

FREE AREA

CHARACTERISTICS

'Free Area' is the area within an aperture unobstructed by the components of an air transfer grille product when in the normal or open position through which air is free to flow.

Its size can be given in square metres, square centimetres, square millimetres, square feet or square inches.

The sketch shows a typical air transfer grille fitted in a door where the aperture size is indicated by the heavy line i.e. W x H. The shaded area represents the components of the grille and the non-shaded area within the aperture is the 'free area'.

As can be seen the free area equals the aperture area minus the shaded area and is often expressed as a percentage of the area of the aperture.

i.e FREE AREA =

$$\frac{\text{unshaded area}}{\text{width} \times \text{height of aperture}}$$

Example

If the overall dimensions of the grille are 0.298 metre by 0.298 metre this gives an area of 0.08804 square metres. If the components of the grille are each 6mm thick then the free area (un-shaded) will be found from:

$$\frac{(298 - (16 \times 6)) \times (298 - (4 \times 6))}{1000 \quad 1000}$$

= **0.0553 sq.meters**

Divide the shaded area by the aperture area to give the percentage of free area:

$$0.0553 / 0.298 \times 0.298 \times 100$$

= **62.33%**

Air Velocity

Is the speed of passage of air and is usually measured in metres per second or in imperial terms in feet per second.

An indication of velocities can be gauged by noting that 2 metres per second is approximately equivalent to 7.2 kilometres per hour or 4.5 miles per hour (a brisk walking pace).

Volumetric Flow

Is the volume of air movement in a specific time and is usually given in cubic metres per hour or litres per second. Volumetric flow through a damper is calculated by multiplying the free area of the product by the velocity of the air passing through it.

Example

The free area 0.0553 sq. metres from the previous example shown in figure one multiplied by preferred velocity of **2.0 metres per second** gives a **volumetric flow** of:

$$0.0553 \times 2.0 = 0.1106 \text{ cubic metres per second or } 398.16 \text{ cubic metres per hour.}$$

Pressure Differential

In order to create air movement through any ventilation system it is necessary to create a pressure differential from one end of the system to the other. Though this can be achieved by natural phenomena in the building such as "stack effect" it is more usual to incorporate motor driven fans.

The pressure differential created reduces as the distance from the fan increases due to frictional losses along the route, e.g. Duct walls. The differential will be further reduced when the air stream meets a partial obstruction such as a damper.

Loss of pressure differential means that the volumetric airflow will also be reduced. It is therefore important to make allowances for the pressure losses that will be encountered when dampers or any other products that cause a degree of obstruction to the airflow are incorporated in the system.

To assist in these calculations each Lorient air transfer product has been tested to measure the pressure losses

incurred through a range of pressure differentials and velocities. Values can be selected from the differential pressure charts provided in this publication.

Air pressure differentials in the UK and Europe are usually given in Pascals (Pa).

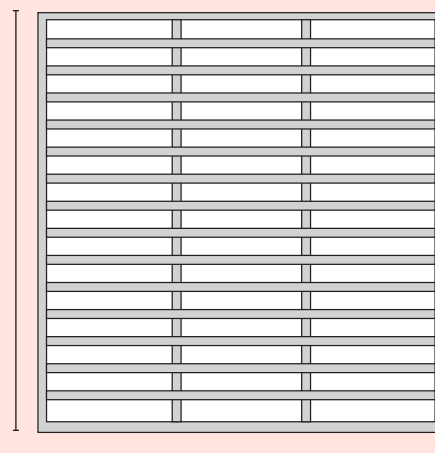


Fig. 1

Air Changes

The number of air changes that are required within a room in a given period so that the air quality can be maintained at an acceptable level when the room is used for its intended purpose.

The following are general recommendations to maintain satisfactory air quality within certain locations:

- ▶ Boiler house or plant room: **15 – 30**
- ▶ Hospital operating theatres: **15 – 17**
- ▶ Canteens: **8 – 12**
- ▶ Lavatories and toilets: **6 – 7**
- ▶ Hospital general rooms and wards: **6**
- ▶ Offices: **4 – 6**
- ▶ Factories and Laundries (subject to special regulations): **more than 4.**

Example of Air Volume Calculation:

In order to establish the volume of air required per hour for a particular room the room volume should be multiplied by the number of changes needed per hour.

