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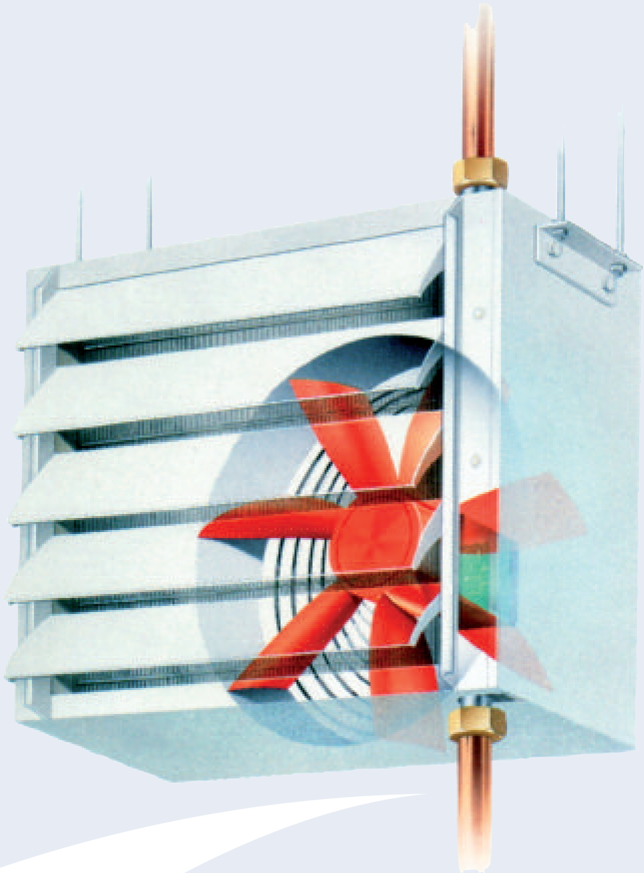
CLIMATE SOLUTIONS



Uniflow™

INDUSTRIAL & COMMERCIAL LARGE-SPACE HEATERS

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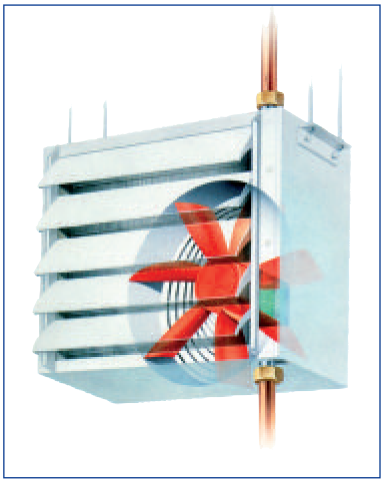

The Concept

The latest Uniflow range from Biddle provides a flexible solution to the problem of controllable, cost-effective heating in large space applications.

Available for fast delivery, Uniflow unit heaters can be installed in the widest variety of locations from factories and warehouses to exhibition halls and showrooms. The two discharge options - downward or horizontal - meet all likely space configurations. Downward discharge is particularly suited to complex areas where obstacles might impede airflows from a horizontal system. The horizontal louvred discharge units are, however, ideal where directional heating, for example along production lines, is required.

Uniflow technology offers the choice of operating on low, medium or high pressure hot water or steam. This means that most existing factory or commercial units need no major or expensive capital installation before an effective heating solution can be found.

Simple fixing of the compact, fully integrated units requires no special equipment.

Comprehensive Range

Five sizes with one, two or three row heating elements depending on performance requirement and heating medium.

Flexibility to suit all applications

Directional heating or full-space comfort - depending on space configuration - with variable mounting heights.

Manufactured Quality

Designed for long, maintenance-free service and manufactured in Biddle's ISO 9001 production unit, the fully integrated steel-cased units incorporate sealed-bearing motors and specially designed, high-efficiency serpentine coils. A unique feature of the motor technology is that the single speed motor can be converted to two speed operation by the use of an additional delta/star changeover switch fitted in the control circuit.

Technical Specification

Detailed technical specifications - including emissions/airflow rates; water current/friction; mounting height and throws; and electrical data are included in the following pages.

Model References

The model reference comprises a code which refines all the information required for identification and manufacture.

Example:

Series reference: — **7 H 24 2 N 3** — Electric supply: 1 = 240 Volt 1 Phase 50 Hz
3 = 415 Volt 3 Phase 50 Hz
0 = Other than standard voltages etc.

Type: H = Horizontal discharge
D = Downward discharge

Unit Size: 5 basic sizes
13, 16, 18, 21, 24

Coil depth: 1 = 1 Row
2 = 2 Row
3 = 3 Row

Fan speed: N = Normal speed
L = Low speed

Application

There are no hard and fast rules governing the selection of unit types; accepted engineering principles coupled with common sense and sound judgement being the best guide. Assuming that there are no special requirements regarding mounting heights, the first consideration is the usage of the building. It is possible to heat a building with a large number of small units or a small number of large units, both arrangements satisfying the heat requirement. The higher rate or recirculation with the larger number of units will result in better air diffusion and more even temperatures. This application is ideal for buildings having a high occupancy. However, the smaller number of units will be more economical. It is obvious that some compromise has to be achieved.

The choice between horizontal and downward discharge units is often decided by the mounting height restrictions. The downward discharge can be mounted at higher levels than the equivalent horizontal discharge unit. Downward discharge units are quite useful in projecting heat down into occupied areas regardless of obstacles which would impede the flow of air from a horizontal unit. To reduce stratification within the building, downward discharge units, can be provided without batteries for use as warm air recirculators. Horizontal discharge units are ideal for creating a flow of warm air along exposed walls or for discharging down narrow aisles or production lines, as well as for blanketing doorways and points of high heat loss.

Fans/Motors:

Fans are direct driven by squirrel cage, asynchronous induction aluminium motors available for either single or three phase electric supply. Motor enclosures are rated at IP55.
Windings are class ‘F’ specification. Motors have sealed for life ball bearings requiring no maintenance.
All motors are supplied with built-in thermal protection overload contacts (TP). These must be connected to the control circuit of the main contractor as indicated in the wiring diagrams.
The motor rotors and fans are dynamically balanced per ISO 1940. Fan blades are of epoxy painted aluminium.
Fan/motors are supported with a wire guard grille with protection against finger insertion per BS3042. The fan plate is manufactured from epoxy painted steel having a ‘bell mouth’ inlet.

Three phase motors are dual speed, the normal and low speeds being achieved by wiring the motor in Delta or Star mode respectively. Two speed operation can be achieved by incorporating a change-over switch in the circuit as shown in the wiring diagrams.

Single phase motors are single speed only with separate motors for either normal or low speed.

