2	44	40	41	33	24	23	54	54	51	44	35	33	58	58	57	52	42	41	60	60	60	56	46	46	61	62	62	58	49	49	64	65	67	61	54	53
	800	378	.01	2	41	33	31	22	-	-	51	50	47	40	31	29	56	55	53	48	39	39	57	58	57	52	44	43	58	58	60	54	47	46	58	60	63	58	51	51
	400	189	.01	2	-	-	-	-	-	-	45	44	41	33	25	25	47	47	47	42	35	34	46	47	50	46	41	41	46	45	51	49	45	47	46	51	52	50	49	53
	2700	1274	.01	2	58	57	62	59	49	45	64	64	65	60	52	48	67	66	66	61	53	49	68	67	68	63	62	55	70	67	69	65	58	57	72	71	71	68	62	60
	2100	991	.01	2	52	53	54	46	40	35	61	59	58	53	45	41	64	63	61	56	48	49	66	64	63	59	52	53	67	65	65	61	54	54	69	68	68	64	59	58
14	1550	543	.01	2	46	41	44	37	30	24	56	53	51	45	38	34	60	59	56	51	43	45	62	61	59	54	49	49	64	62	62	57	52	51	64	64	56	60	55	54
	1050	496	.01	2	-	33	32	23	-	-	51	49	46	39	33	31	56	55	51	47	41	41	56	56	55	50	45	44	58	57	58	53	48	47	58	59	60	57	52	51
	525	248	.01	2	-	-	-	-	-	-	47	43	40	34	29	28	49	48	46	41	36	35	47	46	49	45	42	41	50	48	51	48	45	45	49	49	52	51	49	50
	3500	1652	.01	2	57	58	62	57	52	46	62	64	66	63	56	50	67	68	68	64	57	51	68	69	69	65	58	55	68	69	70	66	60	57	71	71	72	69	63	61
	2800	1322	.01	2	53	53	52	51	46	40	61	61	60	58	50	45	63	65	63	58	52	48	65	66	66	60	54	52	66	67	67	62	57	54	70	70	70	66	61	59
16	2100	991	.01	2	47	45	47	42	36	30	56	56	54	50	43	38	61	62	58	54	48	46	63	64	62	57	51	50	64	64	63	59	50	49	66	66	67	63	59	57
	1400	661	.01	2	-	36	35	28	22	-	51	56	47	43	37	34	56	58	53	49	44	43	58	59	57	52	48	47	58	61	60	55	51	50	60	62	64	59	55	54
	700	330	.01	2	-	-	-	-	-	-	47	45	41	38	34	34	49	51	49	44	41	40	49	51	52	47	45	45	50	52	54	50	48	49	52	52	57	54	52	53
	8000	3776	.62	154	74	72	69	59	60	57	80	77	73	63	64	61	83	80	77	68	69	66	85	81	79	70	71	68	87	84	81	73	74	71	89	86	84	76	77	73
24	7000	3304	.47	117	71	68	68	57	58	55	79	76	72	63	63	60	82	79	76	68	68	65	83	81	78	70	70	67	85	83	81	73	73	69	87	85	83	76	76	72
x	6000	2832	.35	87	68	67	64	54	55	51	77	74	71	62	62	59	80	78	75	67	67	64	81	80	76	69	69	66	83	82	79	72	72	68	85	84	82	75	75	71
16	5000	2360	.24	60	66	63	59	49	50	46	75	73	70	61	60	58	78	76	74	66	65	62	79	78	75	68	67	64	81	80	78	71	70	67	83	82	81	74	73	70
	4000	1888	.12	37	64	58	55	43	44	40	72	71	68	59	59	55	76	75	73	64	64	60	77	77	75	66	66	62	79	78	77	69	69	65	81	80	79	72	72	68

Sound Power Octave Bands @ Inlet Pressure ΔPs shown

For performance table notes, see page B13.

Nailor

Performance Data • Radiated Sound Power Levels

Model Series 3000

A Participating Corporation in the ARI 880 Certification program.

ARI PERFORMANCE CERTIFIED
ARI Standard 880

Inlet Size	Airflow cfm	Airflow l/s	Min. inlet ΔPs "w.g.	Min. inlet ΔPs Pa	Minimum ΔPs						0.5" w.g. (125Pa) ΔPs						1.0" w.g. (250Pa) ΔPs						1.5" w.g. (375Pa) ΔPs						2.0" w.g. (500Pa) ΔPs						3.0" w.g. (750Pa) ΔPs					
					2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	200	94	.11	27	-	36	33	32	-	-	-	39	37	38	29	29	49	46	43	37	30	29	53	52	47	40	32	31	53	53	50	42	33	33	54	55	53	47	37	37
	150	71	.06	15	-	35	29	31	-	-	-	40	36	30	25	23	47	46	40	34	28	26	49	50	47	39	31	30	47	48	48	43	34	32	48	48	48	50	40	37
	100	47	.03	7	-	-	-	-	-	-	-	37	32	27	-	-	-	43	42	34	27	23	-	44	45	41	32	29	-	43	46	46	36	32	-	42	44	51	43	38
	75	35	.01	2	-	-	-	-	-	-	-	37	31	26	-	-	-	41	43	37	29	24	-	42	45	42	32	29	49	38	42	45	40	33	-	36	41	48	44	40
	50	24	.01	2	-	-	-	-	-	-	-	37	38	30	-	-	-	36	41	40	32	27	-	35	40	43	38	31	-	34	38	40	38	33	-	32	36	37	35	37
5	300	142	.04	10	47	38	32	32	30	27	50	43	37	37	35	31	54	46	44	37	35	31	57	49	47	39	38	33	59	52	49	40	39	35	59	55	53	43	43	39
	250	118	.03	7	-	35	31	25	23	-	50	39	36	29	28	25	54	45	42	33	32	28	55	48	45	35	35	30	56	51	48	37	37	32	57	53	51	42	41	35
	200	94	.02	5	-	-	-	-	-	-	50	38	34	27	26	-	52	43	39	30	30	25	52	45	43	32	32	28	53	48	46	36	36	30	53	48	48	44	41	34
	125	59	.01	2	-	-	-	-	-	-	-	43	29	21	-	-	48	40	38	28	27	-	48	42	42	34	33	27	49	42	44	39	38	29	49	42	44	47	46	37
	100	47	.01	2	-	-	-	-	-	-	-	33	29	-	-	-	-	39	38	28	26	-	-	40	42	36	34	26	46	40	43	43	41	31	47	41	43	47	46	37
6	450	212	.09	22	48	44	37	35	30	28	48	47	40	38	32	29	56	50	45	40	34	31	59	53	48	44	36	33	61	55	50	43	39	37	64	58	54	46	42	41
	400	189	.07	17	-	42	33	33	28	26	49	46	39	35	30	28	56	49	44	38	32	29	59	52	47	40	36	33	62	54	49	42	39	36	65	58	54	45	42	41
	300	142	.04	10	-	34	27	26	-	-	47	42	35	29	25	-	55	46	40	33	30	28	58	49	44	36	33	32	59	51	47	38	36	34	60	55	51	43	39	39
	200	94	.02	5	-	-	-	-	-	-	47	36	30	24	-	-	53	43	38	30	29	28	53	45	43	32	31	30	53	47	44	36	32	32	55	49	46	43	37	37
	100	47	.01	2	-	-	-	-	-	-	-	34	27	-	-	-	-	35	38	33	29	24	45	39	40	37	31	28	47	39	40	42	37	32	46	40	40	46	44	38
7	650	307	.01	2	48	45	46	38	31	30	49	48	45	37	31	29	54	50	47	40	34	32	60	54	50	44	37	35	64	58	54	48	40	38	67	63	58	51	44	43
	550	260	.01	2	49	43	41	33	27	25	48	44	40	32	28	26	55	49	45	38	32	30	61	54	49	43	36	33	64	58	52	45	38	36	65	61	57	50	42	40
	335	158	.01	2	-	-	28	33	-	-	-	40	35	29	24	-	58	48	42	36	30	28	57	51	46	40	32	30	57	52	48	42	34	32	57	53	50	47	39	38
	225	106	.01	2	-	-	-	-	-	-	-	39	33	28	-	-	50	45	40	34	28	25	52	47	43	38	31	29	51	47	43	41	33	31	52	48	45	42	35	36
	110	52	.01	2	-	-	-	-	-	-	-	-	28	25	-	-	-	37	33	32	27	24	-	36	32	31	27	26	-	38	35	34	29	29	-	38	35	35	32	36
8	800	378	.03	7	51	46	40	33	31	28	55	48	44	35	33	29	57	51	48	38	36	32	61	54	50	41	40	35	64	56	53	43	43	38	66	58	55	46	47	41
	700	330	.02	5	50	43	37	31	29	25	51	47	42	33	31	28	57	51	47	37	36	32	61	53	50	40	39	35	63	55	51	42	41	37	64	59	56	45	44	40
	600	283	.02	5	-	39	33	29	26	-	50	45	40	31	30	26	57	49	45	35	34	31	60	53	49	38	38	33	61	55	51	40	40	36	63	59	56	46	43	40
	400	189	.01	2	-	35	26	-	-	-	49	41	36	28	27	24	54	47	41	32	31	30	57	52	46	35	34	32	57	52	47	37	36	34	59	54	51	41	40	39
	175	83	.01	2	-	-	-	-	-	-	-	36	31	23	23	-	48	41	35	29	29	27	48	42	37	31	31	30	49	42	39	33	33	33	49	42	40	35	37	38
9	1050	496	.01	2	50	44	44	41	34	32	51	46	46	41	36	33	55	51	47	41	36	34	59	54	50	45	39	37	62	58	53	48	42	40	66	62	51	52	46	44
	900	425	.01	2	48	40	39	36	30	29	50	45	42	37	32	30	56	50	45	40	35	33	60	54	49	44	39	36	63	58	52	47	41	38	61	61	57	50	44	42
	675	319	.01	2	47	37	31	29	22	-	49	41	36	31	28	25	55	48	42	37	32	30	58	54	46	41	35	33	60	56	50	44	38	36	60	57	52	47	41	39
	450	212	.01	2	-	-	24	-	-	-	48	40	33	30	26	24	53	46	39	34	30	29	54	49	43	38	33	31	55	50	46	41	35	34	56	52	48	45	39	38
	225	106	.01	2	-	-	-	-	-	-	-	37	31	26	-	-	-	40	34	31	28	26	-	41	36	34	30	30	-	41	37	35	32	33	48	42	39	38	35	38
10	1350	637	.01	2	53	42	41	36	30	23	55	47	46	39	34	29	58	53	50	44	38	34	60	56	53	48	42	37	63	57	54	50	46	41	65	61	57	54	48	45
	1100	519	.01	2	51	37	35	30	25	-	53	46	42	35	31	27	55	50	47	41	35	31	60	54	50	45	39	36	61	66	51	47	42	39	64	61	55	51	45	43
	825	389	.01	2	-	33	29	25	-	-	50	43	38	32	29	25	55	48	43	38	33	30	58	52	47	42	37	34	59	54	49	44	38	36	61	57	53	49	43	40
	550	260	.01	2	-	-	-	-	-	-	-	38	33	29	25	-	51	44	38	34	30	28	53	47	42	38	32	34	56	50	45	41	36	33	57	52	48	45	39	37
	275	130	.01	2	-	-	-	-	-	-	-	35	29	26	-	-	-	39	33	31	28	-	-	40	36	34	31	29	-	40	36	36	33	32	48	43	40	40	36	36
12	2000	944	.01	2	54	50	49	44	37	33	58	55	51	46	39	35	61	59	53	49	43	37	64	61	56	52	45	41	65	62	58	55	48	44	68	66	61	58	51	49
	1600	755	.01	2	52	45	41	36	30	27	56	52	45	40	34	30	59	56	49	46	38	35	61	58	53	49	42	39	62	60	55	51	44	42	65	64	58	55	48	46
	1200	566	.01	2	47	39	33	29	24	-	52	48	40	36	30	27	55	52	45	41	34	32	58	55	49	45	38	36	60	58	51	48	41	39	61	61	55	52	45	44
	800	378	.01	2	-	-	-	-	-	-	50	41	34	30	26	-	52	48	41	37	31	30	53	52	45	42	35	33	54	53	47	44	37	36	56	55	50	48	42	42
	400	189	.01	2	-	-	-	-	-	-	-	37	31	28	-	-	-	42	36	33	29	28	47	45	40	37	32	31	48	47	42	40	35	34	47	44	40	43	40	42
14	2700	1274	.01	2	57	54	50	46	42	36	59	57	52	48	44	38	61	60	54	49	46	38	64	63	56	51	49	45	65	66	59	53	50	48	69	69	63	57	53	51
	2100	991	.01	2	54	48	44	39	35	30	56	53	45	40	37	31	61	57	50	44	41	38	63	61	55	48	44	43	64	63	57	50	46	44	66	66	60	55	50	48
	1550	543	.01	2	46	40	35	30	28	-	51	48	40	33	31	27	57	55	48	40	36	35	60	58	52	45	40	39	60	60	53	47	43	41	62	63	57	52	47	45
	1050	496	.01	2	-	32	24	-	-	-	49	46	38	31	28	24	52	51	43	37	33	31	54	55	47	41	37	35	55	58	50	45	40	38	56	58	52	48	43	42
	525	248	.01	2	-	-	-	-	-	-	-	39	31	27	24	-	-	45	38	32	30	28	-	45	39	35	31	32	48	48	42	39	37	36	49	49	44	42	40	42
16	3500	1652	.01	2	57	57	53	49	43	36	59	60	55	50	45	38	63	62	57	52	46	37	66	65	59	54	48	43	68	68	61	56	50	48	71	71	64	59	53	48
	2800	1322	.01	2	54	51	49	43	37	32	59	55	50	44	38	32	62	59	53	47	41	35	65	63	57	50	44	39	66	65	59	52	46	41	68	69	62	56	50	46
	2100	991	.01	2	49	44	41	34	28	-	54	50	44	37	32	28	59	57	50	42	37	32	61	60	53	45	40	35	63	63	56	49	43	39	64	65	58	53	47	44
	1400	661	.01	2	-	34	31	-	-	-	50	47	39	32	29	26	54	53	46	38	35	31	56	57	49	42	38	35	57	59	51	45	40	38	58	61	54	49	44	42
	700	330	.01	2	-	-	-	-	-	-	-	40	33	28	25	-	47	47	39	33	32	29	49	49	42	37	35	33	60	51	44	39	37	36	51	53	46	43	41	41
24 x 16	8000	3776	.62	154	71	67	66	61	58	53	73	70	68	62	60	55	77	74	72	67	63	58	79	76	75	70	65	60	81	77	77	72	67	61	83	80	80	75	69	63
	7000	3304	.47	117	67	64	65	59	57	53	71	68	66	60	58	53	75	72	71	65	62	56	77	74	73	68	64	58	79	76	75	70	65	59	81	78	78	73	68	61
	6000	2832	.35	87	64	60	61	55	53	51	69	66	64	58	56	51	72	70	69	63	60	54	74	72	71	66	62	56	76	73	73	69	63	57	78	76	76	72	66	59
	5000	2360	.24	60	62	56	56	51	51	46	66	63	62	56	53	48	69	67	67	61	57	52	71	69	69	64	59	54	73	71	71	67	61	55	75	73	74	70	63	57
	4000	1888	.12	37	61	52	50	46	43	40	62	60	60	54	50	45	66	64	64	59	54	49	68	66	67	62	56	51	69	68	69	64	58	52	72	70	71	67	60	54

For performance table notes, see page B13.

