Laminar Flow Diffusers
LFF LFM

Waterloo

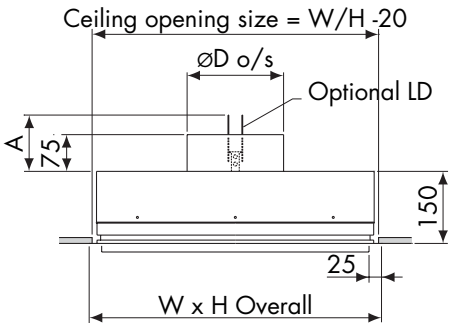
Introduction
LF diffusers have been designed for use in clean rooms, laboratories, operating theatres, or other applications where critical control of room air movement is necessary. They are also suitable for less critical applications such as animal rooms or kitchens where a vertical flow pattern may be required.
The laminar air pattern is achieved by use of a primary baffle within the plenum chamber and a low free area perforated discharge plate at the face of the diffuser.
The diffusers are available with either a flanged frame style (type LFF) to suit conventional exposed or concealed 'T' ceilings, or, with a flangeless frame (type LFM) suitable for modular panel constructions.
The LFM units can be supplied with a perimeter trim strip to suit the overall dimensions of the panel assembly.
Support brackets and mounting plates can also be manufactured to fit suspended light bases used in operating theatres.
The units are available in three standard sizes with options for top, side, or end entry inlet spigots and screw operated louvre dampers.

Description
LF laminar flow diffusers are constructed from aluminium extruded frames and assembled using welding and soldering techniques to form a robust construction.
The perforated aluminium face plate can be easily removed for cleaning using the hook tool provided.
Plenum chambers are manufactured from galvanised sheet steel, with all exposed edges and spot welds protected.

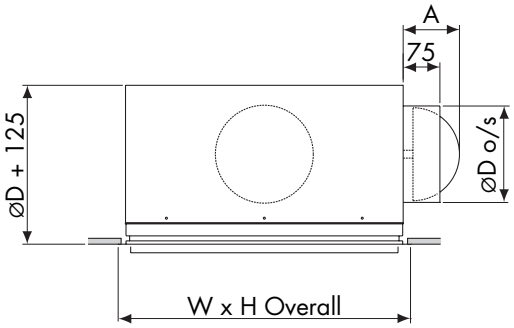
Product Description
LFF Laminar flow panel with flanged frame
LFM Laminar flow panel with modular flangeless frame
LD Louvre damper

Features
- Two frame styles and sizes to suit 600mm and 1200mm 'T' ceilings or modular panel assemblies.
- Side, top, or end entry spigot connections with optional spigot mounted louvre damper.
- Pivoting, removable face plate for easy maintenance.
- Easy clean aluminium face plate and frame with durable polyester powder coating.

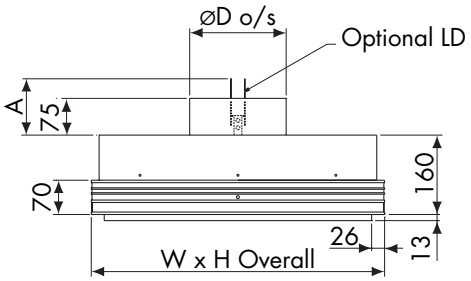
Finishes
PPM9006 (RAL 9006 Matt Silver)
PPM9010 (RAL 9010 20% Gloss White)
PPG9010 (RAL 9010 Gloss White)
Other colours available on request