Explosion proof (increased safety or flame proof) motors can be provided as an alternative for 3 phase electric supply only. These motors are for ignition groups G1, G2 and G3, according to prescription VDE 0171.

Specification

Casing:

‘H’ Type: The casing is manufactured from zinc electro-plated sheet steel rigidly formed to prevent distortion. Angle supports are drilled for simple attachment to suspension rods. Individually adjusted air deflector louvres are provided on the discharge as standard.

‘D’ Type: Zinc electro-plated sheet steel casing encloses all working parts. The diffuser assembly is hinged to give access to the fan and motor. Angle supports are drilled for simple attachment to suspension rods. An eight bladed adjustable diffuser is provided for controlled diffusion of the heated air.

Options: Both types can be provided with a spigot suitable for connection of duct-work to the intake. The ‘H’ type can have a spigotted outlet in lieu of the louvres.

Finish:

Units are finished in White, epoxy powder paint to RAL 9010.

Elements:

Specially designed, high efficiency, serpentined coils are fitted to each unit. The coils comprise aluminium fins with spacer collars mechanically bonded to copper primary tubes by an expansion process which provides a high rate of heat transfer coupled with long life. The primary tubes are brazed into steel headers terminating in 11/2" BSP male threads. Flanged connections can be provided as an alternative extra. All coils are tested to 30bar (435psi) air under water, and suitable for a working pressure of: 15bar with LTHW <95°C, 12bar with MTHW 95°C-135°C, 10bar with HTHW >135°C, 8bar with Steam. With steam units we recommend the installer fits a means of isolating the steam when fans are off.

Note:

Size 13 units now have 1" BSP male threads.

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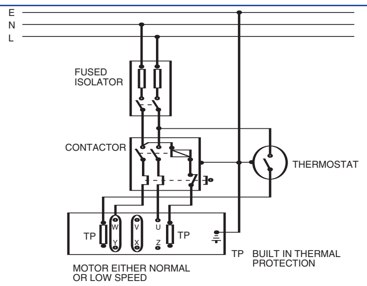
Electrical Data

3 Phase electric supply			
Model No. 3 Phase	Motor rating kW	FLC Amps	Nominal speed rpm
7-13-L3(Y)	0.12	0.22	1200
7-13-N3(Δ)	0.20	0.46	1390
7-16-L3(Y)	0.12	0.22	1060
7-16-N3(Δ)	0.20	0.47	1340
7-18-L3(Y)	0.21	0.39	1075
7-18-N3(Δ)	0.32	0.73	1320
7-21-L3(Y)	0.31	0.54	930
7-21-N3(Δ)	0.50	1.03	1270
7-24-L3(Y)	0.45	0.85	1040
7-24-N3(Δ)	0.66	1.55	1350

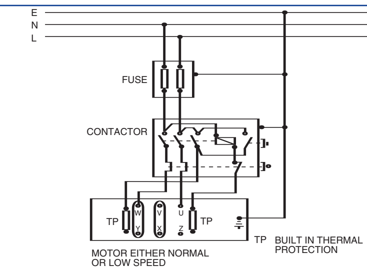
1 Phase electric supply			
Model No. 1 Phase	Motor rating kW	FLC Amps	Nominal speed rpm
7-13-L1	0.07	0.37	850
7-13-N1	0.15	0.79	1385
7-16-L1	0.09	0.49	900
7-16-N1	0.22	1.05	1360
7-18-L1	0.11	0.56	790
7-18-N1	0.34	1.64	1310
7-21-L1	0.22	1.15	870
7-21-N1	0.48	2.30	1276
7-24-L1	0.29	1.60	885
7-24-N1	0.65	3.02	1270

Full model Number 7 - 13 - L1
Insert H or D
Insert 1, 2 or 3 Rows

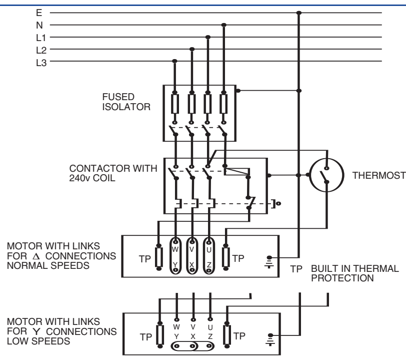
NOTE:
When 3 phase motors are used in the dual speed (ΔY) mode, the contactor overloads should be sized as for normal speed rating.
Suggested Wiring Diagrams.



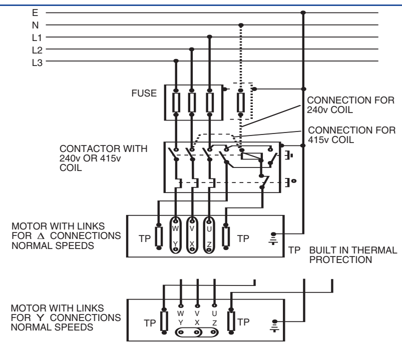
1 Phase Thermostat On/Off Control. Single Speed Only



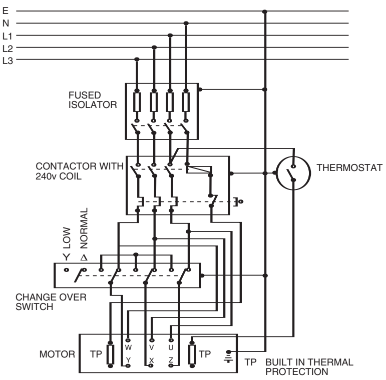
1 Phase Manual Control Single Speed Only



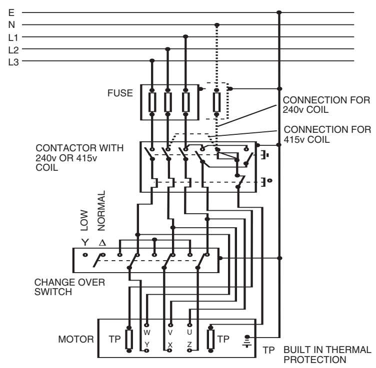
3 Phase Thermostat On/Off Control. Single Speed Operation



3 Phase Manual Control Single Speed Operation

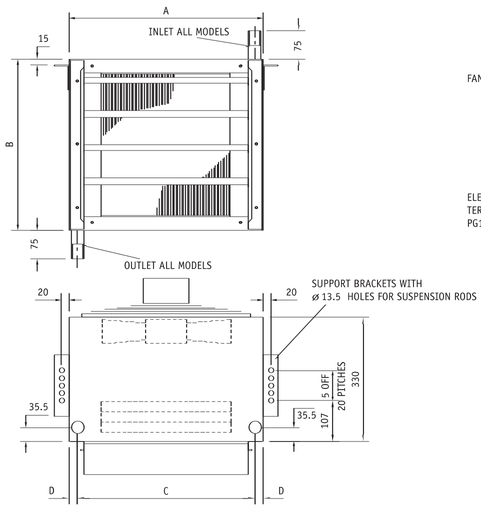


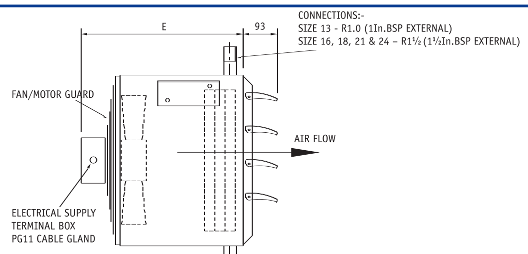
3 Phase Thermostat On/Off Control With Manual Speed Change