Performance Data • ARI Certification and Performance Notes
Model Series 3000

ARI Certification Rating Points

Inlet Size	Airflow		Min. inlet ΔPs		Discharge Sound Power Levels @ 1.5" w.g. (375 Pa) ΔPs						Radiated Sound Power Levels @ 1.5" w.g. (375 Pa) ΔPs					
					Octave Band						Octave Band					
	cfm	l/s	"w.g.	Pa	2	3	4	5	6	7	2	3	4	5	6	7
4	150	71	.06	15	57	59	60	58	54	51	49	50	47	39	31	30
5	250	118	.03	7	64	63	62	61	54	51	55	48	45	35	35	30
6	400	189	.07	17	63	65	66	66	57	54	59	52	47	40	36	33
7	550	260	.01	2	65	64	66	64	60	57	61	54	49	43	36	33
8	700	330	.02	5	63	63	65	64	59	56	61	53	50	40	39	35
9	900	425	.01	2	67	68	67	67	62	58	60	54	49	44	39	36
10	1100	519	.01	2	66	67	67	67	62	58	60	54	50	45	39	36
12	1600	755	.01	2	68	68	69	69	64	59	61	58	53	49	42	39
14	2100	991	.01	2	70	68	68	68	63	63	63	61	55	48	44	43
16	2800	1322	.01	2	70	69	70	69	64	61	65	63	57	50	44	39
24 x 16	5350	2525	.28	70	81	80	79	77	74	70	72	70	70	65	60	55

ARI Standard 880

A Participating Corporation in the ARI 880 Certification program.

B

SINGLE DUCT TERMINAL UNITS

Performance Notes for Sound Power Levels:
1. Discharge sound power is the noise emitted from the unit discharge into the downstream duct.
2. Radiated sound power is the breakout noise transmitted through the unit casing walls.
3. Sound power levels are in decibels, dB re 10^{-12} watts.
4. All sound data listed by octave bands is raw data without any corrections for room absorption or duct attenuation. Dash (-) in space indicates sound power level is less than 20 dB or equal to background.
5. Minimum inlet ΔPs is the minimum operating pressure requirement of the unit (damper full open) and the difference in static pressure from inlet to discharge of the unit.
6. Data derived from independent tests conducted in accordance with ANSI/ASHRAE Standard 130-1996 and ARI Standard 880-98.

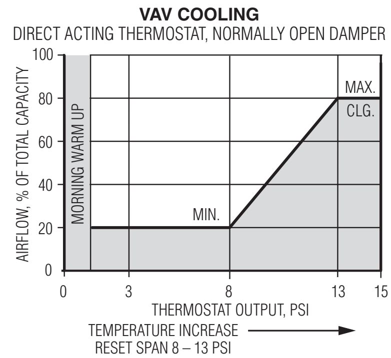
Standard Control Sequences

Pneumatic • Pressure Independent • 3000 Controller

The sequences illustrated feature the 3000 controller and a constant 5 psi reset span which does not vary with minimum and maximum settings. For a more detailed explanation of control options and terminology, refer to the engineering section in the back of this catalog.

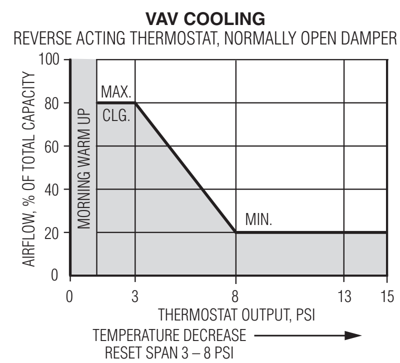
Control Sequence 1P3
Direct Acting, Normally Open

- When main control air is off, damper is fully open. Morning warm-up setting (if required) with warm air from system supplied at full flow rate.
- Main control air on – controller is activated. Begins modulating cold airflow on thermostat demand.
- Increase in room temperature increases thermostat output pressure (thus increasing airflow).
- Minimum airflow is maintained between 0 and 8 psi thermostat signal.
- Further increase in room temperature will increase thermostat signal from 8 to 13 psi which will increase airflow. At 13 psi and above, preset maximum airflow is maintained.
- If main control air fails, damper fails open.



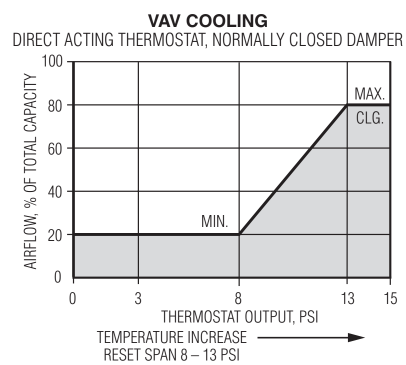
Control Sequence 2P3
Reverse Acting, Normally Open

- When main control air is off, damper is fully open. Morning warm-up setting available if required.
- Main control air on – controller is activated. Begins modulating cold airflow according to thermostat output.
- Decrease in room temperature increases thermostat output pressure (thus decreasing airflow).
- Maximum airflow is maintained between 0 and 3 psi thermostat signal.
- Further decrease in room temperature will increase thermostat signal from 3 to 8 psi which will decrease airflow to room. At 8 psi and above, minimum airflow is maintained.
- If main control air fails, damper fails open.



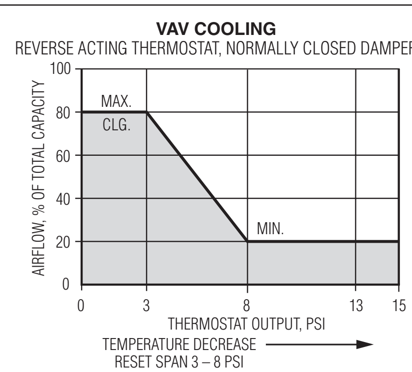
Control Sequence 3P3
Direct Acting, Normally Closed

- When main control air is off, damper is closed.
- Main control air on – controller is activated. Begins modulating cold airflow according to thermostat demand.
- Increase in room temperature increases thermostat output pressure (thus increasing airflow).
- Minimum airflow is maintained between 0 and 8 psi thermostat signal.
- Further increase in room temperature will increase thermostat signal from 8 to 13 psi which in turn increases airflow to room. At 13 psi and above, preset maximum airflow is maintained.
- If main control air fails, damper fails closed.



Control Sequence 4P3
Reverse Acting, Normally Closed

- When main control air is off, damper is closed.
- Main control air on – controller is activated. Begins modulating cold airflow according to thermostat demand.
- Decrease in room temperature increases thermostat output pressure (thus decreasing airflow).
- Maximum airflow is maintained between 0 and 3 psi thermostat signal.
- Further decrease in room temperature will increase thermostat output pressure from 3 to 8 psi which will decrease airflow to room. At 8 psi and above, minimum airflow is maintained.
- If main control air fails, damper fails closed.



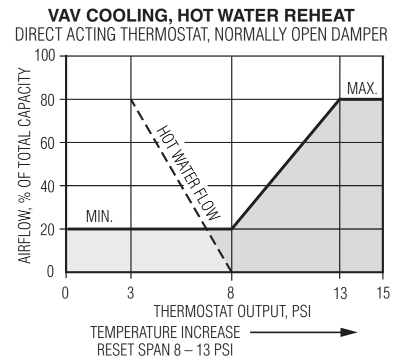
Standard Control Sequences

Pneumatic • Pressure Independent • 3000 Controller

Control Sequence 1P3
D.A.N.O. - Hot Water Reheat N.O.

- When main control air is off, damper is fully open.
- Main control air on – controller is activated and begins modulating on thermostat demand.
- Increase in room temperature modulates hot water valve towards closed position (at 8 psi). Minimum airflow is maintained between 0 and 8 psi thermostat signal.
- Further increase in room temperature will increase thermostat signal from 8 to 13 psi which will increase airflow to maximum cooling.
- If main control air fails, damper fails open and hot water valve fails open.

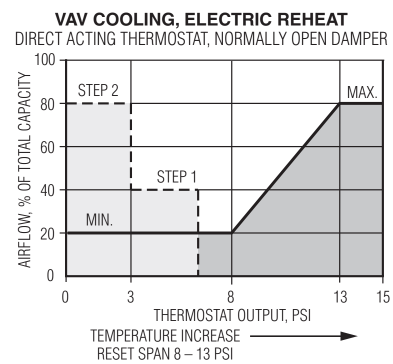
Hot water reheat coils may also be sequenced with 2P3, 3P3 and 4P3.



Control Sequence 1P3
D.A.N.O. - Electric Reheat N.C.

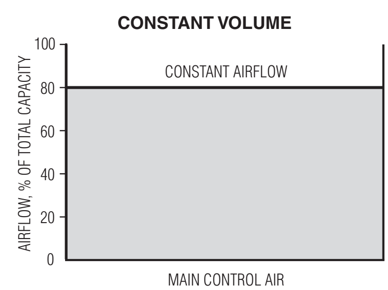
- When main control air is off, damper is fully open.
- Main control air on – controller is activated and begins modulating on thermostat demand.
- Increase in room temperature de-energizes the electric reheat coil one step at a time. Minimum airflow is maintained between 0 and 8 psi thermostat signal. At 8 psi, electric reheat is off.
- Further increase in room temperature will increase thermostat output signal from 8 to 13 psi which will increase airflow to maximum cooling.
- If main control air fails, damper fails open and P.E. switch for electric heater is closed (energized).

Electric reheat coils may also be sequenced with 2P3, 3P3 and 4P3.



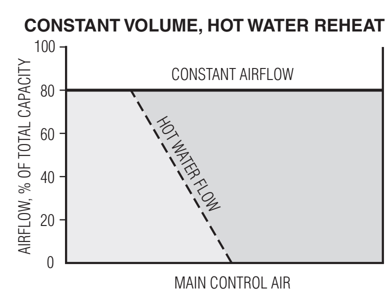
Control Sequence 7P3
C.V.N.C.

- When main control air is off, damper is closed.
- Main control air on – controller maintains preset constant airflow regardless of duct pressure or room temperature.
- A room thermostat is not used.
- If main control air fails, damper fails closed.
- A normally open damper assembly is optional.



Control Sequence 8P3
C.V. - Hot Water Reheat N.O.

- When main air is off, damper is open.
- Main control air is on – controller maintains preset constant airflow regardless of duct pressure or room temperature.
- As room temperature increases, a room thermostat modulates the hot water valve towards the closed position, or opens it on temperature drop.
- If main control air fails, damper fails open and hot water valve fails open.



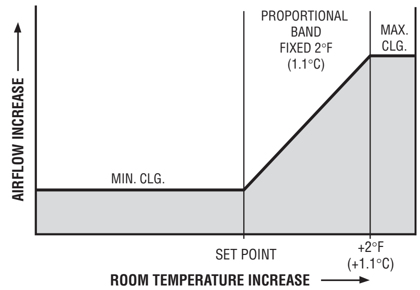
Standard Control Sequences

Analog Electronic • Pressure Independent

Control Sequence 1 EL
Cooling Only

The operating sequence for a cooling application is as follows:

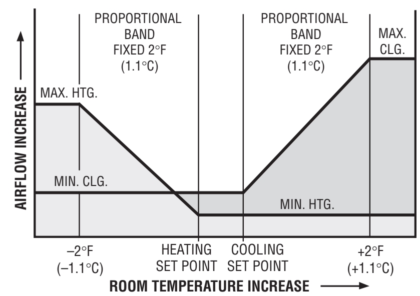
1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow. At 2°F (1.1°C) above thermostat set point, the maximum airflow is maintained at a preselected setting.
2. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce airflow. At thermostat set point, the minimum airflow is maintained at a preselected setting.
3. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.



Control Sequence 3 EL
Cooling/Heating with Auto – Changeover

The heating/cooling thermostat features separate temperature set points and separate min./max. velocity limits for heating and cooling operation. The automatic changeover relay energizes either the heating or cooling mode of the thermostat in response to the duct temperature. The operating sequence is as follows:

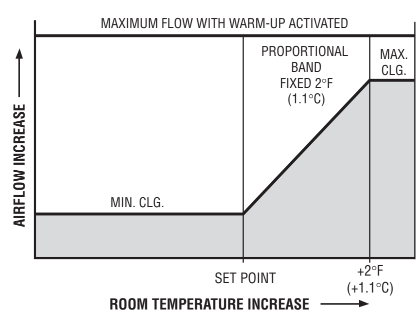
1. At a duct temperature above 77°F (25°C), the heating side of the thermostat is energized.
2. On a decrease in space temperature, the thermostat regulates the controller/actuator to increase the airflow. At 2°F (1.1°C) below thermostat heating set point, the maximum airflow is maintained at a preselected setting on a rise in space temperature, the thermostat regulates the controller/actuator to decrease the airflow. At a space temperature above thermostat heating set point, the minimum airflow is maintained at a preselected setting.
3. At a duct temperature below 77°F (25°C), the cooling side of the thermostat is energized.
4. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow. At 2°F (1.1°C) above thermostat cooling set point, the maximum airflow is maintained at a preselected setting. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce the airflow. At thermostat cooling set point, the minimum airflow is maintained at a preselected setting.
5. During both the heating and cooling cycle, airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.



Control Sequence 4 EL
Cooling with Morning Warm-Up

The operating sequence is as follows:

1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow. At 2°F (1.1°C) above thermostat set point, the maximum airflow is maintained at a preselected setting.
2. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce airflow. At thermostat set point, the minimum airflow is maintained at a preselected setting.
3. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.
4. When duct airflow temperature is above 77°F (25°C) (warm-up cycle), the inlet sensor switches a relay module and the actuator will drive the damper fully open for unrestricted maximum airflow.