A hospital ward measuring 10 metres x 6 metres x 3.2 metres high and needing 6 air changes per hour requires:

$10 \times 6 \times 3.2 \times 6 = 1152$ cubic metres of air supply per hour.

It is worth noting that if the air change is induced by extraction at the above rate "make up" air must

be introduced into the room at the same rate. In most cases it is necessary to provide fire and smoke protection along both the "supply air" and the "extract air" routes.

Example of Calculation of Air Transfer Grille Requirements:

It has been decided that air will be extracted from the above ward through ducting and the supply air will be introduced through air transfer grilles mounted in the 2 doors that give access to the ward. If one grille is to be used per door then the volumetric flow needed will be: $1152/2 = 576$ cubic metres per hour. Given that the free area of the relevant grille type is 62% and the velocity is 2.0 metres per second, then the area of the grille can be calculated:

$$\frac{52 \times 100}{2.0 \times 60 \times 60 \times 62} = 0.129\text{m}^2$$

This gives a theoretical grille size of 0.36 x 0.36 metres.

Selection of Appropriate Air Transfer Grille

Having calculated the theoretical grille size, select the next standard size above (i.e. from the example 400mm x 400mm) then check the acoustic and pressure drop charts to confirm acceptable performance values.

Useful Conversion Data

Pressure:

1 Pascal (Pa) = 1 Newton / per m²

1 Bar = 105 N/ m² = 0.1 mega Pascals = 14.7 pounds per square inch

Note: A Newton is that force which, applied to a mass of one kilogram, gives it an acceleration of one metre per second per second.

1 N = 1 kg m/s²

Length:

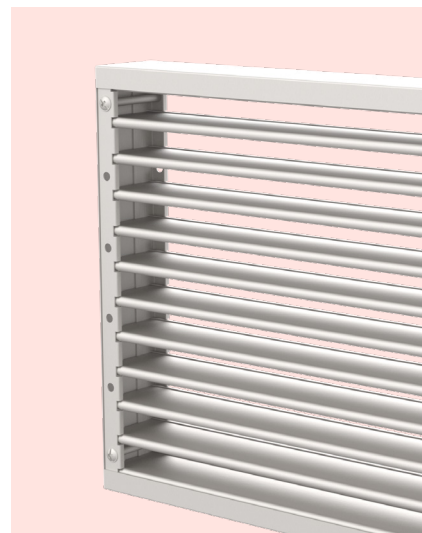
One foot = 305 mm or 30.5 cm

Area:

One square foot = 930 cm²

Volume:

1 metre³ = 1000 litres or 1000 000 cm³ = 35 feet³ or 60700 inch³.



Images: LVH44 air transfer grille

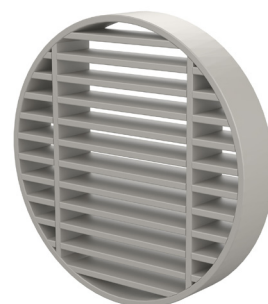
FREE AREA

CHARACTERISTICS

LVV40	MM	CM	M	% FREE AREA
100 X 100	4,650mm ²	46.5cm ²	0.00465m ²	46.50%
150 X 150	12,555mm ²	125.7cm ²	0.0125m ²	55.80%
200 X 200	23,280mm ²	233cm ²	0.0233m ²	58.20%
250 X 250	38,250mm ²	383cm ²	0.0383m ²	61.20%
300 X 300	54,180mm ²	542cm ²	0.0542m ²	60.20%
350 X 350	75,636mm ²	756cm ²	0.0756m ²	61.74%
400 X 400	97,600mm ²	977cm ²	0.0976m ²	61%
450 X 450	128,790mm ²	1,288cm ²	0.128m ²	63.60%
500 X 500	155,500mm ²	1,554cm ²	0.155m ²	62.20%
550 X 550	192,280mm ²	1,922cm ²	0.192m ²	64%
600 X 150	53,998mm ²	539cm ²	0.0539m ²	59.90%
600 X 500	189,400mm ²	1,894cm ²	0.189m ²	63.13%
600 X 600	227,520mm ²	2,278cm ²	0.227m ²	63.20%