3 Phase Manual Control With Manual Speed Change

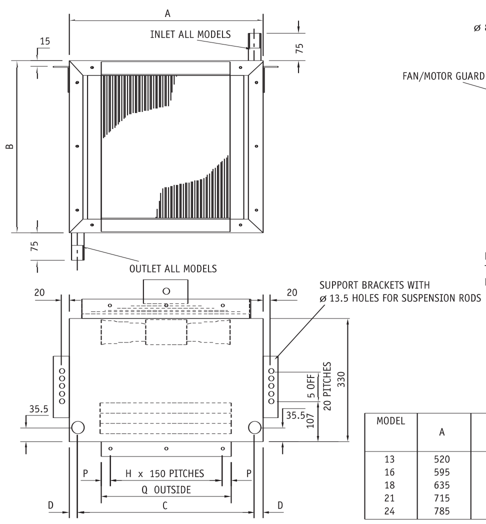
General Arrangement Drawings

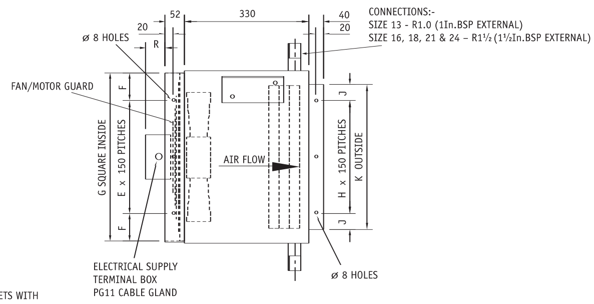




Horizontal discharge, recirculated air

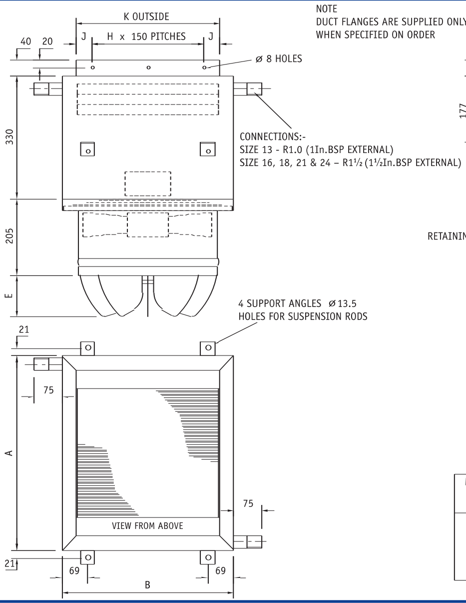
MODEL	A	B	C	D	E	
					1 PHASE	3 PHASE
13	523	480	474	23	434	409
16	585	520	515	40	434	409
18	635	560	555	40	434	409
21	715	635	635	40	438	413
24	785	710	705	40	438	413



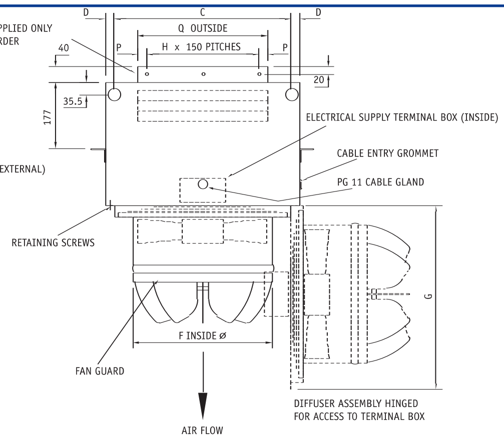


Ducted air intake or outlet

MODEL	A	B	C	D	E	F	G	H	J	K	P	Q	R	
													1 PHASE	3 PHASE
13	520	460	474	23	2	76	450	2	43	386	23.5	347	52	27
16	595	520	515	40	3	26	500	2	59	418	48.5	397	52	27
18	635	560	555	40	3	26	500	2	81	462	68.5	437	52	27
21	715	635	635	40	3	56	560	3	31.5	513	33.5	517	56	31
24	785	710	705	40	4	16	630	3	69.5	589	68.5	587	56	31



NOTE
DUCT FLANGES ARE SUPPLIED ONLY
WHEN SPECIFIED ON ORDER



Downward discharge recirculated air

MODEL	A	B	C	D	E	F	G	H	J	K	P	Q
13	520	460	474	23	111	370	495	2	43	386	23.5	347
16	595	520	515	40	123	419	570	2	59	418	48.5	397
18	635	560	555	40	130	470	610	2	81	462	68.5	437
21	715	635	635	40	133	495	690	3	31.5	513	33.5	517
24	785	710	705	40	140	546	760	3	69.5	589	68.5	587

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LTHW Emissions:
in kW for 82.2°C Flow 71.1°C Return. Entering Air 18°C

3 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C
7-132L3	2	1200	51	0.430	10.09	37.4
7-132N3	2	1390	55	0.520	11.22	35.9
7-133L3	3	1200	51	0.370	13.00	47.1
7-133N3	3	1390	55	0.460	15.00	45.0
7-162L3	2	1060	55	0.595	14.70	38.5
7-162N3	2	1340	58	0.750	16.75	36.5
7-163L3	3	1060	55	0.515	18.78	48.2
7-163N3	3	1340	58	0.675	22.43	45.5
7-182L3	2	1075	57	0.795	19.00	37.8
7-182N3	2	1320	61	0.995	21.63	36.0
7-183L3	3	1075	57	0.695	24.80	47.6
7-183N3	3	1320	61	0.908	29.35	44.8
7-212L3	2	930	58	1.125	26.35	37.4
7-212N3	2	1270	64	1.357	29.35	35.9
7-213L3	3	930	58	0.930	34.00	48.3
7-213N3	3	1270	64	1.222	40.30	45.3
7-242L3	2	1040	64	1.515	36.30	37.9
7-242N3	2	1350	69	2.007	42.65	35.6
7-243L3	3	1040	64	1.370	47.95	47.0
7-243N3	3	1350	69	1.869	58.10	43.8