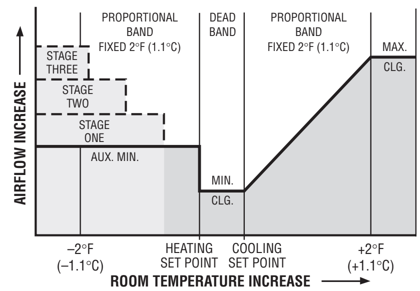
Standard Control Sequences

Analog Electronic • Pressure Independent

Control Sequence 5 EL
Cooling with Electric Reheat and Auxiliary Minimum Flow

The reheat thermostat features a separate temperature set point and a separate auxiliary flow limit for reheat control. The reheat relay energizes up to three stages of electric reheat in response to the thermostat. The operating sequence for a reheat application is as follows:

1. On a rise in space temperature, the thermostat regulates the controller/actuator to increase the airflow. At 2°F (1.1°C) above thermostat set point, the maximum airflow is maintained at a preselected setting.
2. On a decrease in space temperature, the thermostat regulates the controller/actuator to reduce the airflow. At thermostat set point, the minimum airflow is maintained at a preselected setting.
3. On a further decrease in space temperature the heating side of the thermostat is activated, automatically initiating the auxiliary flow limit. Airflow is maintained at the preselected auxiliary setting.
4. Up to three stages of reheat are energized in sequence in response to the thermostat. The first stage is energized 0.7°F (0.4°C) below the heating set point. The optional second and third stage are enegized at 1.3°F and 1.9°F (0.7°C and 1.1°C) below heating, respectively.
5. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.

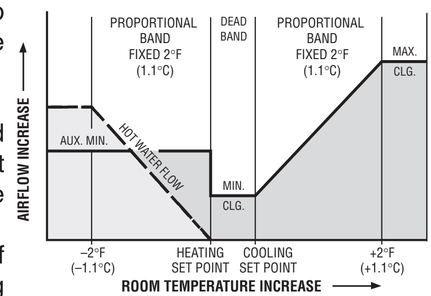


Control Sequence 8 EL
Cooling with Proportional Hot Water Reheat and Auxiliary Minimum Flow

The cooling/reheat thermostat features separate temperature set points and an auxiliary flow limit for desired airflow across the reheat coil. Airflow is held constant in accordance with thermostat demand. Any changes in duct air velocity due to static pressure fluctuations are sensed and compensated for, resulting in pressure independent control.

The sequence of operation is as follows:

1. As the room temperature increases, the room thermostat modulates the cold airflow from the minimum to the maximum setting. At 2°F (1.1°C) above cooling set point, maximum airflow is maintained. On a decrease in room temperature, the damper modulates to the minimum position.
2. On a decrease in room temperature below heating set point, the heating side of the thermostat is activated, automatically indexing the auxiliary minimum setting and the proportional hot water reheat valve (0 – 10 Vdc, by others) begins to modulate open.
3. At a room temperature of 2°F (1.1°C) below the thermostat heating set point, the hot water valve is fully open.
4. On an increase in room temperature, the reverse sequence occurs.



The following additional control sequences are also available (Contact your Nailor representative for further information):

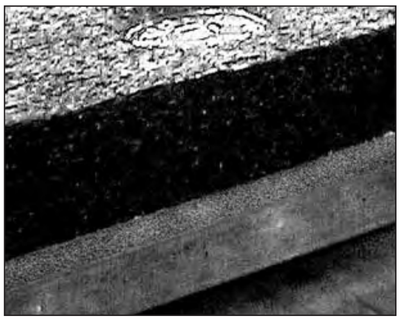
6 EL • Cooling With Electric Reheat Plus Morning Warm-up.
7 EL • Cooling With On/Off Hot Water Reheat and Auxiliary Minimum Flow (24 Vac N.C. valve, by others).
9 EL • Cooling With On/Off Auxillary Heat (Perimeter Radiation).
10 EL • Constant Volume Operation.

Optional Terminal Unit Liners For 'IAQ' Sensitive Applications

Nailor offers several options for terminal unit applications where the maintenance of an extremely high Indoor Air Quality is critical or a primary concern. Specific 'IAQ' liners are designed to address applications where the issue of fiberglass insulation eroding and entering the airstream is a concern and/or to reduce the risk of microbial growth.

These options are ideally suited to medical facilities including hospital operating and recovery rooms and clean room applications such as pharmaceutical and research laboratories, animal labs and food processing plants. When 'IAQ' is a major concern, Nailor 'IAQ' options can be successfully applied to regular commercial construction projects, such as schools.

Fiber-Free Liner



Fiber-Free liner on single duct terminal unit.

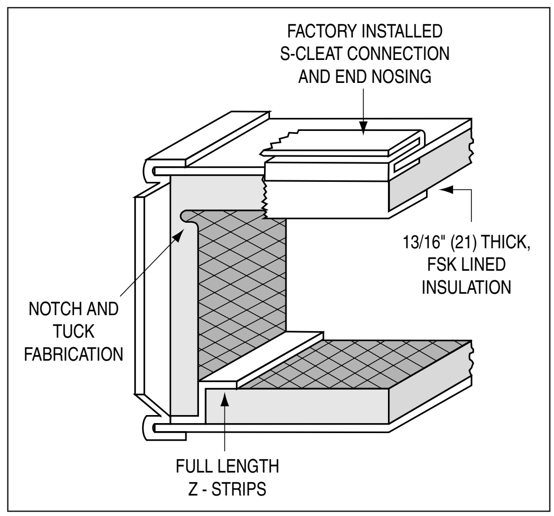
A new offering that totally eliminates fiberglass, Nailor's Fiber-Free liner is a 3/4" (19) thick, closed cell elastomeric foam. The liner has excellent insulating characteristics and provides acoustical attenuation equivalent to Steri-Liner.
The foam does not absorb water, reducing the likelihood of mold or bacterial growth.
The Fiber-Free liner surface is smooth, so that dirt and debris won't accumulate, durable, erosion resistant and washable.
Complies with the following standards and tests:

- NFPA 90A Supplementary materials for air distribution systems.
- ASTM E84 and UL 181 (25/50) Smoke and Flame spread.
- ASTM C1071, G21, G22. No bacterial or fungal growth.

Steri-Liner

Steri-Liner is an internal insulation designed to reduce the risk of microbial growth within the terminal. A smooth non-porous facing provides a vapor barrier to moisture and reduces the risk of micro-organisms becoming trapped. It also facilitates cleaning and prevents insulating material erosion. Damage to the liner though, will expose fiberglass particles to the airstream.
Acoustic absorption of aluminum foil lined insulation is reduced for discharge sound levels and essentially unchanged for radiated sound levels when compared to standard fiberglass insulation.

- 13/16" (21) thick, 4 lb./sq. ft. (64 kg/m^3) density rigid fiberglass with a fire resistant reinforced aluminum foil-scrim-kraft (FSK) facing.
- Meets the requirements of NFPA 90A and UL 181 for smoke and flame spread and the bacteriological requirements of ASTM C665. Will not support the growth of fungi or bacteria.
- No exposed edges. Steri-Liner features 'notch and tuck' fabrication and full seam length steel Z-strip construction providing both superior edge protection and an extremely rigid terminal.
- Metal nosing at unit discharge captures and seals insulation ends.
- S-cleats are provided and sealed in place to eliminate the risk of liner damage and aid installation.



Steri-Liner detail on single duct terminal unit.

Solid Metal Liner

Nailor also offers a solid inner metal liner that completely isolates the standard insulation from the airstream. Solid metal liners offer the ultimate protection against exposure of fiberglass particles to the airstream, all but eliminating the possibility of punctures exposing fiberglass. This option is also resistant to moisture. The encased insulation still provides thermal resisitance and radiated sound attenuation, but acoustic absorption of discharge sound is eliminated. Fabricated as a box within a box and with metal end nosing to encapsulate exposed edges of the insulation. Supplied with factory installed S-cleats.

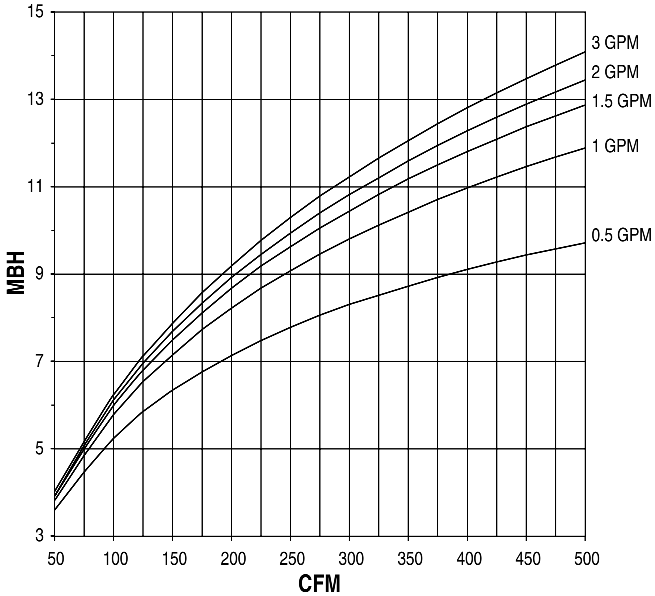
Perforated Metal Liner

Provides additional security and retains standard dual density fiberglass insulation or optional Steri-Liner insulation reducing possibility of long term erosion or breakdown.

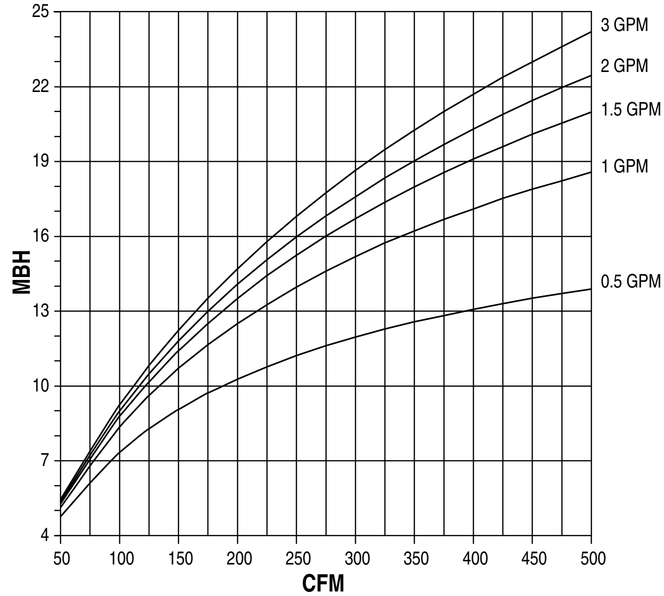
Performance Data • Hot Water Coil • Mbh Capacities
Model 30RW

Unit Size 4, 5 and 6

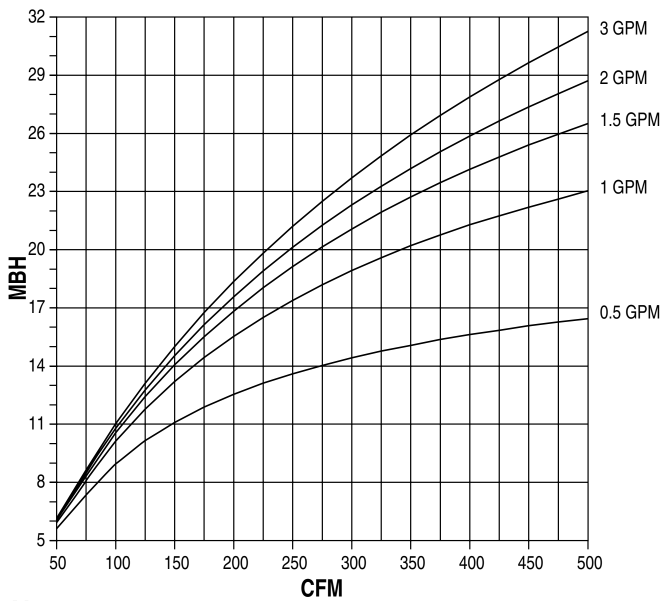
1 Row (single circuit)



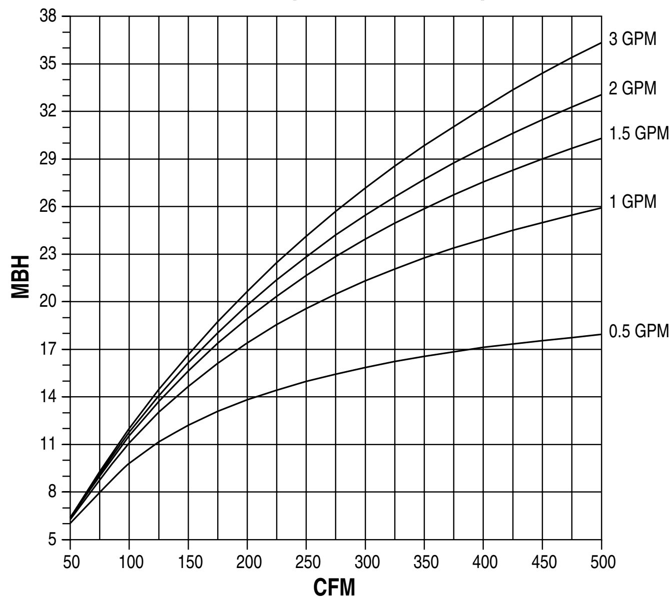
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. $ATR = 927 \times \frac{Mbh}{cfm}$

4. Water Temp. Drop. $WTD = 2.04 \times \frac{Mbh}{GPM}$

5. Connections: 1 Row 1/2" (13), 2, 3 and 4 row 7/8" (22); O.D. male solder.

Correction factors at other entering conditions:

Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Altitude Correction Factors:

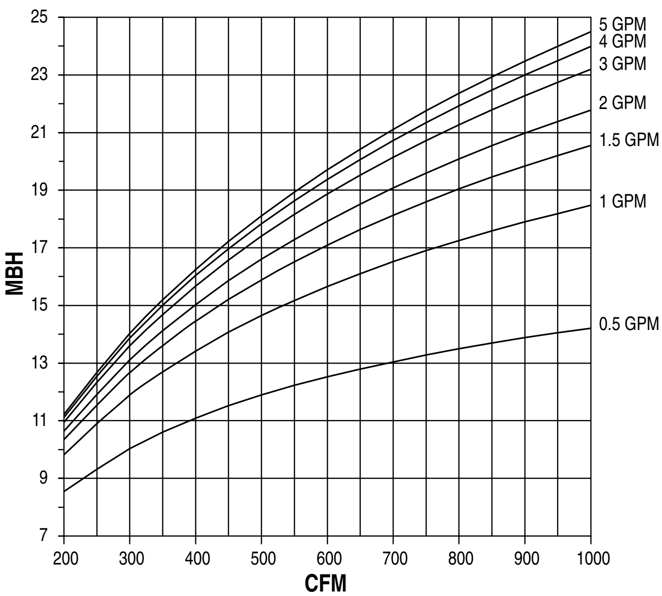
Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Performance Data • Hot Water Coil • Mbh Capacities