LVC40 SIZE	MM	CM	M	% FREE AREA
LVC 100Ø	2,868mm ²	28.7cm ²	0.0028m ²	38.03%
LVC 150Ø	8,185mm ²	81cm ²	0.0081m ²	47.58%
LVC 200Ø	15,550mm ²	155.5cm ²	0.0155m ²	55.25%
LVC 250Ø	26,389mm ²	263cm ²	0.0263m ²	53.75%
LVC 300Ø	41,765mm ²	417.6cm ²	0.0417m ²	59.88%
LVC 350Ø	48,923mm ²	489cm ²	0.048m ²	50.85%
LVC 400Ø	75,241mm ²	752.4cm ²	0.0752m ²	60.47%
LVC 450Ø	77,412mm ²	774cm ²	0.0774m ²	48.50%
LVC 500Ø	107,054mm ²	1,070.5cm ²	0.1070m ²	54.96%
LVC 550Ø	120,537mm ²	1,205cm ²	0.1205m ²	50.73%
LVC 600Ø	147,671mm ²	1,476.7cm ²	0.1476m ²	64.50%

LVH44	MM	CM	M	% FREE AREA
100 X 100	4,240mm ²	42.4cm ²	0.0042m ²	42.40%
150 X 150	10,800mm ²	108cm ²	0.0108m ²	48%
200 X 200	22,520mm ²	225.5cm ²	0.0225m ²	56.30%
250 X 250	35,438mm ²	354cm ²	0.0354m ²	56.70%
300 X 300	54,900mm ²	549.8cm ²	0.0549m ²	61%
350 X 350	73,872mm ²	738cm ²	0.073m ²	61%
400 X 400	98,240mm ²	982.3cm ²	0.0982m ²	61.40%
450 X 300	80,562mm ²	805cm ²	0.0805m ²	59.6%
450 X 450	121,095mm ²	1,211cm ²	0.121m ²	59.80%
500 X 500	157,750mm ²	1,578cm ²	0.157m ²	63.10%
550 X 250	71,148mm ²	711cm ²	0.071m ²	56.9%
550 X 550	188,416mm ²	1,884cm ²	0.1884m ²	62.28%
600 X 600	231,660mm ²	2,316cm ²	0.231m ²	64.35%



LVH50	MM	CM	M	% FREE AREA
100 X 100	4,240mm ²	42.4cm ²	0.00424m ²	42.40%
150 X 150	10,800mm ²	108cm ²	0.0108m ²	48%
200 X 200	22,520mm ²	225.5cm ²	0.0225m ²	56.30%
250 X 250	35,438mm ²	354cm ²	0.0354m ²	56.70%
300 X 300	54,900mm ²	549.8cm ²	0.0549m ²	61%
350 X 350	73,872mm ²	738cm ²	0.73m ²	61%
400 X 400	98,240mm ²	982.3cm ²	0.09824m ²	61.40%
450 X 450	121,095mm ²	1,211cm ²	0.121m ²	59.80%
500 X 500	157,750mm ²	1,578cm ²	0.157m ²	63.10%
550 X 550	188,416mm ²	1,884cm ²	0.1884m ²	62.28%
600 X 600	231,660mm ²	2,316cm ²	0.231m ²	64.35%



LVH54	MM	CM	M	% FREE AREA
100 X 100	4,240mm ²	42.4cm ²	0.00424m ²	42.40%
150 X 150	10,800mm ²	108cm ²	0.0108m ²	48%
200 X 200	22,520mm ²	225.5cm ²	0.0225m ²	56.30%
250 X 250	35,438mm ²	354cm ²	0.0354m ²	56.70%
300 X 300	54,900mm ²	549.8cm ²	0.0549m ²	61%
350 X 350	73,872mm ²	738cm ²	0.073m ²	61%
400 X 400	98,240mm ²	982.3cm ²	0.09824m ²	61.40%
450 X 450	121,095mm ²	1,211cm ²	0.121m ²	59.80%
500 X 500	157,750mm ²	1,578cm ²	0.157m ²	63.10%
550 X 550	188,416mm ²	1,884cm ²	0.1884m ²	62.28%
600 X 600	231,660mm ²	2,316cm ²	0.231m ²	64.35%