1 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C
7-132L1	2	850	48	0.326	8.60	39.9
7-132N1	2	1385	54	0.520	11.22	35.9
7-133L1	3	850	48	0.292	11.20	49.8
7-133N1	3	1385	54	0.460	15.00	45.0
7-162L1	2	900	50	0.500	13.30	40.0
7-162N1	2	1360	58	0.750	16.75	36.5
7-163L1	3	900	50	0.430	16.70	50.2
7-163N1	3	1360	58	0.675	22.43	45.5
7-182L1	2	790	52	0.580	15.80	40.6
7-182N1	2	1310	60	0.995	21.63	36.0
7-183L1	3	790	52	0.510	20.25	50.9
7-183N1	3	1310	60	0.908	29.35	44.8
7-212L1	2	870	56	1.000	24.60	38.4
7-212N1	2	1276	63	1.357	29.35	35.9
7-213L1	3	870	56	0.865	32.40	49.0
7-213N1	3	1276	63	1.222	40.30	45.3
7-242L1	2	885	49	1.285	33.15	39.4
7-242N1	2	1270	68	2.007	42.65	35.6
7-243L1	3	885	49	1.140	42.70	49.0
7-243N1	3	1270	68	1.869	58.10	43.8

LTHW - Factors to be applied to emissions for other operating conditions

Water flow Temp °C	Water temperature drop 11.1°K						Water temperature drop 16.7°K						Water temperature drop 22.2°K					
	Entering air temperature °C						Entering air temperature °C						Entering air temperature °C					
	-1	12	15	18	21	24	-1	12	15	18	21	24	-1	12	15	18	21	24
60	0.939	0.696	0.641	0.587	0.533	0.480	0.855	0.622	0.570	0.518	0.466	0.416	0.785	0.560	0.509	0.459	0.409	0.360
65	1.034	0.789	0.733	0.678	0.623	0.569	0.946	0.711	0.658	0.605	0.552	0.501	0.874	0.646	0.594	0.543	0.492	0.442
70	1.131	0.882	0.826	0.770	0.715	0.660	1.039	0.800	0.747	0.693	0.640	0.587	0.963	0.732	0.680	0.628	0.577	0.526
75	1.228	0.977	0.920	0.864	0.807	0.752	1.113	0.891	0.837	0.782	0.729	0.675	1.054	0.820	0.767	0.715	0.663	0.611
80	1.326	1.073	1.015	0.958	0.901	0.845	1.226	0.983	0.928	0.873	0.819	0.764	1.145	0.909	0.856	0.803	0.750	0.698
82.2	1.369	1.115	1.057	1.000	0.943	0.886	1.268	1.024	0.968	0.913	0.858	0.804	1.186	0.949	0.895	0.842	0.789	0.736
85	1.425	1.169	1.111	1.054	0.996	0.939	1.321	1.076	1.020	0.965	0.910	0.855	1.237	0.999	0.945	0.892	0.838	0.785
90	1.524	1.267	1.208	1.150	1.092	1.034	1.417	1.170	1.113	1.057	1.002	0.946	1.330	1.090	1.036	0.981	0.927	0.874
95	1.624	1.365	1.306	1.247	1.189	1.131	1.513	1.264	1.207	1.151	1.095	1.039	1.424	1.182	1.127	1.072	1.018	0.963

NOTE:

1. When operating on water and air conditions involving low duty correction factors (especially on large water temperature drops) check that the water flow rates do not fall below the minimums stated in the following tables to avoid streamline flow conditions resulting in rapid deterioration of heat transfer.
2. When applying emission factors check that the leaving air temperature is satisfactory.

$$\text{LAT °C} = \frac{\text{Corrected emission kW}}{\text{Airflow rate m}^3\text{/s x 1.207}} + \text{EAT °C}$$

Leaving air temperatures less than 38°C on low speed units or 40° C on normal speed units may give rise to complaints of cold draughts. Air temperatures in excess of 57-60° C should be avoided as the buoyancy will seriously affect mounting heights and throws.

3. See page 10 for air flows against external pressure and emission factors.

$$\text{Waterflow rate Kg/s} = \frac{\text{kW}}{\text{td x Cf}}$$

Where:
kW = Corrected heat emission
td = Water temperature drop °K
Cf = Specific heat capacity of water kJ/kg °K

Unit size	Minimum flow rate in Kg/s for 2 and 3 row elements				
	mean water temperature °C				
	90	80	70	60	50
13	0.039	0.045	0.051	0.059	0.069
16	0.048	0.054	0.062	0.072	0.084
18	0.053	0.059	0.068	0.078	0.092
21	0.061	0.069	0.079	0.091	0.107
24	0.070	0.079	0.090	0.104	0.122
Cf	4.208	4.198	4.191	4.185	4.182

MTHW Emissions:
in kW for 115.5°C Flow 93.3°C Return. Entering Air 18°C

3 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C
7-132L3	2	1200	51	0.430	14.65	46.2
7-132N3	2	1390	55	0.520	16.35	44.0
7-133L3	3	1200	51	0.370	18.90	60.3
7-133N3	3	1390	55	0.460	21.75	57.2
7-162L3	2	1060	55	0.595	21.40	47.8
7-162N3	2	1340	58	0.750	24.30	44.8
7-163L3	3	1060	55	0.515	27.40	62.1
7-163N3	3	1340	58	0.675	32.55	58.0
7-182L3	2	1075	57	0.795	27.65	46.8
7-182N3	2	1320	61	0.995	31.45	44.2
7-183L3	3	1075	57	0.695	35.95	60.9
7-183N3	3	1320	61	0.908	42.60	56.9
7-212L3	2	930	58	1.125	38.40	46.3
7-212N3	2	1270	64	1.357	42.50	43.9
7-213L3	3	930	58	0.930	49.00	61.7
7-213N3	3	1270	64	1.222	58.65	57.8
7-242L3	2	1040	64	1.515	52.62	46.8
7-242N3	2	1350	69	2.007	61.95	43.6
7-243L3	3	1040	64	1.370	69.60	60.1
7-243N3	3	1350	69	1.869	84.55	55.5

1 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C
7-132L1	2	850	48	0.326	12.50	49.8
7-132N1	2	1385	54	0.520	16.35	44.0
7-133L1	3	850	48	0.292	16.25	64.1
7-133N1	3	1385	54	0.460	21.75	57.2
7-162L1	2	900	50	0.500	19.38	50.1
7-162N1	2	1360	58	0.750	24.30	44.8
7-163L1	3	900	50	0.430	24.35	46.9
7-163N1	3	1360	58	0.675	32.55	58.0
7-182L1	2	790	52	0.580	23.10	51.0
7-182N1	2	1310	60	0.995	31.45	44.2
7-183L1	3	790	52	0.510	29.53	66.0
7-183N1	3	1310	60	0.908	42.60	56.9
7-212L1	2	870	56	1.000	35.80	47.7
7-212N1	2	1276	63	1.357	42.50	43.9
7-213L1	3	870	56	0.865	47.00	63.0
7-213N1	3	1276	63	1.222	58.65	57.8
7-242L1	2	885	49	1.285	48.00	48.9
7-242N1	2	1270	68	2.007	61.95	43.6
7-243L1	3	885	49	1.140	62.05	63.1
7-243N1	3	1270	68	1.869	84.55	55.5