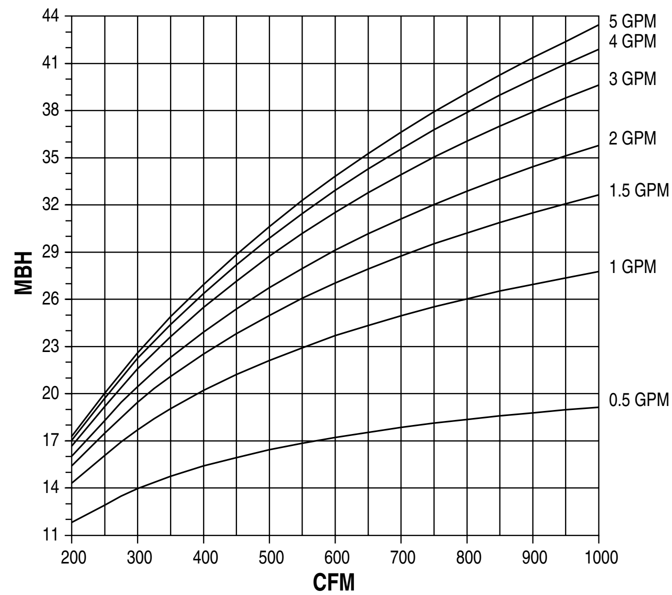
Model 30RW

Unit Size 7 and 8

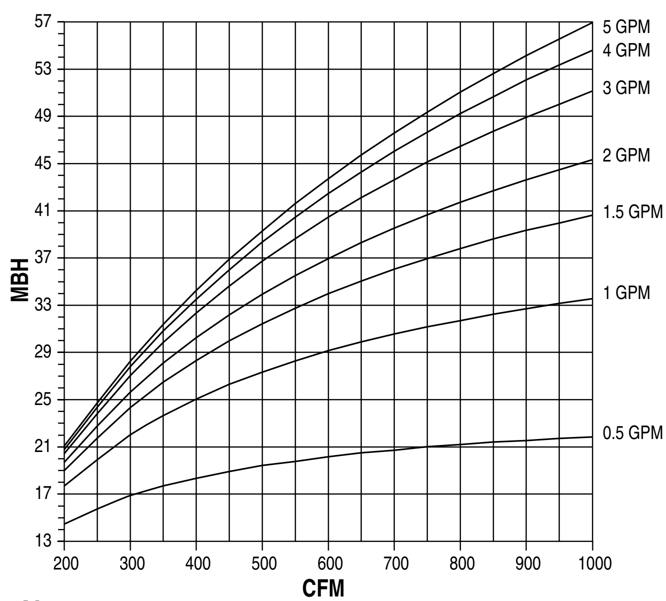
1 Row (single circuit)



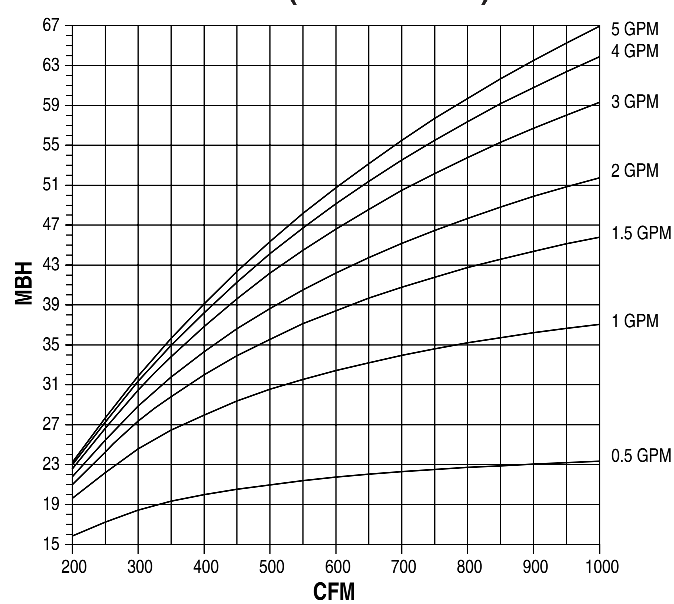
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. ATR = 927 x $\frac{\text{Mbh}}{\text{cfm}}$

4. Water Temp. Drop. WTD = 2.04 x $\frac{\text{Mbh}}{\text{GPM}}$

5. Connections: 1 Row 1/2" (13), 2, 3 and 4 row 7/8" (22); O.D. male solder.

Altitude Correction Factors:

Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Correction factors at other entering conditions:

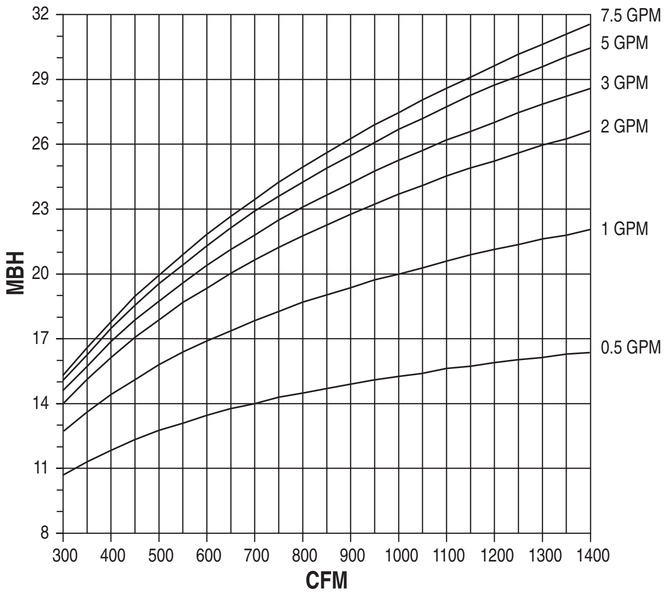
Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Performance Data • Hot Water Coil • Mbh Capacities

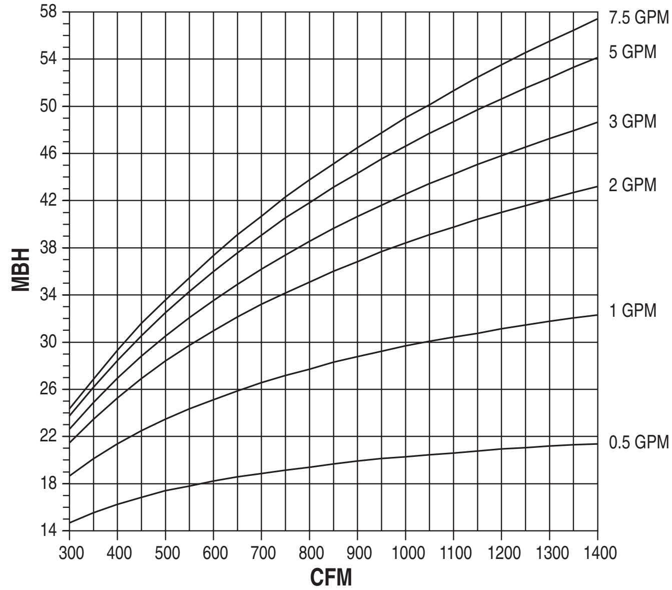
Model 30RW

Unit Size 9 and 10

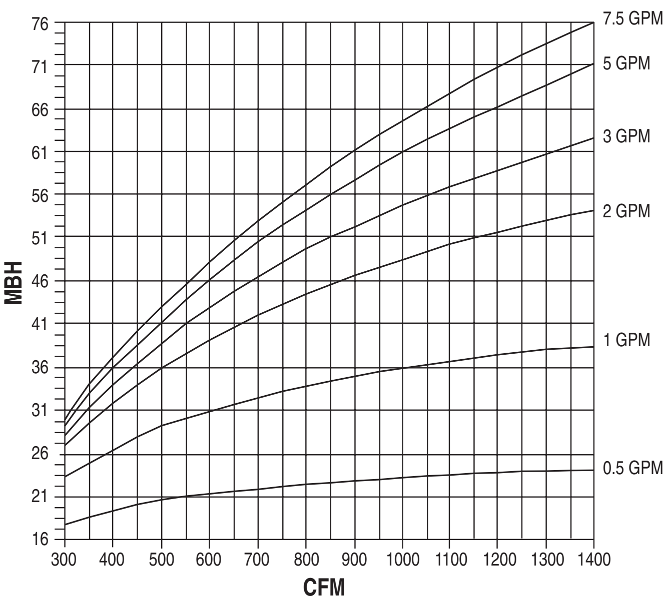
1 Row (single circuit)



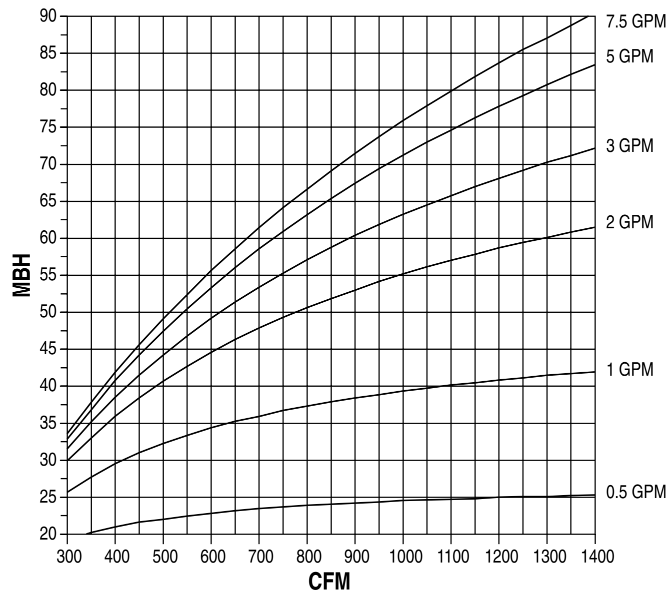
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. ATR = 927 x $\frac{\text{Mbh}}{\text{cfm}}$

4. Water Temp. Drop. WTD = 2.04 x $\frac{\text{Mbh}}{\text{GPM}}$

5. Connections: 1 Row 1/2" (13), 2, 3 and 4 row 7/8" (22); O.D. male solder.

Altitude Correction Factors:

Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Correction factors at other entering conditions:

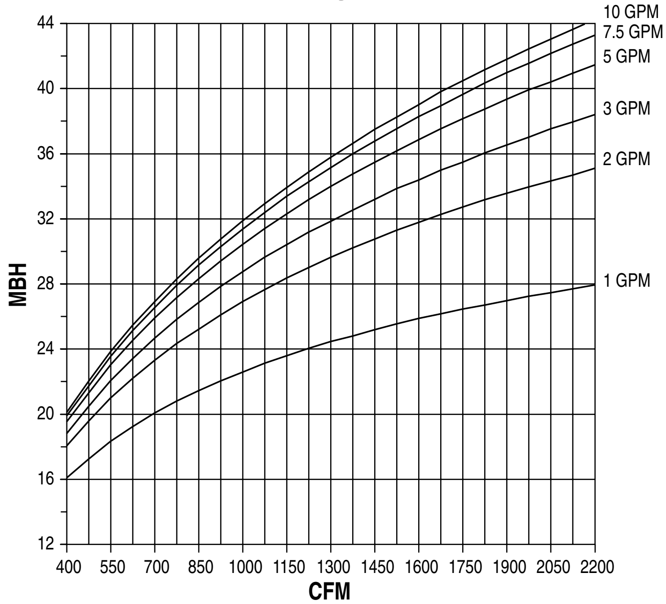
Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Performance Data • Hot Water Coil • Mbh Capacities

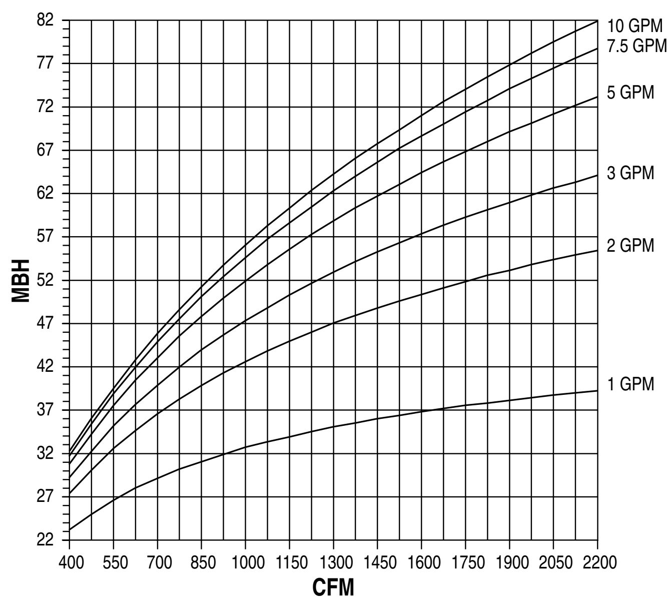
Model 30RW

Unit Size 12

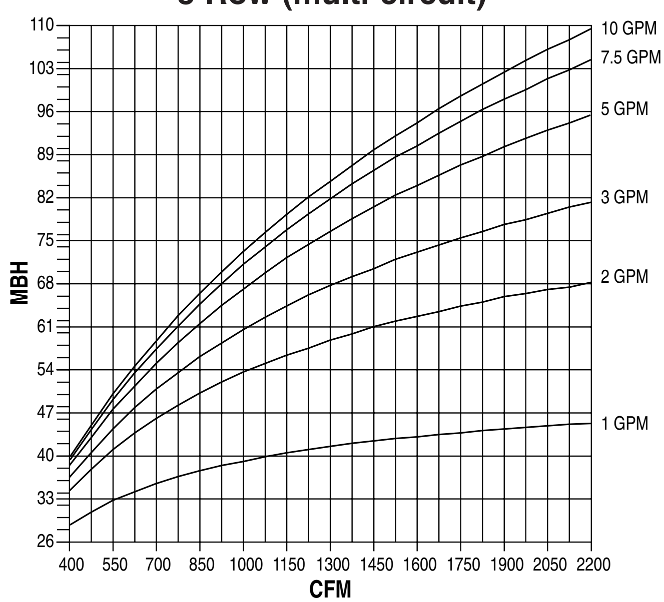
1 Row (single circuit)