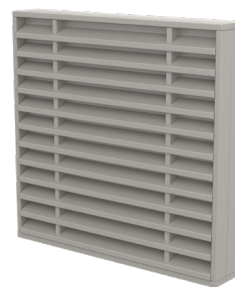
LVH44C	MM	CM	M	% FREE AREA
LVHC 98Ø	2,967mm ²	29.6cm ²	0.0029m ²	39.34%
LVHC 148Ø	8,527mm ²	85.2cm ²	0.0085m ²	52.36%
LVHC 200Ø	16,766mm ²	167cm ²	0.0167m ²	53.36%
LVHC 248Ø	27,532mm ²	275.3cm ²	0.0275m ²	56.9%
LVHC 300Ø	41,275mm ²	412cm ²	0.0412m ²	59.7%
LVHC 350Ø	55,732mm ²	557cm ²	0.00557m ²	58.59%
LVHC 450Ø	74,520mm ²	745cm ²	0.00745m ²	47.27%
LVHC 498Ø	97,876mm ²	978.7cm ²	0.0978m ²	50.25%



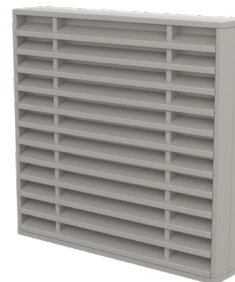
COVER GRILLES	MM	CM	M	% FREE AREA
100 X 100	6,300mm ²	63cm ²	0.0063m ²	63%
150 X 150	15,187mm ²	152cm ²	0.0152m ²	67.50%
200 X 200	26,200mm ²	262cm ²	0.0262m ²	65.50%
250 X 250	42,375mm ²	424cm ²	0.0424m ²	67.80%
300 X 300	62,550mm ²	626cm ²	0.0625m ²	69.50%
400 X 400	103,040mm ²	1,031cm ²	0.103m ²	64.4%
450 X 450	142,155mm ²	1,422cm ²	0.142m ²	70.20%
500 X 500	172,500mm ²	1,726cm ²	0.172m ²	69%
600 X 600	253,800mm ²	2,539cm ²	0.254m ²	70.50%



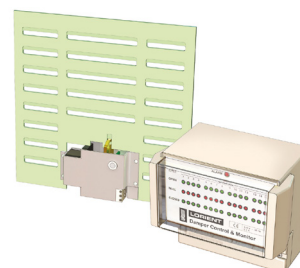
LVN20 SIZE	MM	CM	M	% FREE AREA
200 X 200	10,666mm ²	106.6cm ²	0.0106m ²	27.20%
250 X 250	16,387mm ²	163cm ²	0.0163m ²	26.22%
300 X 300	26,446mm ²	264.4cm ²	0.02644m ²	29.78%
350 X 350	3,3811mm ²	338cm ²	0.0338m ²	27.60%
400 X 400	50,911mm ²	509.1cm ²	0.0509m ²	32.14%
450 X 450	63,266mm ²	632cm ²	0.0632m ²	21.24%
500 X 500	8,527mm ²	769.5cm ²	0.0769m ²	31.02%
550 X 550	90,169mm ²	901cm ²	0.09m ²	29.80%
600 X 600	126,392mm ²	1,263cm ²	0.126m ²	35.10%



LVN25 SIZE	MM	CM	M	% FREE AREA
200 X 200	12,512mm ²	125.1cm ²	0.0125m ²	31.9%
300 X 300	31,013mm ²	310.1cm ²	0.0310m ²	34.92%
450 X 450	73,962mm ²	739cm ²	0.0739m ²	36.50%
600 X 600	130,416mm ²	1,304.1cm ²	0.1304m ²	36.46%



TALKBACK F+S DAMPERS	MM	CM	M	% FREE AREA
200 X 200	8,240mm ²	82.4cm ²	0.0082m ²	20.6%
250 X 250	15,437mm ²	154.3cm ²	0.0154m ²	24.7%
300 X 300	26,640mm ²	266.4cm ²	0.0266m ²	29.6%
350 X 350	37,975mm ²	379.7cm ²	0.0379m ²	31.0%
400 X 400	50,880mm ²	508.8cm ²	0.0508m ²	31.8%
450 X 450	69,862mm ²	692.5cm ²	0.0692m ²	34.2%
500 X 500	86,250mm ²	862.5cm ²	0.0862m ²	34.5%
600 X 600	133,200mm ²	1,332cm ²	0.1332m ²	37.0%