MTHW - Factors to be applied to emissions for other operating conditions

Water flow Temp	Water temperature drop 16.7°K						Water temperature drop 22.2°K						Water temperature drop 33.3°K					
	Entering air temperature °C						Entering air temperature °C						Entering air temperature °C					
°C	-1	12	15	18	21	24	-1	12	15	18	21	24	-1	12	15	18	21	24
100	1.108	0.936	0.896	0.857	0.818	0.779	1.045	0.878	0.839	0.801	0.763	0.726	0.939	0.779	0.742	0.706	0.670	0.634
105	1.176	1.002	0.963	0.923	0.884	0.845	1.111	0.942	0.903	0.865	0.827	0.789	1.002	0.840	0.803	0.767	0.730	0.694
110	1.244	1.068	1.028	0.988	0.949	0.910	1.177	1.006	0.968	0.929	0.890	0.852	1.065	0.902	0.865	0.828	0.791	0.754
115.5	1.319	1.142	1.102	1.062	1.022	0.982	1.249	1.075	1.039	1.000	0.961	0.923	1.135	0.971	0.933	0.896	0.859	0.822
120	1.380	1.203	1.163	1.122	1.082	1.042	1.309	1.137	1.098	1.059	1.019	0.981	1.192	1.027	0.989	0.952	0.914	0.877
125	1.449	1.270	1.230	1.189	1.149	1.108	1.376	1.203	1.163	1.124	1.085	1.045	1.256	1.090	1.052	1.014	0.977	0.939

Unit size	Minimum flow rate in Kg/s for 2 and 3 row elements				
	mean water temperature °C				
	120	110	100	90	80
13	0.029	0.032	0.035	0.039	0.045
16	0.035	0.039	0.043	0.048	0.054
18	0.039	0.042	0.047	0.053	0.059
21	0.045	0.049	0.055	0.061	0.069
24	0.051	0.056	0.063	0.070	0.079
Cf	4.248	4.233	4.219	4.208	4.198

NOTE:

1. When operating on water and air conditions involving low duty correction factors (especially on large water temperature drops) check that the water flow rates do not fall below the minimums stated in the following tables to avoid streamline flow conditions resulting in rapid deterioration of heat transfer.
2. When applying emission factors check that the leaving air temperature is satisfactory.

$$\text{LAT °C} = \frac{\text{Corrected emission kW}}{\text{Airflow rate m}^3\text{/s x 1.207}} + \text{EAT °C}$$

Leaving air temperatures less than 38°C on low speed units or 40° C on normal speed units may give rise to complaints of cold draughts. Air temperatures in excess of 57-60° C should be avoided as the buoyancy will seriously affect mounting heights and throws.

3. See page 10 for air flows against external pressure and emission factors.

$$\text{Waterflow rate Kg/s} = \frac{\text{kW}}{\text{td x Cf}}$$

Where:
kW = Corrected heat emission
td = Water temperature drop °K
Cf = Specific heat capacity of water kJ/kg °K

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HTHW Emissions:
in kW for 165.5°C Flow 132.2°C Return.
Entering Air 18°C

3 Phase electric supply							1 Phase electric supply						
Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C	Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m³/s	Heat emission kW	L.A.T. °C
7-131L3	1	1200	51	0.497	12.00	38.0	7-131L1	1	850	48	0.380	10.45	40.8
7-131N3	1	1390	55	0.600	13.10	36.0	7-131N1	1	1350	54	0.600	13.10	36.0
7-161L3	1	1060	55	0.670	17.72	39.9	7-161L1	1	900	50	0.550	16.05	42.2
7-161N3	1	1340	58	0.830	19.55	37.5	7-161N1	1	1360	58	0.830	19.55	37.5
7-181L3	1	1075	57	0.900	22.70	38.9	7-181L1	1	790	52	0.660	19.60	42.6
7-181N3	1	1320	61	1.123	24.05	35.7	7-181N1	1	1310	60	1.123	24.05	35.7
7-211L3	1	930	58	1.250	32.00	39.2	7-211L1	1	870	56	1.095	30.15	40.8
7-211N3	1	1270	64	1.449	34.40	37.7	7-211N1	1	1276	63	1.449	34.40	37.7
7-241L3	1	1040	64	1.690	43.40	39.3	7-241L1	1	885	49	1.425	40.01	41.3
7-241N3	1	1350	69	2.180	48.90	36.6	7-241N1	1	1270	68	2.180	48.90	36.6

HTHW - Factors to be applied to emissions for other operating conditions

Water flow Temp °C	Water temperature drop 22.2°K						Water temperature drop 33.3°K						Water temperature drop 44.4°K					
	Entering air temperature °C						Entering air temperature °C						Entering air temperature °C					
	-1	12	15	18	21	24	-1	12	15	18	21	24	-1	12	15	18	21	24
130	0.940	0.826	0.800	0.774	0.749	0.723	0.860	0.751	0.726	0.702	0.677	0.652	0.793	0.687	0.664	0.640	0.615	0.592
140	1.028	0.913	0.887	0.861	0.835	0.809	0.945	0.835	0.810	0.784	0.759	0.735	0.875	0.768	0.744	0.720	0.695	0.672
150	1.117	1.001	0.975	0.948	0.922	0.896	1.030	0.919	0.894	0.868	0.843	0.818	0.957	0.850	0.826	0.801	0.777	0.753
160	1.206	1.090	1.063	1.036	1.010	0.983	1.116	1.004	0.979	0.953	0.928	0.902	1.041	0.933	0.908	0.883	0.859	0.834
165.5	1.256	1.139	1.112	1.086	1.059	1.032	1.164	1.051	1.026	1.000	0.974	0.949	1.088	0.979	0.954	0.929	0.904	0.879
170	1.297	1.179	1.152	1.125	1.100	1.073	1.203	1.090	1.064	1.039	1.013	0.987	1.126	1.016	0.992	0.966	0.941	0.917
180	1.389	1.269	1.243	1.216	1.189	1.162	1.291	1.177	1.151	1.125	1.099	1.073	1.211	1.101	1.075	1.050	1.025	0.999