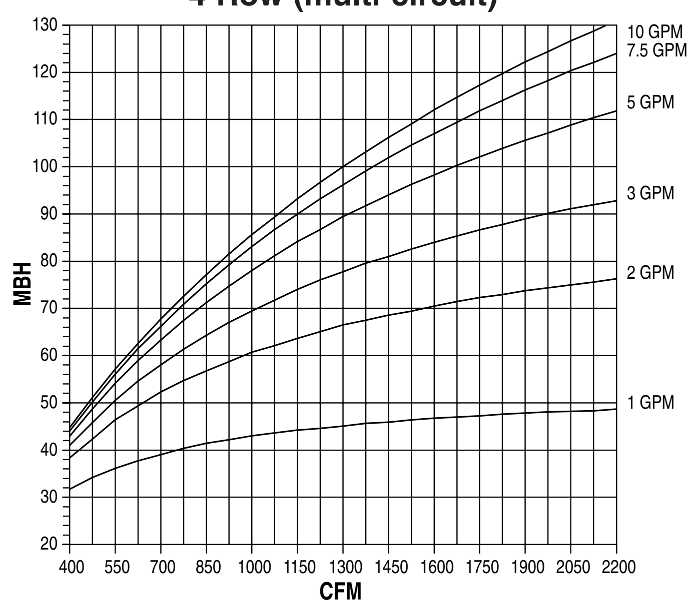
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. $ATR = 927 \times \frac{Mbh}{cfm}$

4. Water Temp. Drop. $WTD = 2.04 \times \frac{Mbh}{GPM}$

5. Connections: 1 Row 1/2" (13), 2, 3 and 4 row 7/8" (22); O.D. male solder.

Correction factors at other entering conditions:

Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Altitude Correction Factors:

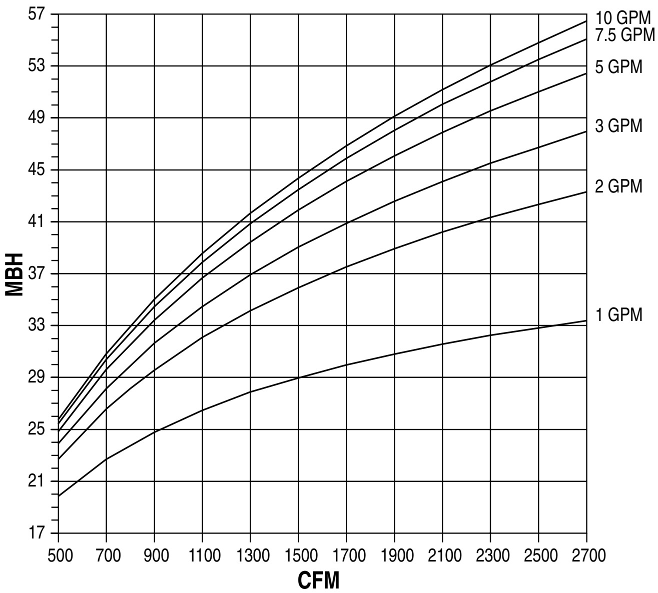
Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Performance Data • Hot Water Coil • Mbh Capacities

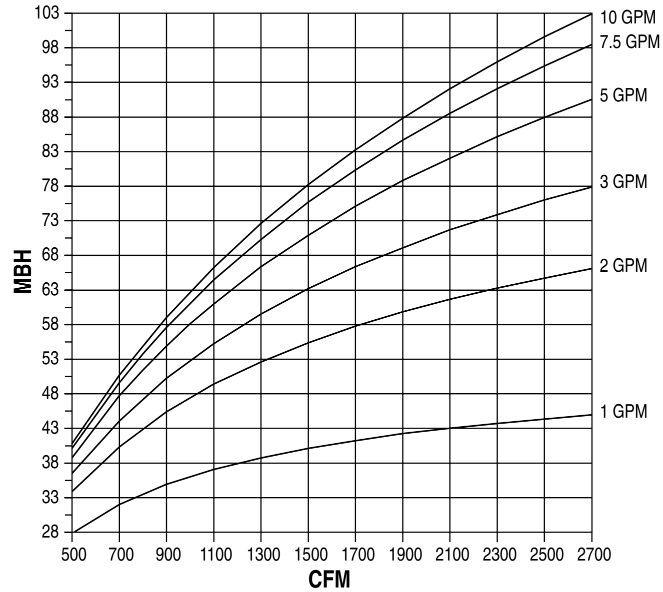
Model 30RW

Unit Size 14

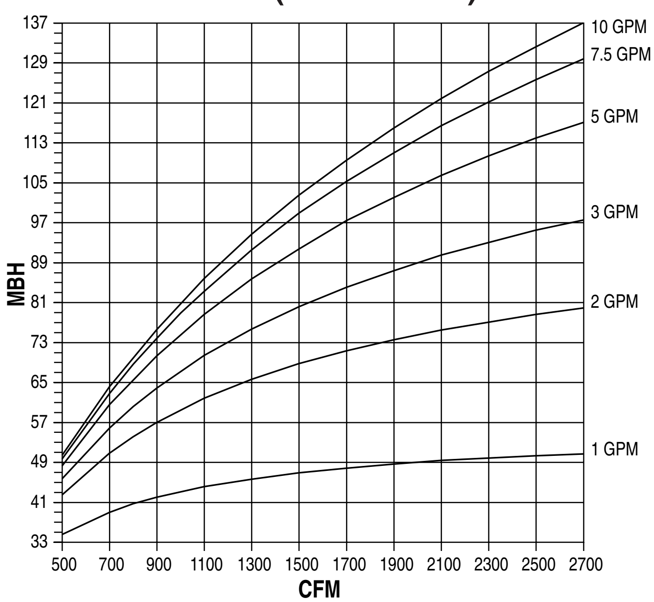
1 Row (single circuit)



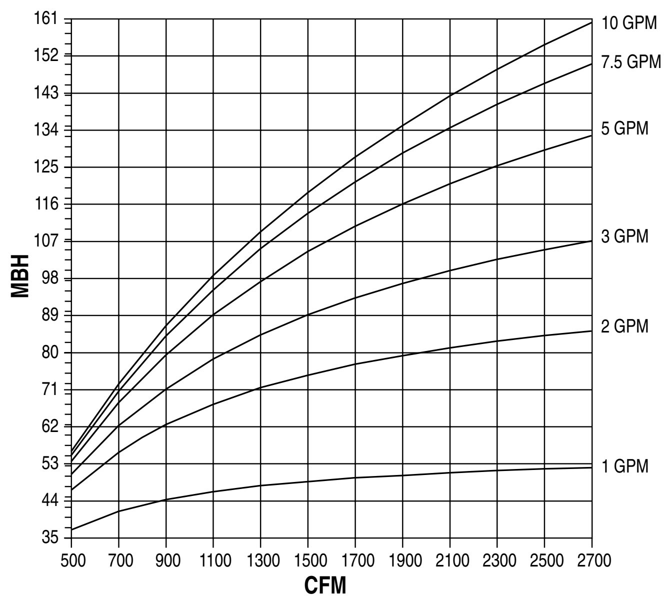
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. ATR = 927 x $\frac{\text{Mbh}}{\text{cfm}}$

4. Water Temp. Drop. WTD = 2.04 x $\frac{\text{Mbh}}{\text{GPM}}$

5. Connections: 1 Row 1/2" (13), 2, 3 and 4 row 7/8" (22); O.D. male solder.

Altitude Correction Factors:

Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Correction factors at other entering conditions:

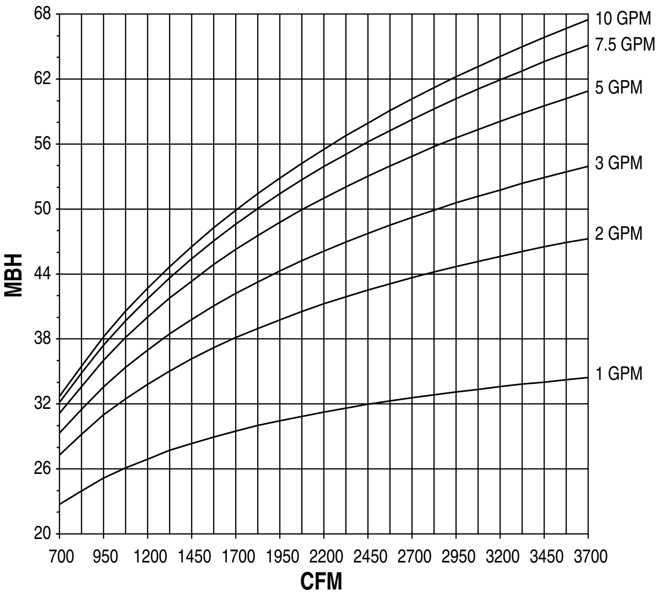
Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Performance Data • Hot Water Coil • Mbh Capacities

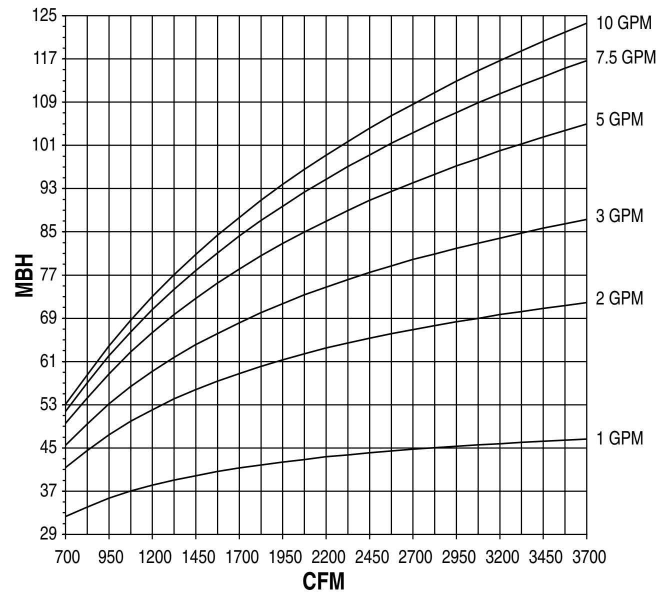
Model 30RW

Unit Size 16

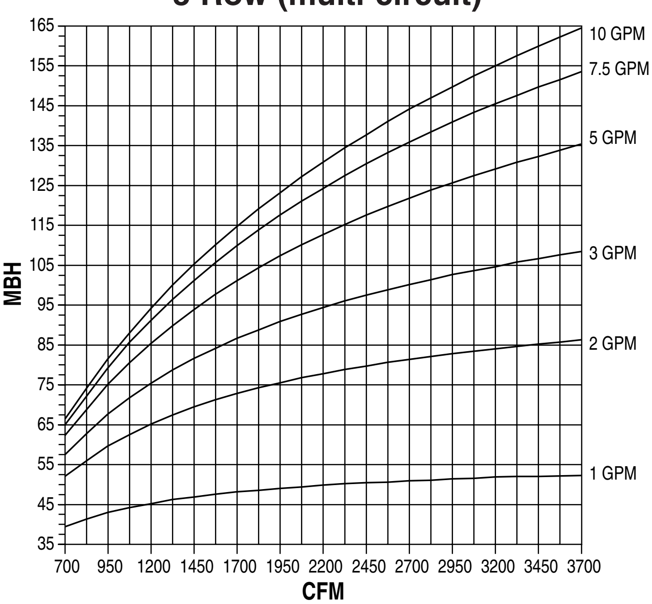
1 Row (single circuit)



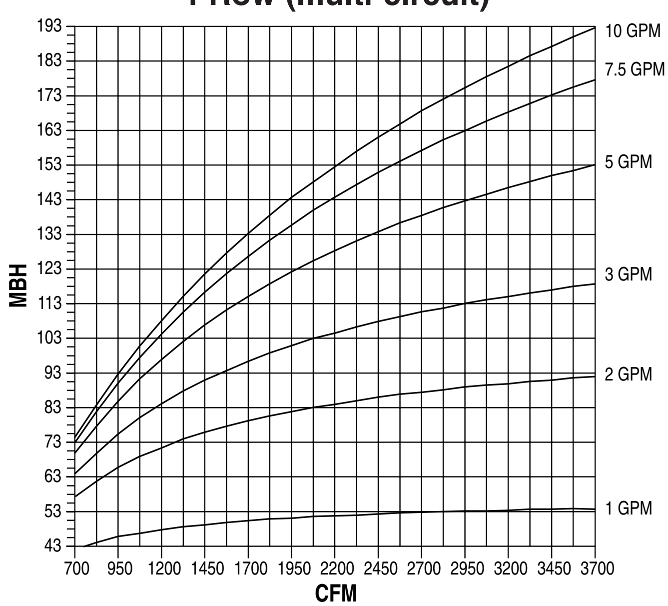
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. $ATR = 927 \times \frac{Mbh}{cfm}$

4. Water Temp. Drop. $WTD = 2.04 \times \frac{Mbh}{GPM}$

5. Connections: 1, 2, 3 and 4 row 7/8" (22); O.D. male solder.

Correction factors at other entering conditions:

Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Altitude Correction Factors:

Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

B

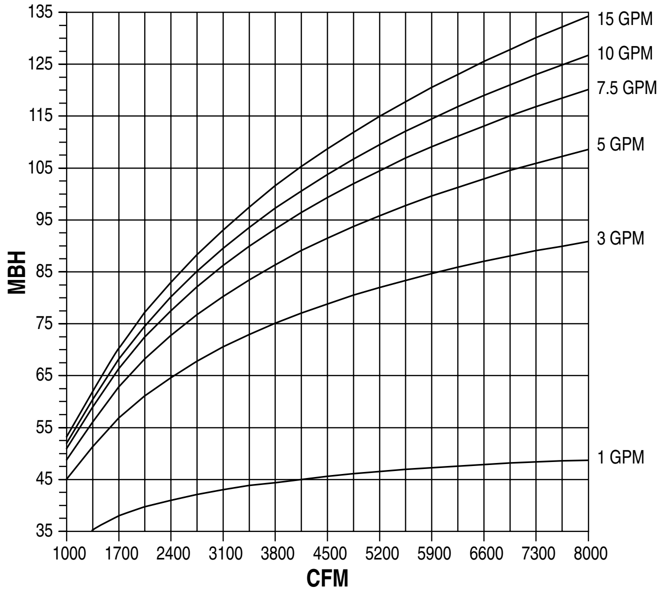
SINGLE DUCT TERMINAL UNITS

Performance Data • Hot Water Coil • Mbh Capacities

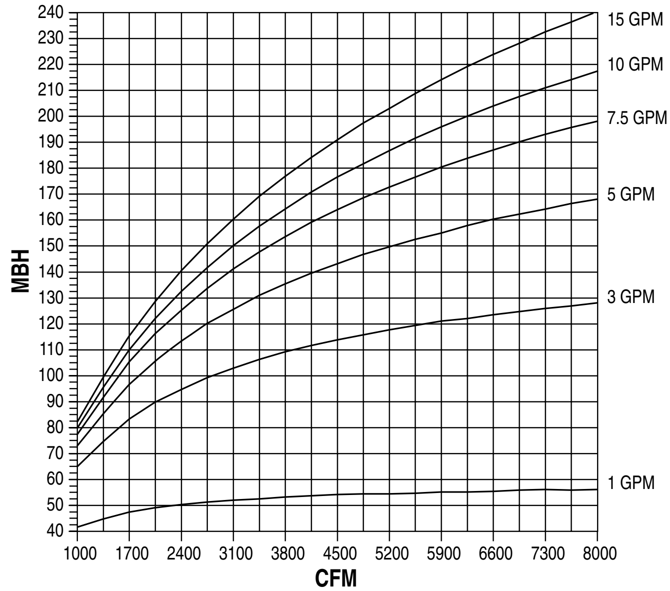
Model 30RW

Unit Size 24 x 16

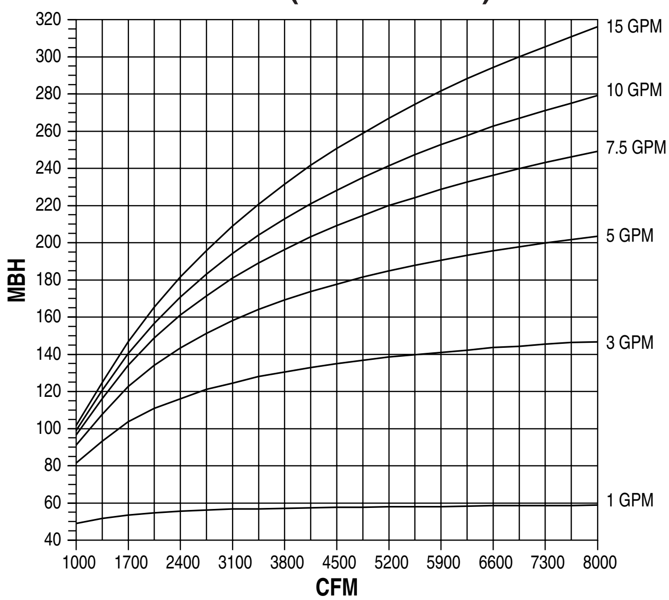
1 Row (single circuit)



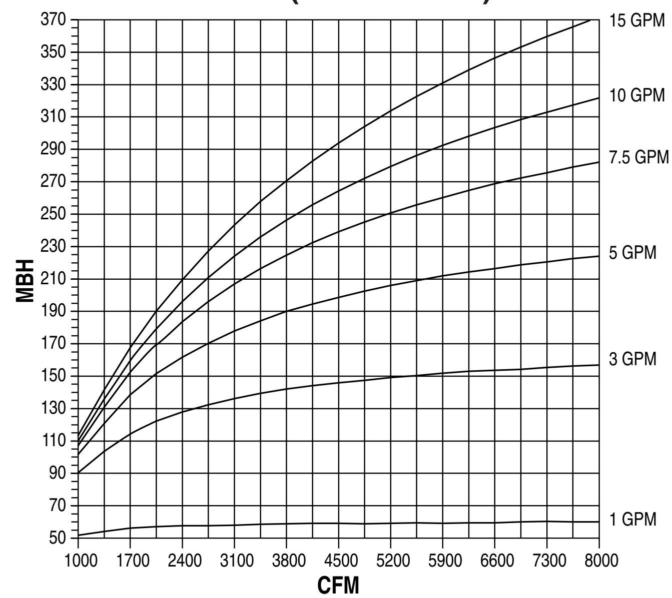
2 Row (multi-circuit)



3 Row (multi-circuit)



4 Row (multi-circuit)



Notes:

1. Capacities are in Mbh (thousands of Btu per hour).

2. Mbh values are based on a Δt (temperature difference) of 125°F between entering air and entering water. For other Δt's; multiply the Mbh values by the factors below.

3. Air Temperature Rise. ATR = 927 x $\frac{\text{Mbh}}{\text{cfm}}$

4. Water Temp. Drop. WTD = 2.04 x $\frac{\text{Mbh}}{\text{GPM}}$

5. Connections: 1 and 2 Row 7/8" (22), 3 and 4 row 1 3/8" (35); O.D. male solder.

Altitude Correction Factors:

Altitude (ft.)	Sensible Heat Factor
0	1.00
2000	0.94
3000	0.90
4000	0.87
5000	0.84
6000	0.81
7000	0.78

Correction factors at other entering conditions:

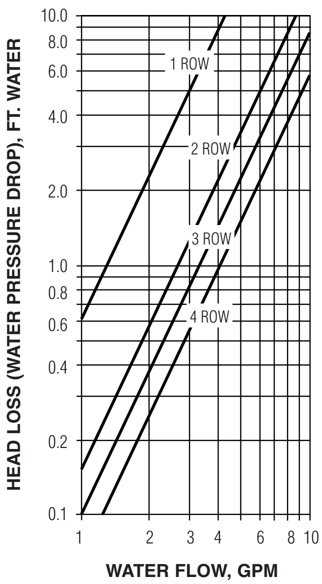
Δt °F	40	50	60	70	80	90	100	110	125	140	160	180
FACTOR	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.88	1.00	1.12	1.28	1.44

Performance Data • Hot Water Coil • Pressure Drop

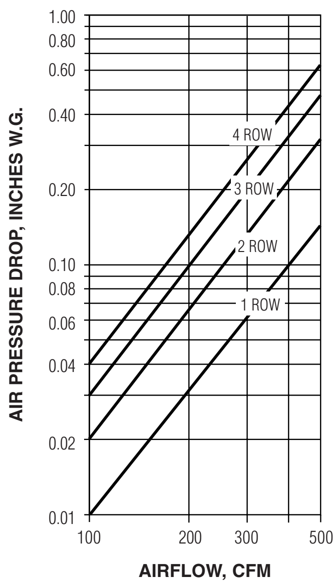
Model 30RW

Unit Size 4, 5 & 6

Water Pressure Drop

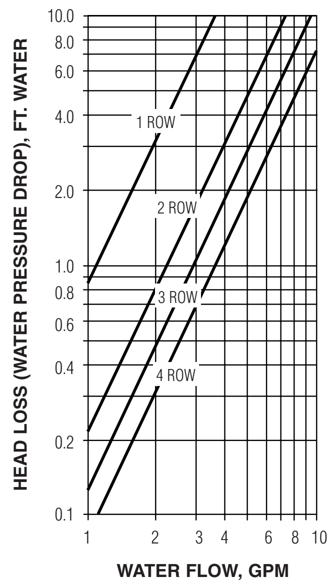


Air Pressure Drop

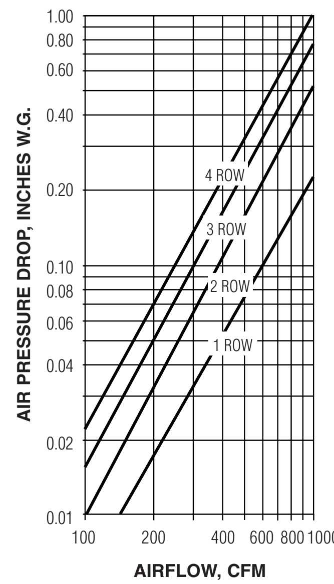


Unit Size 7 & 8

Water Pressure Drop

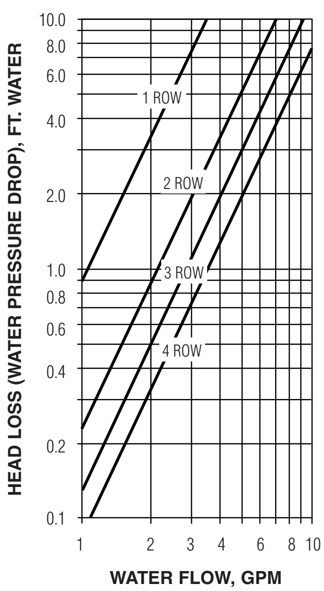


Air Pressure Drop

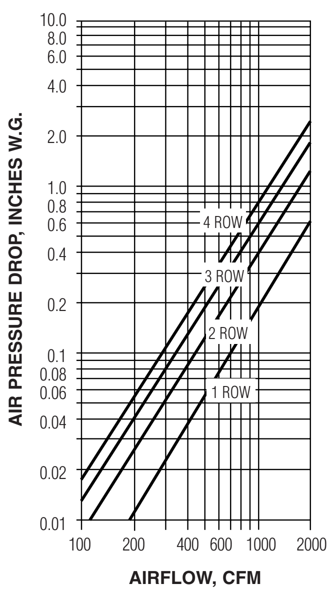


Unit Size 9 & 10

Water Pressure Drop

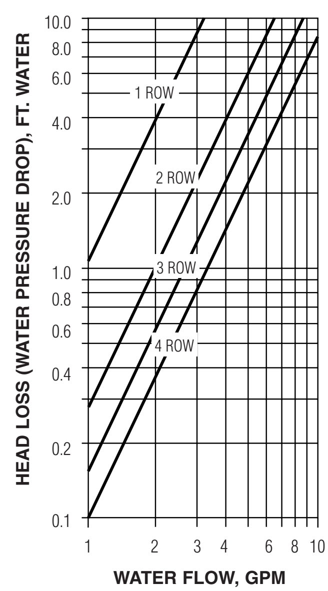


Air Pressure Drop

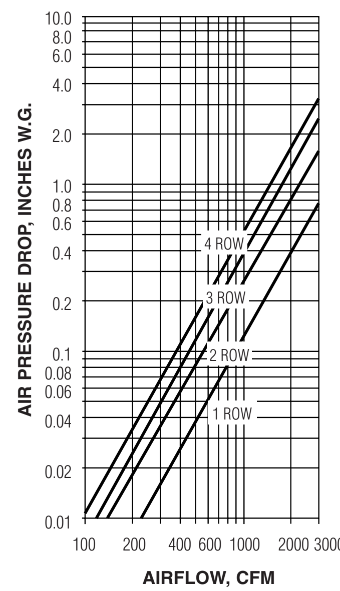


Unit Size 12

Water Pressure Drop



Air Pressure Drop



Metric Conversion Factors:

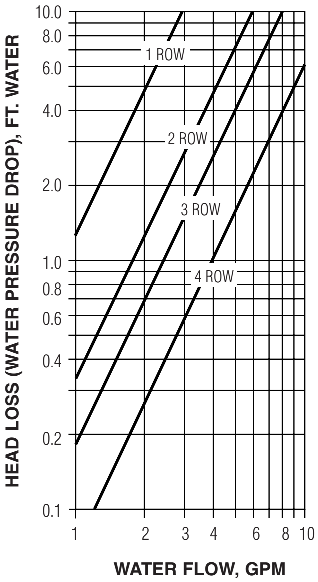
1. Water Flow (liters per second)
   l/s = gpm x 0.06309
2. Water Head Loss (kilopascals):
   kPa = ft. w.g. x 2.9837
3. Airflow Volume (liters per second)
   l/s = cfm x 0.472
4. Air Pressure Drop (Pascals):
   Pa = in. w.g. x 248.6
5. Heat (kilowatts):
   kW = Mbh x 0.293

Performance Data • Hot Water Coil • Pressure Drop

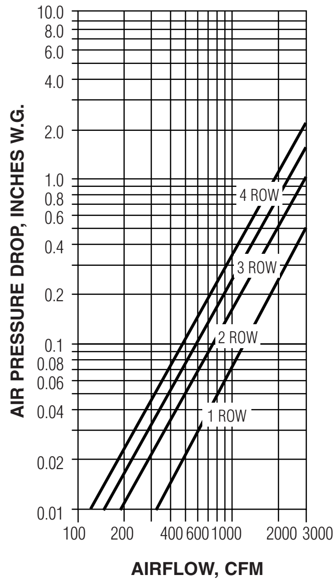
Model 30RW

Unit Size 14

Water Pressure Drop

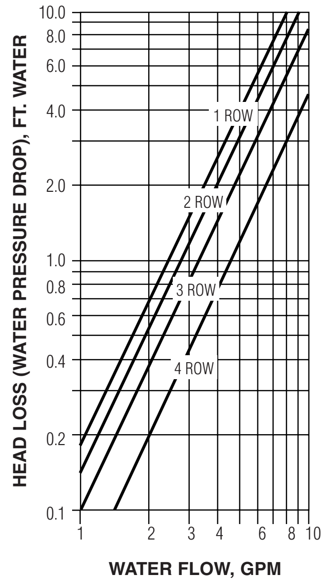


Air Pressure Drop

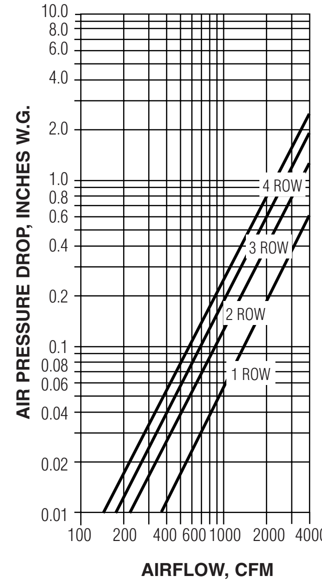


Unit Size 16

Water Pressure Drop

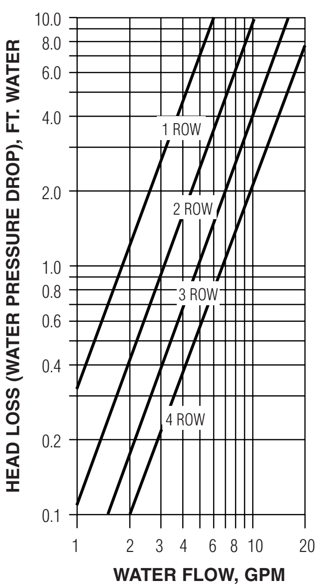


Air Pressure Drop

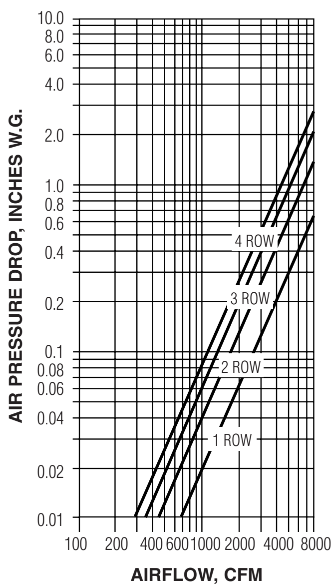


Unit Size 24 x 16

Water Pressure Drop



Air Pressure Drop



Metric Conversion Factors:

1. Water Flow (liters per second)
   l/s = gpm x 0.06309
2. Water Head Loss (kilopascals):
   kPa = ft. w.g. x 2.9837
3. Airflow Volume (liters per second)
   l/s = cfm x 0.472
4. Air Pressure Drop (Pascals):
   Pa = in. w.g. x 248.6
5. Heat (kilowatts):
   kW = Mbh x 0.293

Features, Selection, and Capacities

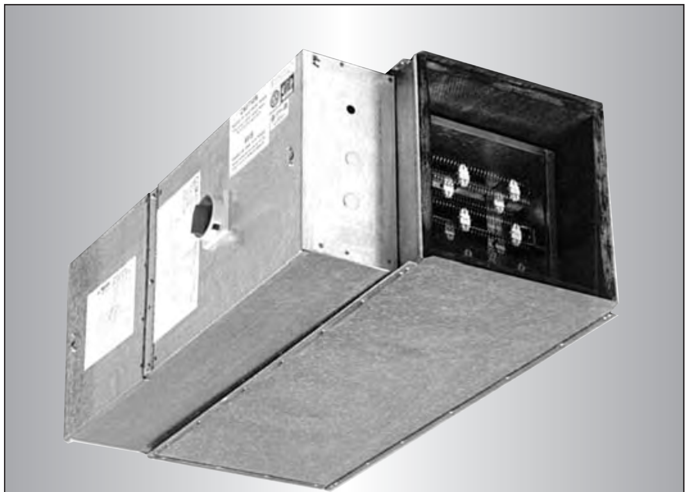
Electric Heating Coils

Nailor manufactures its own electric heating coils. They have been specifically designed and tested for use with variable air volume single duct terminal units.