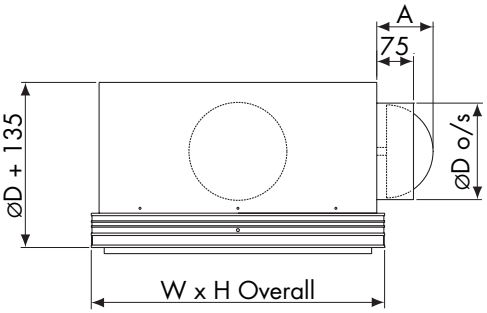
LFF-TE = Top Entry



LFF-SE = Side Entry
LFF-EE = End Entry



LFM-TE = Top Entry



LFM-SE = Side Entry
LFM-EE = End Entry

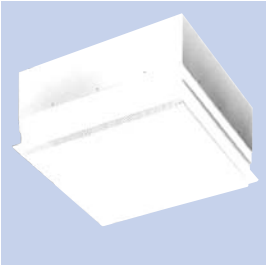
Order Example

LFM/900x600/TE/PPM9010/LD

Type
Nominal Width
Nominal Height
Spigot Location
Finish
Damper (if required)

Free Area
23%

Type	Unit size	W x H	øD	A
LFM	600 x 600	600 x 600	197	120
LFM	900 x 600	900 x 600	197	120
LFM	1200 x 600	1200 x 600	312	165
LFF	600 x 600	598 x 598	197	120
LFF	1200 x 600	1198 x 598	312	165



Selection Criteria

Laminar flow diffuser airstreams are characterised by the tendency to reduce in sectional area from the point of discharge, particularly with high cooling differentials. Although this produces a slight initial increase in the core velocity, friction between the airstream boundary and the static room air offsets this, the net result being to maintain a near constant air velocity at distances up to 2.5m from the face. This characteristic is reflected in the data presentation of tables 1 and 2 which give information on the face discharge velocity and the average airstream velocity over this distance. The discharge velocity is based on an average number of vane anemometer readings at the face plate, whilst the airstream velocity is derived from time averaged readings with a 15 probe array at distances of 1m and 2m from the face. In the case of the latter, data is given for cooling differentials of 3°C, 5°C and 10°C. The temperature diffusion data presented in table 3 can be used to determine the approximate airstream temperature by adding the indicated temperature rise to the discharge air temperature.

The acoustic data shown in table 5 is presented in terms of sound power based NR levels. To obtain the resulting NRlp level in the occupied zone, room absorption factors should be applied as appropriate to the installation conditions.

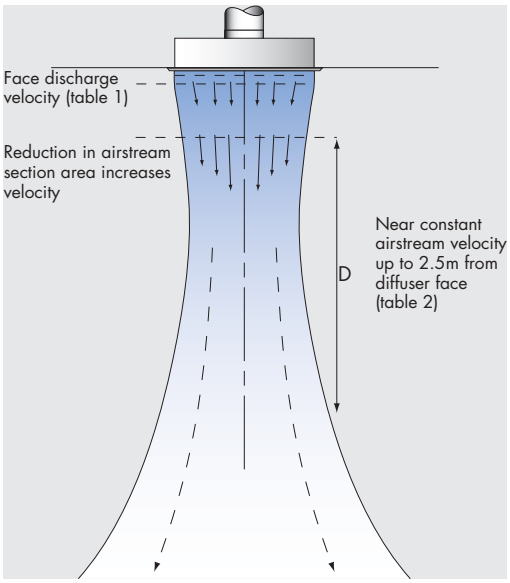
Performance Tables

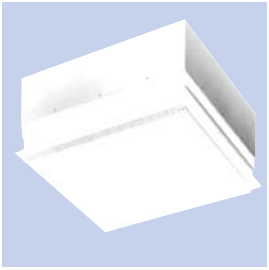
Table 1. Average Face Air Velocity

LFM LFF		Air Flow Rate											
	m^3/h	72	108	144	180	216	288	360	432	504	576	648	720
Unit size	l/s	20	30	40	50	60	80	100	120	140	160	180	200
600x600		0.05	0.10	0.13	0.17	0.21	0.30	0.37					
900x600			0.05	0.07	0.10	0.13	0.18	0.24	0.30				
1200x600					0.05	0.06	0.11	0.15	0.19	0.24	0.28	0.32	0.37

Table 2. Average Airstream Velocity

LFM LFF		Air Flow Rate											
	m^3/h	72	108	144	180	216	288	360	432	504	576	648	720
	l/s	20	30	40	50	60	80	100	120	140	160	180	200
Unit size	DT												
600x600	-3 °C	0.09	0.11	0.13	0.16	0.20	0.26	0.33					
	-5 °C	0.09	0.12	0.15	0.20	0.25	0.31	0.36					
	-10 °C	0.10	0.13	0.15	0.25	0.32	0.41	0.45					
900x600	-3 °C	0.07	0.09	0.11	0.12	0.14	0.16	0.22	0.25				
	-5 °C	0.07	0.10	0.13	0.17	0.20	0.25	0.29	0.32				
	-10 °C	0.08	0.11	0.15	0.20	0.24	0.31	0.36	0.40				
1200x600	-3 °C				0.05	0.07	0.09	0.10	0.14	0.22	0.26	0.29	0.31
	-5 °C				0.05	0.07	0.10	0.12	0.16	0.25	0.30	0.35	0.39
	-10 °C				0.05	0.10	0.14	0.23	0.30	0.38	0.42	0.45	0.47





Selection Example

Diffuser selection criteria will be dependent on the application, but as a general guide most sedentary occupants would be tolerant of airstream velocities up to 0.25m/s if the air temperature is 1-2°C below that in the room. In applications where there are concentrated heat sources or where the occupants are mostly transitory, this can generally be increased to 0.35 - 0.5m/s.

As an example, consider the use of a 1200 x 600 diffuser in an operating theatre where the cooling differential is to be 5°C with a supply air temperature of 17°C.

Reference to table 2 shows that the maximum air flow rate to achieve an average airstream velocity of 0.25m/s would be 140l/s.

Airstream temperatures at distances of 1m and 2m from the diffuser face can be found from table 3; in this case, at 140l/s, the supply air temperature will rise by 3.5°C and 4.5°C respectively, giving moving air temperatures of 20.5°C and 21.5°C at the two heights.

The diffuser noise level can be found from table 5, which, assuming a fully open damper, would be less than NRlw20 at 140l/s.

Performance Tables

Table 3. Airstream Temperature Rise (°C)

LFM LFF			Air Flow Rate											
		m^3/h	72	108	144	180	216	288	360	432	504	576	648	720
		l/s	20	30	40	50	60	80	100	120	140	160	180	200
Unit size	DT	D												
600 x 600	-3°C	1m	2.5	2.5	2.5	2.5	2.0	2.0	1.0					
		2m	3.0	3.0	3.0	3.0	2.5	2.5	2.0					
	-5°C	1m	4.5	4.5	4.5	4.0	3.5	3.0	2.5					
		2m	5.0	5.0	5.0	4.5	4.0	3.5	3.0					
	-10°C	1m	8.5	8.0	8.0	8.0	7.5	6.5	6.0					
		2m	9.5	9.5	9.5	9.0	8.5	8.0	7.0					
900 x 600	-3°C	1m	3.0	3.0	3.0	3.0	2.5	2.5	2.0	1.5				
		2m	3.0	3.0	3.0	3.0	3.0	2.5	2.5	2.0				
	-5°C	1m	5.0	4.5	4.5	4.5	4.0	3.5	3.0	2.5				
		2m	5.0	5.0	5.0	5.0	4.5	4.5	4.0	3.5				
	-10°C	1m	10.0	9.5	9.5	9.0	8.5	8.0	7.0	5.5				
		2m	10.0	10.0	9.5	9.5	9.0	8.5	8.0	7.0				
1200 x 600	-3°C	1m				3.0	3.0	3.0	2.5	2.5	2.0	2.0	1.5	1.0
		2m				3.0	3.0	2.5	2.5	2.5	2.5	2.5	2.0	1.5
	-5°C	1m				4.5	4.5	4.5	4.0	4.0	3.5	3.0	2.5	2.0
		2m				5.0	5.0	5.0	5.0	4.5	4.5	4.0	3.0	2.5
	-10°C	1m				10.0	10.0	10.0	9.5	9.0	8.0	7.5	6.5	5.5
		2m				10.0	10.0	10.0	9.5	9.5	9.0	8.5	8.0	7.0

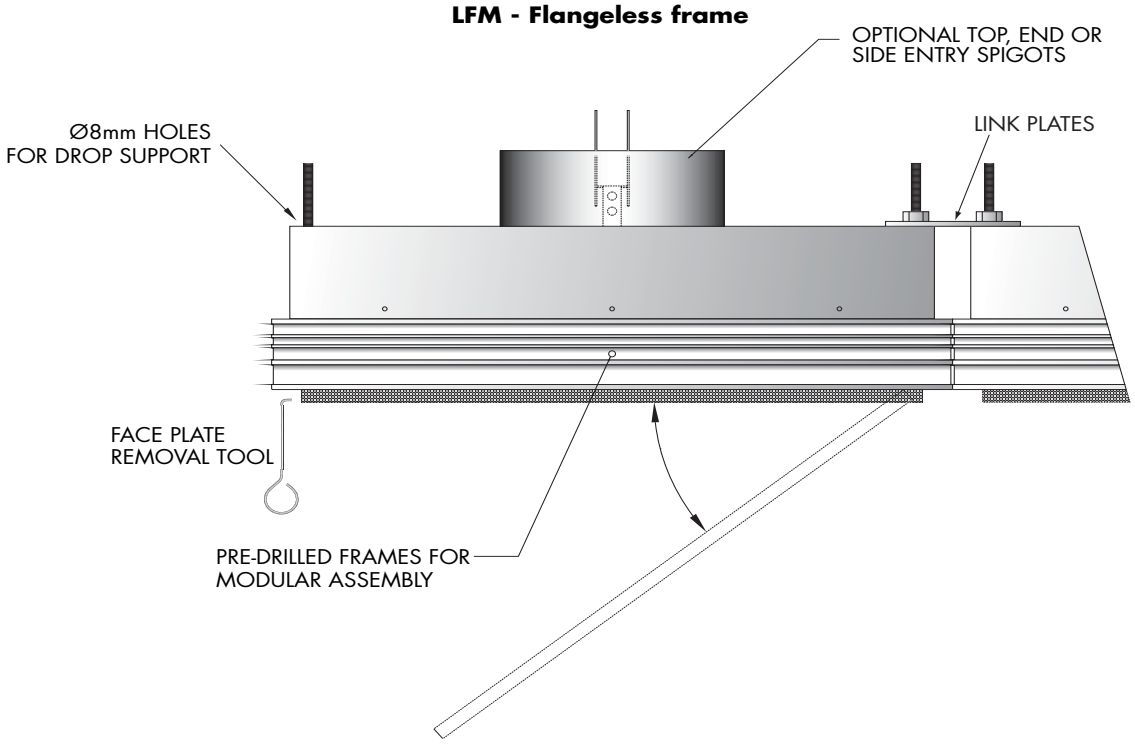
Table 4. Diffuser Static Pressure Loss (Pa) (open damper)

LFM LFF			Air Flow Rate											
		m^3/h	72	108	144	180	216	288	360	432	504	576	648	720
		l/s	20	30	40	50	60	80	100	120	140	160	180	200
Unit size														
600x600			1	1	1	2	2	4	5					
900x600			1	1	1	2	2	4	5	7				
1200x600						1	1	1	2	2	3	3	4	4

Table 5. Acoustic Data (Noise Level) (NR) (open damper)

LFM LFF			Air Flow Rate											
		m^3/h	72	108	144	180	216	288	360	432	504	576	648	720
		l/s	20	30	40	50	60	80	100	120	140	160	180	200
Unit size														
600x600						<20	20	24	28					
900x600							<20	23	27	30				
1200x600													<20	<20

LFM - Flangeless frame



LFF - Flanged frame