Unit size	Minimum flow rate in Kg/s for 1row elements						
	mean water temperature °C						
	170	160	150	140	130	120	110
13	0.020	0.022	0.023	0.025	0.027	0.029	0.032
16	0.025	0.027	0.028	0.030	0.033	0.035	0.039
18	0.027	0.029	0.031	0.033	0.035	0.039	0.042
21	0.032	0.034	0.036	0.038	0.041	0.045	0.049
24	0.036	0.039	0.041	0.044	0.047	0.051	0.056
Cf	4.380	4.350	4.320	4.290	4.270	4.248	4.233

NOTE:

1. When operating on water and air conditions involving low duty correction factors (especially on large water temperature drops) check that the water flow rates do not fall below the minimums stated in the following tables to avoid streamline flow conditions resulting in rapid deterioration of heat transfer.
2. When applying emission factors check that the leaving air temperature is satisfactory.

$$\text{LAT °C} = \frac{\text{Corrected emission kW}}{\text{Airflow rate m}^3\text{/s x 1.207}} + \text{EAT °C}$$

Leaving air temperatures less than 38°C on low speed units or 40° C on normal speed units may give rise to complaints of cold draughts. Air temperatures in excess of 57-60° C should be avoided as the buoyancy will seriously affect mounting heights and throws.

3. See page 10 for air flows against external pressure and emission factors.

$$\text{Waterflow rate Kg/s} = \frac{\text{kW}}{\text{td x Cf}}$$

Where:
kW = Corrected heat emission
td = Water temperature drop °K
Cf = Specific heat capacity of water kJ/kg °K

4. 2 Row HTHW Units are now discontinued. For further advice on choosing alternative models, please contact Biddle Air Systems.

Steam Emissions:
in kW for 0.5 BARS G
Entering Air 18°C

3 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m^3/s	Heat emission kW	L.A.T. °C
7-131L3	1	1200	51	0.497	12.15	38.3
7-131N3	1	1390	55	0.600	13.30	36.4
7-161L3	1	1060	55	0.670	17.20	39.3
7-161N3	1	1340	58	0.830	19.12	37.1
7-181L3	1	1075	57	0.900	21.78	38.0
7-181N3	1	1320	61	1.123	23.12	35.1
7-211L3	1	930	58	1.250	29.95	37.9
7-211N3	1	1270	64	1.449	32.10	36.4
7-241L3	1	1040	64	1.690	40.00	37.6
7-241N3	1	1350	69	2.180	45.55	35.3

1 Phase electric supply

Model No.	Element depth Rows	Fan speed rpm	Approx noise level dBA	Air volume m^3/s	Heat emission kW	L.A.T. °C
7-131L1	1	850	48	0.380	10.55	41.0
7-131N1	1	1350	54	0.600	13.30	36.4
7-161L1	1	900	50	0.550	15.53	41.4
7-161N1	1	1360	58	0.830	19.12	37.1
7-181L1	1	790	52	0.660	18.58	41.3
7-181N1	1	1310	60	1.123	23.12	35.1
7-211L1	1	870	56	1.095	27.95	39.1
7-211N1	1	1276	63	1.449	32.10	36.4
7-241L1	1	885	49	1.425	36.60	39.3
7-241N1	1	1270	68	2.180	45.55	35.3

Steam - Factors to be applied to emissions for other operating conditions

Steam pressure bars.g.	Steam Temp °C	Entering air temperature °C -1	12	15	18	21	24
0.25	106.0	1.146	1.006	0.974	0.942	0.899	0.878
0.50	111.4	1.203	1.066	1.032	1.000	0.968	0.936
0.75	116.1	1.254	1.115	1.082	1.050	1.018	0.986
1.00	120.2	1.298	1.158	1.126	1.094	1.062	1.030
1.50	127.4	1.375	1.236	1.203	1.171	1.139	1.107
2.00	133.5	1.440	1.301	1.269	1.237	1.204	1.172
2.50	138.9	1.498	1.359	1.327	1.294	1.262	1.230
3.00	143.6	1.548	1.409	1.377	1.345	1.313	1.281

Steam pressure bars.g.	Steam Temp °C	Entering air temperature °C -1	12	15	18	21	24
3.50	147.9	1.594	1.455	1.423	1.391	1.359	1.327
4.00	151.9	1.637	1.498	1.466	1.434	1.401	1.369
4.50	155.5	1.676	1.536	1.504	1.472	1.440	1.408
5.00	158.8	1.711	1.572	1.540	1.507	1.475	1.443
6.00	165.0	1.777	1.638	1.606	1.574	1.542	1.510
7.00	170.4	1.835	1.696	1.664	1.632	1.600	1.567
8.00	175.4	1.889	1.749	1.717	1.685	1.653	1.621

All steam unit heaters must be installed to provide a 2° slope of the coil towards the coil outlet. Steam supply must be dry. If using a modulating steam valve a vacuum breaker must be fitted to prevent less than atmospheric pressures within the steam space from holding back condensate. There should be a 1m drop between coil outlet and steam trap. Condensate must not be lifted after the trap other than via the use of a condensate pump. We recommend for all applications that some form of steam isolation/control be employed for when the fans are turned off.

NOTE:

1. When applying emission factors check that the leaving air temperature is satisfactory.

$$\text{LAT °C} = \frac{\text{Corrected emission kW}}{\text{Airflow rate } m^3/s \times 1.207} + \text{EAT °C}$$

   Leaving air temperatures less than 38°C on low speed units or 40° C on normal speed units may give rise to complaints of cold draughts. Air temperatures in excess of 57-60° C should be avoided as the buoyancy will seriously affect mounting heights and throws.

2. See page 10 for air flows against external pressure and emission factors.

$$\text{Waterflow rate Kg/s} = \frac{\text{kW}}{\text{td} \times \text{Cf}}$$

   Where:
   kW = Corrected heat emission
   td = Water temperature drop °K
   Cf = Specific heat capacity of water kJ/kg °K

3. 2 Row Steam Units are now discontinued. For further advice on choosing alternative models, please contact Biddle Air Systems.

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Airflow Rates:
Against External Air Pressures and Emisson Factors

Model No. 3 Phase	Model No. 1Phase	Element depth Rows	Fan speed rpm	EXTERNAL AIR PRESSURE 0 Pa Airflow m^3/s	0 Pa Emiss. factor	25 Pa Airflow m^3/s	25 Pa Emiss. factor	50 Pa Airflow m^3/s	50 Pa Emiss. factor	75 Pa Airflow m^3/s	75 Pa Emiss. factor
	7-131L1	1	850	0.380	1.00	0.188	0.72				
7-131L3		1	1200	0.497	1.00	0.390	0.89	0.220	0.68		
7-131N3	7-131N1	1	1385	0.600	1.00	0.510	0.93	0.400	0.83	0.250	0.66
	7-132L1	2	850	0.326	1.00	0.157	0.66				
7-132L3		2	1200	0.430	1.00	0.330	0.86	0.180	0.61		
7-132N3	7-132N1	2	1385	0.520	1.00	0.440	0.91	0.330	0.78	0.220	0.62
	7-133L1	3	850	0.292	1.00	0.142	0.63				
7-133L3		3	1200	0.370	1.00	0.280	0.84	0.150	0.56		
7-133N3	7-133N1	3	1385	0.460	1.00	0.380	0.89	0.280	0.73	0.200	0.59
	7-161L1	1	900	0.550	1.00	0.350	0.81				
7-161L3		1	1060	0.670	1.00	0.510	0.88	0.220	0.59		
7-161N3	7-161N1	1	1340	0.830	1.00	0.725	0.94	0.610	0.86	0.450	0.75
	7-162L1	2	900	0.500	1.00	0.285	0.73				
7-162L3		2	1060	0.595	1.00	0.440	0.84	0.200	0.54		
7-162N3	7-162N1	2	1340	0.750	1.00	0.660	0.93	0.550	0.84	0.370	0.67
	7-163L1	3	900	0.430	1.00	0.250	0.71				
7-163L3		3	1060	0.515	1.00	0.365	0.80	0.180	0.51		
7-163N3	7-163N1	3	1340	0.675	1.00	0.585	0.91	0.475	0.80	0.270	0.56
	7-181L1	1	790	0.660	1.00	0.450	0.83				
7-181L3		1	1075	0.900	1.00	0.740	0.91				
7-181N3	7-181N1	1	1310	1.123	1.00	0.977	0.94	0.816	0.86	0.586	0.74
	7-182L1	2	790	0.580	1.00	0.400	0.81				
7-182L3		2	1075	0.795	1.00	0.620	0.87				
7-182N3	7-182N1	2	1310	0.995	1.00	0.884	0.94	0.710	0.83	0.359	0.57
	7-183L1	3	790	0.510	1.00	0.280	0.68				
7-183L3		3	1075	0.695	1.00	0.490	0.80				
7-183N3	7-183N1	3	1310	0.908	1.00	0.790	0.92	0.636	0.80		
	7-211L1	1	870	1.095	1.00	0.890	0.91				
7-211L3		1	930	1.250	1.00	1.050	0.92				
7-211N3	7-211N1	1	1270	1.449	1.00	1.354	0.97	1.236	0.93	1.071	0.87
	7-212L1	2	870	1.000	1.00	0.770	0.86				
7-212L3		2	930	1.125	1.00	0.730	0.78				
7-212N3	7-212N1	2	1270	1.357	1.00	1.258	0.96	1.159	0.92	1.000	0.84
	7-213L1	3	870	0.865	1.00	0.660	0.84				
7-213L3		3	930	0.930	1.00	0.610	0.77				
7-213N3	7-213N1	3	1270	1.220	1.00	1.114	0.94	1.022	0.89	0.882	0.81
	7-241L1	1	885	1.425	1.00	1.170	0.91	0.800	0.76		
7-241L3		1	1040	1.690	1.00	1.455	0.93	1.185	0.85		
7-241N3	7-241N1	1	1350	2.180	1.00	2.010	0.96	1.845	0.92	1.590	0.86
	7-242L1	2	885	1.285	1.00	1.040	0.89				
7-242L3		2	1040	1.515	1.00	1.320	0.93	0.960	0.77		
7-242N3	7-242N1	2	1350	2.007	1.00	1.825	0.95	1.634	0.89	1.400	0.82
	7-243L1	3	885	1.140	1.00	0.930	0.88				
7-243L3		3	1040	1.370	1.00	1.150	0.89	0.850	0.74		
7-243N3	7-243N1	3	1350	1.869	1.00	1.628	0.92	1.445	0.85	1.215	0.76

NOTE:

1. When applying emission factors check that the leaving air temperature is satisfactory. See notes on pages 6 to 9.
2. Check that the water flow rates do not fall below the values given on pages 6 to 8 (especially where low factors and large water temperature drops are involved).

EXAMPLE:

What will be the emission for a model 7H133N3 uniflow operating against 50 Pa external pressure, when using LTHW 82.2° C flow, 71.1° C return (11.1° C drop) and air entry at -1° C. The standard emission from 3 phase table on page 6 = 15.00kW. The emission correction factor for LTHW 82.2° C flow, 11.1° C drop and EAT -1° C = 1.369. The emission correction factor for this unit operating at 50 Pa external from above table = 0.73.

Airflow rate from above table = $0.280 m^3/s$.

∴ Actual emission = 15.00 x 1.369 x 0.73 = 14.99 kW.

Check leaving air temperature

$$= -1\ °C + \frac{14.99}{0.28 \times 1.207} = 43.3\ °C$$

Check water flow rate

$$= \frac{14.99}{11.1 \times 4.195} = 0.322\ Kg/s \text{ (above minimum)}$$

Performance Data

Mounting Heights and Throws:
Type H Horizontal Discharge

Model No. 3 Phase	1 Phase	Maximum mounting height in metres for leaving air temp 40˚C	55˚C	Maximum throw metres
	7H132L1	2.7	2.1	7.7
7H132L3		3.0	2.4	9.7
7H132N3	7H132N1	3.2	2.6	11.4
	7H162L1	3.1	2.2	8.7
7H162L3		3.5	2.6	10.8
7H162N3	7H162N1	3.9	3.0	13.4
	7H182L1	2.9	2.0	8.0
7H182L3		3.6	2.6	12.2
7H182N3	7H182N1	4.1	3.1	15.4
	7H212L1	3.8	2.8	13.0
7H212L3		4.2	3.1	15.1
7H212N3	7H212N1	4.5	3.5	17.5
	7H242L1	4.1	3.0	14.8
7H242L3		4.4	3.3	17.5
7H242N3	7H242N1	5.0	4.2	21.8

Water Content kg

Unit Size	1 Row	2 Row	3 Row
13	1.8	2.3	2.8
16	2.3	2.9	3.6
18	2.5	3.2	4.1
21	3.0	3.9	5.0
24	3.5	4.7	6.1

Water Pressure Drop kPa
Table A
Basic pressure drops based on water flow rate of 1.0 kg/s

Unit Size	Element depth 1 Row	2 Row	3 Row
13	7.4	10.5	13.5
16	5.7	8.0	10.5
18	5.0	7.1	9.2
21	4.1	5.9	7.7
24	3.4	5.0	6.5

Table B
Water temperature Factor

MWT ˚C	Factor
50	1.053
75	1.000
100	0.964
125	0.938
150	0.916
175	0.898

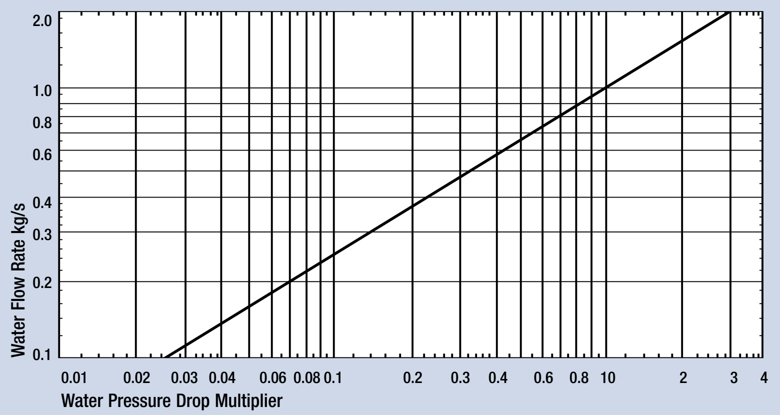
Weight

Unit Size	Dry Weight (kg)
13	32
16	36
18	42
21	50
24	58

Mounting Heights and Spread:
Type D Downward Discharge

Model No. 3 Phase	1 Phase	Leaving Air Temperature (˚C)	Diameter Spread (meters) for mounting heights (meters) for: 2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0	11.0
	7D132L1	40	7.7	6.7	5.7	4.6								
		55	6.7	5.5	4.3									
7D132L3		40	8.8	7.8	6.9	5.9	5.0							
		55	7.8	6.6	5.3	4.0								
7D132N3	7D132N1	40			13.3	12.0	10.5	9.2	6.5					
		55	12.5	10.2	9.6	8.1	6.8							
	7D162L1	40		8.6	7.5	6.5	5.6	4.5						
		55	8.5	7.3	6.2	5.0								
7D162L3		40		9.8	8.8	7.8	6.8	5.8						
		55	9.8	8.5	7.3	6.0	4.8							
7D162N3	7D162N1	40			15.2	13.9	12.7	11.4	8.8	6.2				
		55	14.7	13.1	11.8	10.3	8.9	7.4						
	7D182L1	40		9.6	8.6	7.5	6.5	5.4						
		55		8.2	6.9	5.7	4.5							
7D182L3		40			10.8	9.8	8.8	7.8	5.7					
		55		10.6	9.4	8.2	7.1	5.8						
7D182N3	7D182N1	40			18.4	17.0	15.6	14.2	11.5	8.8	6.0			
		55		15.8	14.1	12.7	11.1	9.6	6.5					
	7D212L1	40				12.0	10.9	9.9	7.8	5.8				
		55		12.6	11.4	10.3	9.1	7.9						
7D212L3		40				13.5	12.5	11.4	9.4	7.3				
		55			12.8	11.5	10.3	9.1	6.7					
7D212N3	7D212N1	40				20.6	19.2	17.8	15.0	12.2	9.4	6.6		
		55			17.6	16.0	14.5	13.0	10.0	6.9				
	7D242L1	40					14.3	13.3	11.2	9.1	7.0			
		55			14.5	13.4	12.3	11.0	8.6	6.2				
7D242L3		40					16.9	15.8	13.7	11.7	9.6			
		55				15.7	14.5	13.2	10.8	8.4				
7D242N3	7D242N1	40							21.3	18.7	16.0	13.3	10.6	8.0
		55				21.4	20.0	18.5	15.5	12.6	9.6			

Graph C Factor for the water flow rate



To obtain water pressure drop, multiply basic pressure drop from table A by factors from table B and graph C.

NOTE:
1 The mounting heights are based on a room temperature of 18˚C. Interpolate between the leaving air temperatures.
2 The diameter spreads and maximum throws can be affected by site conditions and are therefore only approximate.
3 The diameter spreads and maximum throws are for 2 row recirculated air models as indicated. For 1 Row models the stated throws can be increased by 10%, whilst for 3 Row models the throws will be reduced by 10%.

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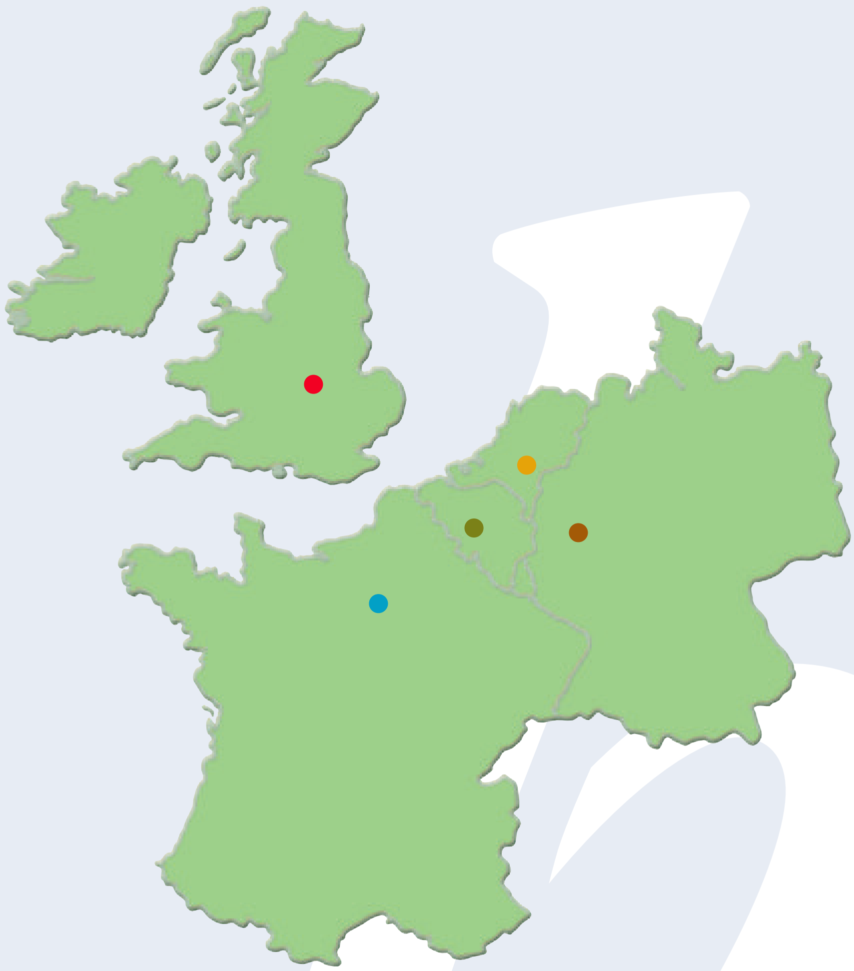

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