All terminals with electric heat have been tested and ETL listed as an assembly, eliminating the need to mount coils a minimum of 36" (914) downstream or having to ship a bulky length of ductwork when coils are to be supplied mounted on the terminal.

Nailor electric coils are factory mounted as an integral part of the terminal unit in an insulated extended plenum section. Total length of the casing including heater terminal is only 31" (787), providing a compact, easy to handle unit. Freight costs are reduced. All terminals include a perforated diffuser plate on the damper discharge in order to minimize air stratification, avoid nuisance tripping of the thermal cut-outs and to maximize heat pick-up.

For dimensional data, see page B5.



Model 30RE

Standard Features:

- Primary auto-reset high limit thermal cut-out (one per coil in control circuit).
- Secondary manual reset high limit thermal cut-outs (one per element).
- Positive pressure airflow switch.
- Derated high quality nickel-chrome alloy heating elements.
- Magnetic or safety contactors and/or PE switches as required.
- Line terminal block.
- ETL Listed as an assembly.
- Hinged door control enclosure.
- High performance arrowhead insulators.
- Slip and drive discharge connection.

Options:

- Class 2, 24V control transformer.
- Mercury contactors.
- Toggle type disconnect switch.
- Door interlock disconnect switch.
- Power circuit fusing.
- Dust tight construction.
- SCR control.
- Class 'A' 80/20 wire.

Tested and approved to the following standards:

ANSI/UL 1996, 1st. ed.

CSA C22.2 No. 155-M1986.

Selection:

The adjacent table provides a general guideline as to the voltages, kilowatt range and number of stages available. Terminals are required to have a minimum of 0.5 kW per stage.

A minimum airflow of 70 cfm (33 l/s) per kW is required for any given terminal in order to avoid possible nuisance tripping of the thermal cutouts.

A good design will hold the discharge temperature between 90 and 105°F (32 to 40.5°C). Never select kW to exceed a discharge temperature of 120°F (49°C) maximum for comfort heating.

$$\Delta t \text{ (air temp. rise, °F)} = \frac{\text{kW x 3160}}{\text{cfm}}$$

The coils ranges listed are restricted to a maximum of 48 amps and do not require circuit fusing to meet NEC code requirements. Total pressure at the airflow switch should be at least 0.07" w.g. (17 Pa) to ensure correct coil operation and prevent cut-out due to insufficient airflow over the coil elements.

Electric Coil Limitations

Voltage/ Phase	kW Range	No. of Stages
120/1	0.1 – 3.0 1.9 – 5.7	1 2
208/1	0.1 – 5.2 3.2 – 9.9	1 2
240/1	0.1 – 6.0 6.1 – 11.5	1 2
277/1	0.1 – 6.9 4.2 – 13.0	1 2 or 3
480/1	0.1 – 6.0 6.1 – 12.0 6.1 – 18.0	1 or 2 2 3
208/3	0.1 – 9.0 0.1 – 17.3	1 2 or 3
240/3	0.1 – 10.4 0.1 – 20.0	1 2 or 3
480/3	0.1 – 20.8	1, 2 or 3
600/3	0.1 – 26.0	1, 2 or 3

Specification Text File

Suggested Specifications

Model Series 3000 Basic Unit

Section 15840

1.01 Furnish and install **Nailor Model 3000 Single Duct Variable Volume Terminal Units** of the sizes and capabilities as indicated on the drawings. Units shall be pressure independent with (pneumatic, analog electronic, DDC) controls. Units shall reset to any flow between 0 and the maximum cataloged airflow as allowed by the specific controller.

1.02 The entire terminal unit shall be designed and built as a single unit. The units shall be provided with a primary variable air volume damper that controls the air quantity in response to a (pneumatic, electric, analog electronic, or DDC) thermostat. The units shall also include all options such as electric or hot water heating coils, attenuators and access doors. The space limitations shall be reviewed carefully to insure that all units will fit into the space allowed.

1.03 Unit casing shall be 22 gauge galvanized steel with round or flat oval inlets with 5 ½" (140 mm) deep inlet duct dollar for field connection. Outlets shall be rectangular and configured for slip and drive connections. Casing leakage downstream of the damper shall not exceed 1% @ 1" w.g. (250 Pa). High side casing leakage shall not exceed 2% @ 3" w.g. (750 Pa).

1.04 Damper assemblies of 16 gauge galvanized steel shall be multiple opposed blade construction arranged to close at 45 degrees from full open to minimize air turbulence and provide near linear operation. Damper blades shall be fitted with flexible seals for tight closure and minimized sound generation. Damper blades shall be screwed through the shaft to insure that no slippage occurs. Blade shafts shall pivot on corrosion free Celcon® bearings. In the fully closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating at 3" w.g. (750 Pa) inlet static pressure as rated by ASHRAE Standard 130.

1.05 The terminal units shall be capable of operation as described herein with an inlet static pressure of 0.10" w.g. (24 Pa) from 0 to 2000 fpm. (The sequence of operations should be described here, if not part of the temperature controls specifications.) Each unit shall be complete with factory mounted (pneumatic, electric, analog electronic, or DDC) controls. Gauge tap ports shall be supplied in the piping between the flow pick up and the controller.

1.06 Each unit shall be constructed with single point electrical (and pneumatic) connections. All electrical components shall be ETL or UL listed or recognized and installed in accordance with the National Electrical Code. All electrical components shall be installed in a control box. The entire assembly shall be ETL listed and so labeled.

1.07 Each unit shall be internally lined with ¾" (19) dual density fiberglass insulation. Edges shall be sealed against airflow erosion. Units shall meet NFPA 90A and UL 181 standards.

1.08 All sound data shall be compiled in an independent laboratory and in accordance with the latest version of ARI Standard 880 and ANSI/ASHRAE Standard 130. All units shall be ARI certified and bear the ARI certification label.

The following specification (digital controls by Div. 17) is recommended where an independent laboratory test and performance verification is required.:

Single Duct VAV Terminal Units - Models 3000, 30RE and 30RW

Section 15840

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, and the following specification sections apply to all Work herein:

1. Section 15 - - - General.
2. Section 15 - - - Scope of Work.
3. Section 15 - - - Design Conditions.
4. Section 15 - - - Electric Motors and Controllers.
5. Section 15 - - - Access Doors and Color Coded Identification in General Construction.
6. Section 15 - - - Ductwork and Sheet Metal.
7. Section 15 - - - Testing, Balancing, and Adjusting.

1.02 SUMMARY

A. Furnish and install all air terminal units herein specified and as indicated on the Drawings.

1.03 REFERENCE STANDARDS

A. All air terminal units shall be designed, manufactured, and tested in accordance with the latest applicable industry standards including the following:

1. ANSI/ASHRAE Standard 130-96.
2. ARI Standard 880-98.
3. Underwriters Laboratories UL Standard 1995.
4. Underwriters Laboratories UL Standard 1996.

1.04 QUALITY ASSURANCE

A. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authority having jurisdiction, and suitable for its intended use on this Project. Space limitations shall be reviewed to ensure that the equipment will fit into the space allowed.

B. All equipment and material to be furnished and installed on this Project shall be run tested at the factory and results of that testing shall be tabulated and provided to the engineer when the equipment ships to the job site. See paragraph 2.03 G for specific requirements.

1.05 SUBMITTALS

A. The following submittal data shall be furnished according to the Conditions of the Construction Contract, Division 1 Specifications, and Section 15 - - - General and shall include but not be limited to:

1. Single Duct Variable Air Volume Terminal Units, complete with capacity data, test data, construction details, physical dimensions, electrical characteristics, etc.

1.06 ACOUSTICS

This acoustical specification describes sound power levels as tested to ARI 880 and ASHRAE 130.

A. Sound Power Acoustical Performance:

1. Discharge Noise: Maximum permissible sound power levels in octave bands of discharge sound through discharge ducts from terminal units operated at an inlet pressure of 1.0" w.g. and the maximum amount of air volume shown on the Project Mechanical Drawings leaving the terminal unit and entering the reverberant chamber shall be as follows:

Suggested Specifications

Single Duct VAV Terminal Units – Models 3000, 30RE and 30RW (continued)

Octave Band	NC-35	NC-40
2	67	71
3	64	69
4	67	72
5	66	71
6	67	72
7	67	72

Table 1. Maximum Discharge Sound Power Levels (dB re 10^{-12} Watts).

2. Radiated Noise: Maximum permissible radiated sound power levels in octave bands of radiated transmission from terminal units operated at an inlet pressure of 1.0" w.g. and the maximum scheduled air quantity in an installed condition over occupied spaces shall be as follows:

Octave Band	NC-35	NC-40
2	64	68
3	57	62
4	53	58
5	50	55
6	50	55
7	53	58

Table 2. Maximum Radiated Sound Power Levels (dB re 10^{-12} Watts).

1.07 WARRANTY

A. Manufacturer shall warrant equipment for one year from start up or 18 months from shipment.

PART 2 – PRODUCTS

2.01 UNAUTHORIZED MATERIALS

A. Materials and products required for the work of this section shall not contain asbestos, polychlorinated biphenyl's (PCB) or other hazardous materials identified by the Engineer or Owner.

2.02 ACCEPTABLE MANUFACTURERS

A. These Specifications set forth the minimum requirements for single duct VAV terminal units. If they comply with these Specifications, single duct VAV terminal units manufactured by one of the following manufacturers will be acceptable:

1. Nailor Industries.

2.03 SINGLE DUCT AIR VOLUME TERMINAL UNITS

A. Furnish and install single duct VAV terminal units as indicated on the Drawings. The units shall be designed and built as a single unit and provided with a primary variable air volume damper that controls the primary air quantity in response to a temperature control signal. The damper construction shall be rectangular with multiple opposed blades designed to operate on a 45° arc. Blades shall be 16 gauge galvanized steel, single thickness construction with heavy-duty gasket glued to the blades. Units shall be suitable for pressure independent operation with digital (DDC) controls. The units shall contain a damper assembly as described above and [electric or hot water] heating coils where scheduled and/or indicated on the Drawings. The space limitations shall be reviewed carefully to ensure all terminal units will fit into the space provided including National Electric Code clearances required in front of all panels containing electrical devices. Unit shall be fully lined with at least ¾" thick, dual density fiberglass insulation that complies with NFPA 90 for fire and smoke resistivity and UL 181 for erosion. Any exposed edges shall be coated with approved sealant to prevent erosion. Casing leakage shall not exceed 2% of terminal rated airflow at 1.5" w.g. interior casing pressure. All high side casing joints shall be sealed with approved sealant and high side casing and damper leakage shall not exceed 2% of terminal rated airflow at 3" w.g.. Unit casing shall be minimum 22 gauge, galvanized steel with round or flat oval inlets and rectangular outlets.

Terminal unit manufacturer shall provide flow curves for the primary air sensor clearly labeled and permanently attached on the bottom or side of each terminal unit. At an inlet velocity of 2000 fpm, the differential static pressure for any unit size, 4 – 16 shall not exceed 0.10" w.g. for the basic unit.

The unit shall include all equipment and controls as required to provide a complete and operating system with at least the following:

1. Single point electrical connection for the voltage/phase as scheduled in the Contract Documents. See Electrical Drawings for power feeder arrangements. Units, heaters and/or transformers shall be rated at [**24, 120 or 277**] single phase as scheduled in the contract documents.

2. A door interlocking disconnect switch for units with electric heaters. All disconnecting devices shall be sized and located as required to disconnect all ungrounded power conductors to all internal electrical components.

3. Individual overcurrent protection devices as required to protect individual units and transformers.

4. The primary inlet shall be equipped with an inlet collar sized to fit the primary duct size shown on the Drawings. The inlet collar shall provide at least a 5 ½" length with a ⅛" high raised single or double bead located approximately 1 ½" from the inlet connection. The primary airflow (cfm) settings shall be clearly and permanently marked on the bottom of the unit along with the terminal unit identification numbers. Each terminal unit shall incorporate a Nailor Diamond Flow sensor with four pick up points on each side to insure that with typical duct turbulence, the controller fidelity shall be +/- 5% of set volume even with a hard 90° elbow at the inlet. Static variation of 0.5" w.g. to 6.0" w.g. shall not affect the flow reading. Provide a transformer with 24 volt AC secondary to provide power for the unit's controls and the Division 17 controls. The VAV terminal unit manufacturer and the Division 17 Building Controls Subcontractor shall verify compatibility of the multipoint flow sensors with transducer and DDC microprocessor furnished under Division 17 prior to bidding this Project.