LVN20S	MM	CM	M	% FREE AREA
150 X 150	2,590mm ²	25.9cm ²	0.0025m ²	11.8%
200 X 200	8,089mm ²	80.8cm ²	0.0080m ²	20.6%
250 X 250	14,059mm ²	140.5cm ²	0.0140m ²	22.8%
300 X 300	25,024mm ²	250.2cm ²	0.0250m ²	28.1%
350 X 350	37,440mm ²	374.4cm ²	0.0374m ²	30.9%
400 X 300	42,360mm ²	423cm ²	0.0423m ²	35.3%
400 X 400	49,234mm ²	492.3cm ²	0.0492m ²	31.8%
450 X 450	64,985mm ²	649.8cm ²	0.0649m ²	32.3%
500 X 200	23,409mm ²	234cm ²	0.023m ²	23.4%
500 X 500	76,844mm ²	768.4cm ²	0.0768m ²	30.9%
550 X 550	90,386mm ²	903.8cm ²	0.0903m ²	30%
600 X 200	39,917mm ²	399cm ²	0.0399m ²	33.2%
600 X 600	130,416mm ²	1,304.1cm ²	0.1304m ²	36.4%



LVN25S	MM	CM	M	% FREE AREA
150 X 150	2,590mm ²	25.9cm ²	0.0025m ²	11.8%
200 X 200	8,089mm ²	80.8cm ²	0.0080m ²	20.6%
250 X 250	14,059mm ²	140.5cm ²	0.0140m ²	22.8%
300 X 300	25,024mm ²	250.2cm ²	0.0250m ²	28.1%
350 X 350	37,440mm ²	374.4cm ²	0.0374m ²	30.9%
400 X 400	49,234mm ²	492.3cm ²	0.0492m ²	31.8%
450 X 450	64,985mm ²	649.8cm ²	0.0649m ²	32.3%
500 X 500	76,844mm ²	768.4cm ²	0.0768m ²	30.9%
550 X 550	90,386mm ²	903.8cm ²	0.0903m ²	30%
600 X 600	130,416mm ²	1,304.1cm ²	0.1304m ²	36.4%



LVV40S	MM	CM	M	% FREE AREA
150 X 150	4,013mm ²	40.13cm ²	0.004m ²	17.80%
200 X 150	5,550mm ²	55.5cm ²	0.0055m ²	18.94%
200 X 200	8,089mm ²	80.89cm ²	0.00808m ²	20.22%
250 X 250	14,059mm ²	140.59cm ²	0.014m ²	22.49%
300 X 200	14,597mm ²	145.9cm ²	0.0145m ²	24.73%
300 X 300	25,024mm ²	250.24cm ²	0.025m ²	27.80%
350 X 350	37,440mm ²	374cm ²	0.0374m ²	30.56%
400 X 300	35,992mm ²	359.9cm ²	0.0359m ²	30.34%
400 X 400	47,208mm ²	472cm ²	0.0472m ²	29.50%
450 X 450	53,274mm ²	532cm ²	0.05m ²	26.30%
500 X 500	80,862mm ²	808cm ²	0.08m ²	32.32%
550 X 550	103,292mm ²	1,032cm ²	0.1m ²	34.14%
600 X 600	117,663mm ²	1,176cm ²	0.11m ²	32.68%



LVH44S	MM	CM	M	% FREE AREA
150 X 150	4,013mm ²	40.13cm ²	0.004m ²	17.80%
200 X 150	5,550mm ²	55.5cm ²	0.0055m ²	18.94%
200 X 200	8,089mm ²	80.89cm ²	0.008m ²	20.22%
250 X 200	10,739mm ²	107.4cm ²	0.0107m ²	21.87%
250 X 250	14,059mm ²	140.59cm ²	0.014m ²	22.49%
300 X 200	14,597mm ²	145.9cm ²	0.0145m ²	24.73%
300 X 300	25,024mm ²	250.24cm ²	0.025m ²	27.80%
350 X 350	37,440mm ²	374cm ²	0.037m ²	30.56%
400 X 300	35,992mm ²	359.9cm ²	0.0359m ²	30.34%
400 X 400	47,208mm ²	472cm ²	0.047m ²	29.50%
450 X 450	53,274mm ²	532cm ²	0.05m ²	26.3%
500 X 500	80,862mm ²	808cm ²	0.08m ²	32.32%
550 X 550	103,292mm ²	1,032cm ²	0.1m ²	34.14%
600 X 600	117,663mm ²	1,176cm ²	0.11m ²	32.68%