5. The outlets shall be rectangular and suitable for slip and drive duct connections. Casing shall have mounting area for hanging by sheet metal straps from a concrete slab or shall be supplied with angle brackets for mounting on all thread rods.

6. The terminal unit shall be listed in accordance with UL 1995 as a composite assembly consisting of the terminal unit with or without the electric or hot water heating device.

7. Heating Options [**Insert Electric or Hot Water Coil specification**]

8. The terminal unit shall be capable of operation as described herein with inlet static pressure of .10" w.g. at 2000 fpm of primary air. [The sequence of operation should be described here if not part of the temperature controls specifications.] The primary air damper shall be of a design that shall vary primary air supply in response to electronic signal. Primary air damper close-off leakage shall not exceed 2% of the maximum ARI rated primary air cfm as shown in the manufacturer's catalog for each size terminal unit at 3" w.g. inlet static pressure.

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Single Duct VAV Terminal Units – Models 3000, 30RE and 30RW (continued)

Submit damper leakage test data to the Engineer for review. Damper connection to the operating shaft shall be a positive mechanical through bolt connection to prevent any slippage. Provide non-lubricated Celcon® or bronze oilite bearings for the damper shaft. The primary air damper in conjunction with the DDC microprocessor furnished under Division 17 shall be selected to provide accurate control at low primary air velocities. The total deviation in primary airflow shall not exceed ± 5% of the primary air cfm corresponding to a 300 fpm air velocity through the primary air damper.

9. Provide duct inlet and outlet connections as indicated on the Drawings.

10. The casing construction shall be a minimum 22 gauge galvanized sheet metal lined with a minimum ¾" thick, dual density, minimum 1 ½ lb. density fiberglass insulation. The terminal units shall not exceed the depth indicated on the Drawings. Mounting connections for hanging the unit by sheet metal straps shall be clearly identified on the housing. All components, including all controls and wiring, shall be factory installed, except the room sensor or thermostat. No field assembly will be allowed. The unit shall be complete and suitable to accept the following field connections:

a. Primary duct.

b. Secondary duct.

c. Single point electrical connection. See Drawings for control box locations required for each terminal unit.

d. DDC controller control signals and wiring.

e. Room sensor connection.

B. The terminal unit shall be capable of operating throughout the full cataloged primary airflow range with an inlet static pressure of 0.10" w.g. or less. See the schedules on the Contract Documents for static pressure requirements.

C. The control sequence shall be as specified in Division 17 (DDC by others).

D. Each size of each terminal unit to be used on this Project shall be completely laboratory tested for air performance and acoustics. The acceptability of the independent testing laboratory is subject to review by the Owner, Project Acoustical Consultant, and the Engineer. The terminal unit manufacturer shall submit complete details, brochures, instrumentation information, etc., for review. The laboratory shall be capable of properly testing the largest terminal unit on this Project. See paragraph 1.06 A for acoustic guidelines. The air volume listed on the Drawings for the terminal units shall be supplied for the test with the primary cold duct supplying 55°F air.

Operation of the flow control device shall be demonstrated to repeat under all conditions of operation of the primary air damper or valve and duct pressures as specified hereinbefore. If the single duct VAV terminal unit manufacturer has conducted the hereinbefore specified air performance and has demonstrated to the Engineer and Owner compliance with the specified criteria the previous testing will be accepted and will not need to be repeated. See Section 15 - - - titled "Design Conditions".

E. After the manufacturer has submitted certified copies of the laboratory air performance and acoustical performance test results to the Engineer, the Engineer may witness the laboratory tests to verify compliance with the Specifications. See Section 15 - - - for additional submittal and certification requirements.

F. All terminal units shall be identified on the bottom of the unit (minimum ½" high letters) and on the shipping carton, with the floor and box number that identifies it along with the CFM settings. Every unit shall have a unique number combination that matches numbers on the contractor's coordination drawings as to its location and capacity and is coordinated with the DDC controller and the Division 17 Building Control System submittal drawings.

G. The terminal unit manufacturer will verify the operation of each single duct VAV terminal unit before shipment. Testing shall include at least the following:

1. Apply electric power to the unit.

2. Energize the electric heat through the electric heating coil relay. Verify the signal with a voltmeter and ammeter to ensure proper heater operation.

3. De-energize the electric heating coil and verify the signal with a volt-meter to ensure the heater is de-energized.

4. If DDC controls are mounted, disconnect the primary air damper actuator from the DDC terminal unit controller. Provide separate power source to the actuator to verify operation and rotation of damper. Drive the damper closed and verify by feel or observation that damper is driven fully closed. Return primary air damper to the fully open position prior to shipment.

5. Provide a written inspection report for each terminal unit signed and dated by the factory test technician verifying all terminal unit wiring and testing has been performed per the manufacturer's testing and quality assurance requirements.

Options

Electric Heat

Insert following paragraphs:

7 (A). Single Duct VAV Terminal Unit Electric Heating Coils:

a. Electric heating coils shall consist of open coils of high grade nickel and chromium resistance wire or nichrome elements and insulated with ceramic insulators in galvanized steel brackets, supported in heavy gauge galvanized steel frames. Each unit employing an electric heating coil shall be constructed and installed in accordance with the requirements of the local authorities and shall be UL or ETL listed specifically with the heater as a component of the terminal unit device.

b. Coils shall have the capacities indicated in Contract Documents. Coils rated up through 5 kW shall be single phase, 277 volt, 60 hertz and coils larger than 5 kW shall be three phase, four wire, 480Y/277 volt, 60 hertz. Electric heating coils up to and including 4 kW shall be single stage. Electric coils above 4 kW shall be two stage.

c. Terminal bolts, nuts and washers shall be of corrosion resistant materials. Coils shall be constructed so the installation may be accomplished in accordance with the provisions of the National Electrical Code, for zero clearance. Coils shall be given a 2000 volt dielectric test at the factory.

d. Automatic reset thermal cutouts shall be furnished for primary protection with manually resettable limit switches in power circuits for secondary protection. Both devices shall be serviceable through terminal box without removing heating element from the terminal device. The air pressure safety cutout pickup probe shall be remotely mounted near the volume control damper for maximum fidelity.

e. Heating coils shall have a terminal box and cover, with quiet type built-in magnetic step controlled contactors for each circuit, branch circuit fusing for each branch circuit on heaters over 48 amps per the NEC, and an air flow safety interlock switch for installation in the heater control enclosure. Contactors mounted in

B SINGLE DUCT TERMINAL UNITS

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terminal units that are located above the ceiling in tenant occupied spaces shall be mercury step type. Provide a 120 or 24 volt control power transformer with an integral or separately mounted primary and/or secondary overcurrent protection device in accordance with NEC requirements.

f. All wiring of built-in devices shall be brought to clearly marked terminal strips. A complete wiring diagram shall be permanently attached to the heating coil panel cover.

g. Electric heating coils shall be designed for operation with the DDC controller and control system as specified in the Division 17 Specifications.

h. Electric heating coils and the associated control panels shall be constructed as a component of the entire terminal unit and mounted in the discharge attenuator downstream of the terminal unit. The resulting unit, including the heater and the VAV damper shall be no longer than 31 ½" in length.

i. The manufacturer shall prove adequate even airflow over the electric heating coil under the full range of airflow scheduled (minimum to maximum) to prevent uneven heating of the electric coils. The terminal device shall be listed in accordance with UL 1995 and UL 1996 as a composite assembly consisting of the VAV terminal device and the electric heating device.

j. Shop Drawings shall be submitted for review as specified in Section 15 - - -. These Shop Drawings shall indicate specifically the exact construction, materials, internal wiring, NEC working clearances, etc., of the terminal units and electric heating coils to be furnished under these Specifications.

Hot Water Heating Coil
Insert following paragraphs:

7 (B). Single Duct VAV Terminal Device Hot Water Heating Coils

a. Terminal unit hot water heating coils shall be mounted on the discharge of the unit with slip and drive connections. Provide an access door or panel on the bottom of the attenuator section of the terminal unit for servicing and cleaning the unit.

b. Hot water heating coils shall be constructed with copper tubes and aluminum plate fins. Coils shall have a maximum of 10 fins per inch. Supply and return connections shall be on the same end of the coil. Fins shall be bonded to the tubes by means of mechanical expansion of the tubes. Fins shall be at least .0045" thick.

c. Coils shall have galvanized steel casings on all sides no lighter than 22 gauge.

d. Tubes shall be ½" O.D. and shall be spaced approximately 1 ¼" apart, and shall have a minimum wall thickness of 0.016". Hot water shall be equally distributed through all tubes by the use of orifices or header design. Water velocity in the tubes shall not exceed five feet per second. The water pressure drop through the coil shall not exceed 10 feet. Heating coil face velocities shall not exceed the maximum face velocity indicated in the schedules on the Contract Documents.

e. Coils shall be tested by air pressure under water. Coils shall be tested at 300 psig static pressure for 250 psig working pressure or as indicated on the Contract Documents.

f. Coil ratings, calculations, and selection data shall be in accordance with the applicable ARI Standards and shall be submitted with the Shop Drawings.

Control Specifications (select one)
Pneumatic Controls (Pressure Independent)

1. The terminal unit manufacturer shall provide factory mounted pressure independent controls which can be reset to modulate airflow between zero and the maximum cataloged capacity. Maximum airflow limits or mechanical volume regulators are not acceptable.
2. Each unit shall be supplied with a **Nailor** Diamond flow sensor with four pick-up points on each side to ensure that controller fidelity shall be within ± 5% of set volume under various same size duct inlet conditions and inlet static variation of 0.05" – 6.0" w.g. (12 – 1500 Pa). The sensor shall amplify the sensed velocity pressure and provide a minimum differential pressure of 0.03" w.g. (7.46 Pa) at 500 fpm (2.54 m/s) inlet velocity. Flow measuring taps shall be furnished with each terminal.
3. The reset volume flow controller shall have a constant reset span regardless of the minimum and maximum airflow settings selected. Reset span shall be adjustable from a minimum of 5 psi up to a maximum of 10 psi. Reset start point shall be adjustable from 3 – 10 psi. Controller air bleed off through the flow sensor is not acceptable. Controller shall be field convertible for direct or reverse acting. The compressed air consumption of the controller shall not exceed 1.0 SCFH at 20 psi. Acceptable controller is Kreuter CSC-3011 or equal.
4. Reset volume controller shall be factory calibrated and set for the scheduled maximum and minimum airflow settings. Flow measuring taps and flow charts shall be supplied with each terminal unit for field balancing and adjustment of airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type. Each terminal shall be supplied with a label showing unit type, size, tag location, minimum and maximum airflow settings and control sequence number. Pneumatic spring return actuators shall be provided and factory mounted by the terminal unit manufacturer.
5. Reset volume controller shall be factory set and calibrated for operation with a direct/reverse (select one) acting room thermostat.

The actuator/damper connection shall be factory mounted to fail to a normally open/closed (select one) position upon loss of control main air pressure.

Analog Electronic Controls (Pressure Independent)

1. The terminal unit manufacturer shall provide factory mounted pressure independent analog electronic controls which can be reset to modulate airflow between zero and the maximum cataloged capacity. Each terminal shall be equipped with a label showing unit type, size, tag location, minimum and maximum airflow settings and control sequence number. Controls shall be factory calibrated and set for the scheduled minimum and maximum flow rates.
2. Each unit shall be supplied with a **Nailor** Diamond flow sensor with four pick-up points on each side to ensure that controller fidelity shall be within ± 5% of set volume under various same size duct inlet conditions and inlet static variation of 0.05" – 6.0" w.g. (12 – 1500 Pa). The sensor shall amplify the sensed velocity pressure and provide a minimum differential pressure of 0.03" w.g. (7.46 Pa) at 500 fpm (2.54 m/s) inlet velocity. Flow measuring taps shall be furnished with each terminal. All pneumatic tubing shall be UL listed for fire retardant (FR) type.
3. The velocity controller shall have a constant 2° F (1.11°C) reset span regardless of minimum and maximum airflow limits. It shall include an onboard flow-through transducer utilizing twin platinum

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resistance temperature detectors and shall be capable of controlling a velocity set point from 0 – 3300 fpm with an accuracy of 3%. The controller shall allow all airflow adjustments to be made from the matching room thermostat. The thermostat shall be furnished by the terminal unit manufacturer and provide a live velocity readout and feature semi-concealed set point slider(s) and set point indicator(s) and thermometer with a fahrenheit (centigrade optional) scale plate.

4. The terminal shall have a 24 VAC combination controller/actuator single assembly. The actuator shall be of a direct drive design and provide a minimum torque of 50 in. lbs. (5.6 Nm). The actuator shall be of the floating reversible type and include a magnetic clutch, adjustable stops and a gear disengagement button. A tri-color LED shall indicate green for opening, red for closing and white for satisfied damper positions. Power consumption of the controller/actuator shall not exceed 4 VA.

5. The terminal manufacturer shall provide a Class 2, 24 VAC control transformer with internal current limiting protection. All controls shall be installed in an approved NEMA 1 enclosure.

Digital (DDC) Controls (Pressure Independent) Factory Mounting Procedure

1. The terminals shall be equipped with pressure independent direct digital controls supplied by the control contractor under the automatic temperature controls Division 17 and mounted by the terminal unit manufacturer. The control contractor shall, in addition to sending the controls to the terminal unit manufacturer, provide technical data sheets for all components to be mounted, including dimensional data, mounting hardware and method, as well as application specific wiring and piping diagrams for each terminal type as depicted on the schedules and mechanical drawings.

2. Controls shall be compatible with the pneumatic 'Diamond Flow' multi-point averaging flow sensor supplied by the terminal manufacturer. The sensor shall have four pick-up points on each side to ensure that controller fidelity shall be ± 5% of set volume with any typical air turbulence in the duct and any typical flex inlet condition and with an inlet static variation of 0.05" w.g. to 6.0" w.g. (12 – 1500 Pa). The sensor shall amplify the sensed velocity pressure and provide a minimum differential pressure of 0.03" w.g. (7.46 Pa) at 500 fpm (2.54 m/s) inlet velocity. Flow measuring taps and flow curves shall be furnished with each terminal.

3. Controls shall be configured and field calibrated in the field by the control contractor after terminal installation has been completed. Pneumatic tubing shall be UL Listed fire retardant (FR) type. Each terminal shall be supplied with a label showing unit type, size and tag location.

4. The terminal manufacturer shall provide a Class 2, 24 VAC control transformer with internal current limiting protection and disconnect switch. All controls shall be installed in an approved NEMA 1 enclosure supplied and installed by the terminal manufacturer.

Notes: