



Products of WB Air



Single deflection grille: WBG - 1H



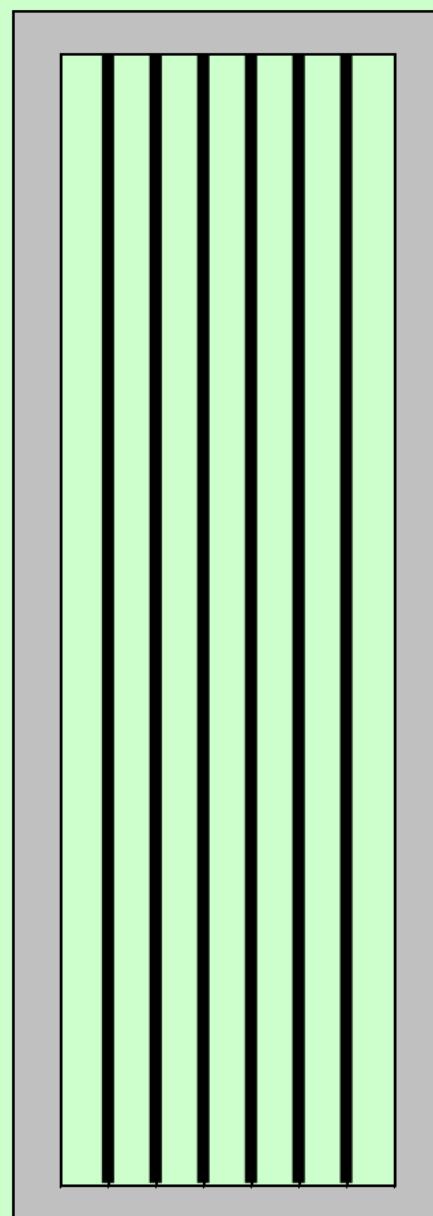
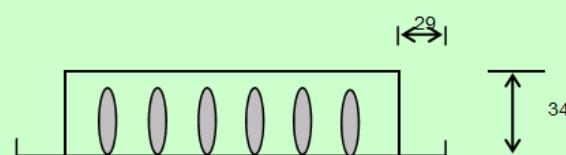
45 Degree Fixed Blade grille: WBG - FH

Single deflection grille

Model : WBG - 1H

Intro

WBG - 1H is an adjustable single deflection grille .
 Most commonly used in toilet and carpark exhaust .
 They can be mounted vertically or horizontally .
 They are available in an extensive range of standard and made to measure sizes .
 When equipped with an opposed blade damper , not only does it control the amount of air required , it also acts to provide an even air distribution across the entire face of the grille .



Standard Features

Fabricated in extruded aluminum .
 Blades are of an Airfoil profile to minimise turbulence and noise .
 Natural anodise finish or epoxy polyester powder coating in our standard white

Optional Features

- Opposed blade damper (D)
- Square to round neck adaptors (Adr)
- Removable core option
 - Hinge mechanism (H)
 - Spring mechanism (S)
- Air filters (F)
- Other powder coating colors

Model : WBG - FH**Technical Performance Data**

Size(sqm)	cmh	100	150	200	250	300	350	400	450	500	600	700	800	900	1000	1200
	l/s	28	42	56	69	83	97	111	125	139	167	194	222	250	278	333
	cfm	59	88	118	147	176	206	235	265	294	353	412	471	529	588	706
0.015	PD	15	37.4	69.9												
	NR	B	C	E												
0.02	PD	4.99	9.98	15	25	37.4	49.9	64.9	82.3							
	NR	A	B	B	C	D	E	E	F							
0.03	PD	2.5	4.99	9.98	12.5	20	29.9	37.4	44.9	54.9	79.8					
	NR	A	A	B	B	C	D	D	E	E	F					
0.05	PD		2.5	4.99	4.99	7.49	9.98	9.98	12.5		25	34.9	44.9	57.4	72.4	
	NR		A	A	A	A	B	B	B	C	D	E	E	F	G	
0.06	PD			2.5	4.99	4.99	7.49	7.49	9.98	9.98	15	22.5	29.9	37.4	44.9	62.4
	NR			A	A	A	A	A	B	B	C	D	D	E	F	G
0.08	PD				2.5	2.5	4.99	4.99	4.99	7.489	7.98	9.98	12.5	17.5	22.5	34.9
	NR				A	A	A	A	A	A	B	B	C	D	D	E

Size(sqm)	cmh	1600	1800	2000	2500	3000	2500	4000	500	5000	6000	7000	8000	9000	10000
	l/s	444	500	556	694	833	694	1111	139	1389	1667	1944	2222	2500	2778
	cfm	941	1059	1176	1471	1765	1471	2353	294	2941	3529	4118	4706	5294	5882
0.1	PD	39.9	47.4	57.4	84.8										
	NR	F	G	G	H										
0.2	PD	9.98	9.98	12.5	22.5	34.9	47.4	59.9	74.9						
	NR	C	D	D	E	F	G	H	H						
0.3	PD	4.99	4.99	7.49	9.98	9.98	15	20	27.4	34.9	47.9	64.9	82.3		
	NR	A	B	B	C	D	E	F	F	G	H	H	H		
0.4	PD	2.5	4.99	4.99	7.49	2.5	9.98	12.5	17.5	22.5	32.4	44.9	57.4	72.4	82.3
	NR	A	A	B	B	C	D	E	E	F	G	H	H	H	H
0.8	PD				2.5	2.5	4.99	4.99	4.99	7.49	7.49	9.98	12.5	15	22.5
	NR				A	A	A	B	C	C	D	E	E	F	G
1.0	PD					2.5	2.5	2.5	4.99	4.99	4.99	749	9.98	9.98	12.5
	NR					A	A	A	B	B	C	D	E	E	F

	A	B	C	D	E	F	G	H
NC Range	<20	20-25	25-30	30-35	35-40	40-45	45-50	>50

PD - Static pressure drops in pascal

NR - Noise rating in dB re 10-12 watts . Based on a 10dB room absorption . (calibrated in NC values)

Data of performances are based on independent tests conducted in accordance to ADC 1062 : GRD - 84

45 Degrees Fixed Blade Grilles

Model : WBG - FH



Intro

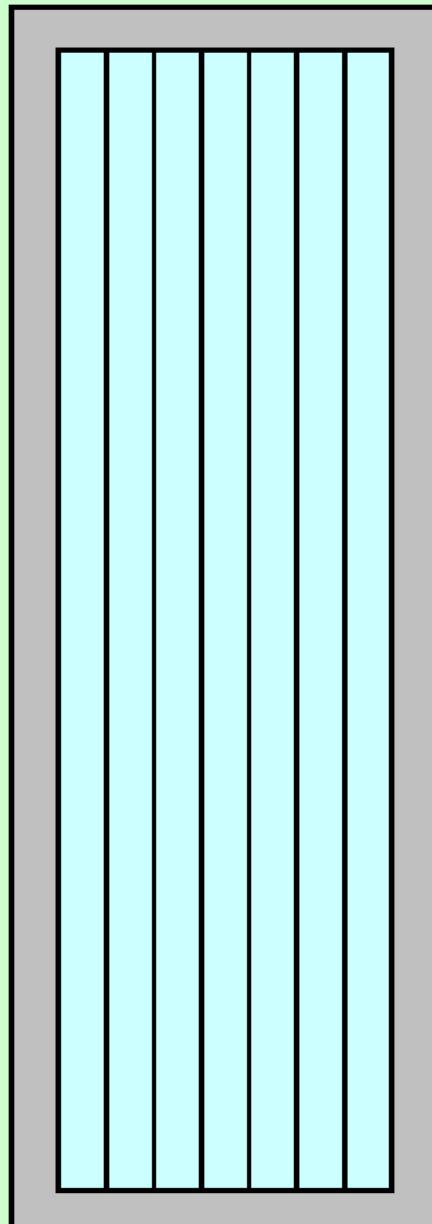
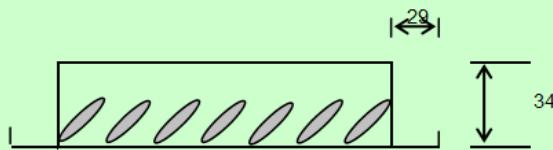
The WBG - FH is a single blade grille set at 45degrees horizon tal ,it has a free area of about 70%.

Most commonly used in toilet and carpark exhaust .

They can be mounted vertically or horizontally .

They are available in an extensive range of standard and made to measure sizes .

When equipped with an opposed blade damper , not only does it control the amount of air required , it also acts to provide an even air distribution across the entire face of the grille .



Standard Features

Fabricated in extruded aluminum .
 Blades are of an Airfoil profile to minimise turbulance and noise .
 Natural anodise finish or epoxy polyester powder coating in our standard white

Optional Features

- Opposed blade damper (D)
- Square to round neck adaptors (Adr)
- Removable core option
 - Hinge mechanism (H)
 - Spring mechanism (S)
- Air filters (F)
- Other powder coating colors

Model : WBG - 1H**Technical Performance Data**

Size(sqm)	cmh	100	150	200	250	300	350	400	450	500	600	700	800	900	1000	1200
	l/s	28	42	56	69	83	97	111	125	139	167	194	222	250	278	333
	cfm	59	88	118	147	176	206	235	265	294	353	412	471	529	588	706
0.015	PD	12.5	34.9	57.4												
	NR	A	B	C												
0.02	PD	4.99	9.98	12.5	22.5	34.9	46.15	57.4	74.9							
	NR	A	A	A	B	C	D	D	E							
0.03	PD	2.5	4.99	7.49	9.98	17.5	27.4	34.9	42.4	49.9	74.9					
	NR	A	A	A	B	B	C	D	D	E						
0.05	PD		2.5	2.5	4.99	7.49	7.49	9.98	9.98	15	25	32.4	42.4	52.4	64.9	
	NR		A	A	A	A	A	B	B	B	C	D	D	E	E	
0.06	PD			2.5	4.99	4.99	7.49	7.49	9.98	12.5	20	27.4	32.4	39.9	57.4	77.3
	NR			A	A	A	A	A	B	B	C	C	D	E	E	F
0.08	PD					2.5	4.99	4.99	4.99	7.49	7.49	9.98	12.5	17.5	22.5	32.4
	NR					A	A	A	A	A	A	B	B	C	C	D

Size(sqm)	cmh	700	800	900	1000	1200	1600	2000	2500	3000	4000	5000	6000	8000	10000	
	l/s	194	222	250	278	333	444	556	694	833	1111	1389	1667	2222	2778	
	cfm	412	471	529	588	706	941	1176	1471	1765	2353	2941	3529	4706	5882	
0.1	PD	7.49	9.98	9.98	12.5	20	34.9	54.9	79.8							
	NR	A	B	B	B	C	E	F	G							
0.2	PD		2.5	4.99	4.99	4.99	9.98	12.5	20	32.4	54.9	79.8				
	NR		A	A	A	A	B	B	C	D	F	G				
0.3	PD					2.5	4.99	4.99	7.49	9.98	20	32.4	44.9	74.9		
	NR					A	A	A	B	C	E	F	G	H		
0.4	PD						2.5	4.99	4.99	7.49	9.98	22.5	32.4	54.9	77.3	
	NR						A	A	A	B	D	E	F	G	H	
0.8	PD								2.5	2.5	4.99	4.99	7.49	9.98	20	
	NR								A	A	A	B	C	E	F	
1.0	PD										2.5	4.99	4.99	9.98	9.98	
	NR										A	A	B	D	E	

	A	B	C	D	E	F	G	H
NC Range	<20	20-25	25-30	30-35	35-40	40-45	45-50	>50

PD - Static pressure drops in pascal

NR - Noise rating in dB re 10-12 watts . Based on a 10dB room absorption . (calibrated in NC values)

Data of performances are based on independent tests conducted in accordance to ADC 1062 : GRD - 84



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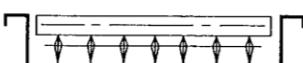
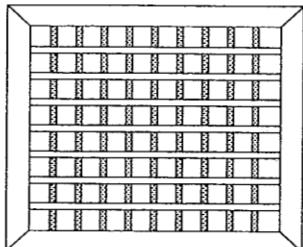
Grilles & Registers

Double deflection grille WBG - 2HV

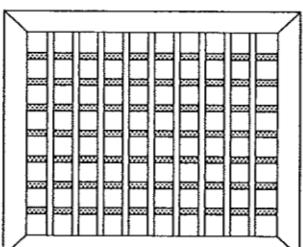




WBG - 2HV and 2VH Wall Mounted Double Deflection Grilles



WBG - 2HV



WBG - 2VH

The WBG-2HV and WBG-2VH universal double deflection grilles are most commonly used as a side-wall supply grille.

The WBG-2HV is constructed of 2 sets of individually adjustable deflector blades, with the horizontal set at the front (to control throw/drop) and the vertical set at the back (to control spread). The WBG-2VH on the others hand has the vertical set of blades at the front and the horizontal set at the back.

The Wong Bros 2HV and 2VH models are available in an extensive range of standard and made to measure sizes.

When equipped with an opposed blade volume control damper, not only does it control the amount of air required, it also acts to provide an even distribution of air throughout the entire face of the grille.

Where flexible duct or rigid round ducts are concerned, the WBG-2HV or WBG-2VH may even be equipped with a square to round neck adaptor for quick and easy co-ordination.

Though calibrated and tested for supply applications, the WBG-2HV and WBG-2VH can also be used as a fresh air grille, exhaust air grille or even as a return air grille.

Standard Features:

- Extruded aluminium construction for durability and light weight.
- Louvre blades shall be of an airfoil profile to minimise unnecessary turbulence and noise.
- Individually adjustable blades set in air rigid aluminium extruded frames.
- Natural anodise finish or standard epoxy powder coating.

Optional Accessories:

- Opposed Blade Volume Dampers (OBD)
- Square to Round Neck Adaptors (ADR)
- Removable core type construction c/w hinged mechanism or screw fasteners. (For installation of filter media or easy access thru duct for maintenance.)



SELECTION/LOCATION OF REGISTERS/GRILLES

The following text that has been prepared is intended to assist Engineers & Designers to achieve and maintain an optimum operating system, incorporating a suitable Wong Bros Register.

Part I

Should a designer consider the use of a register/grille, the structural & technical elements of the conditioned space and the performances of the outlet are to be carefully matched and studied. A high quality of air diffusion in the occupied zone could be achieved and maintained if the following factors are to be considered altogether.

- 1) Maintaining desirable conditions within the conditioned space - The objective of air diffusion is to create a well balanced combination of air motion, humidity and temperature in the occupied zone. Inability to maintain these conditions could cause discomfort to occupants, which primarily arises due to excessive air motion (draft), excessive variations in room air temperature or failure to meet load requirements (ie. to deliver correct amount of air to different locations).
- 2) Effective mixing of air - Effective ventilation requires a complete mixture (by induction) of the total air in the specified space with the conditioned air that has been supplied.
- 3) (i) Grille mounting height
(ii) Direction of air throw (toward wall, away from wall or both)
(iii) Distance between Grilles or distance between grille and wall.

Throw may be selected for an entire or a substantial portion of the distance between the outlet and the enclosing wall. For optimum air diffusion, the air should drop before striking the wall or in other cases, an opposing air stream. To promote greater air motion where high ceilings are concerned, it is necessary to adopt a longer throw, but drop should never be exceeded into the 1800mm level. For VAV designs, a throw that exceeds the maximum design volume may even be desirable but again, the total air drop should not reach the occupied zone. Spread should be sufficient so that the space at the end of the throw is totally blanketed.

- 4) Outlet vane deflection setting - It directly affects the throw and drop. Tests shows that the vane depth should be greater or equals the distance between the vanes, otherwise airstream control would not be possible. The most desirable setting would be one that causes a ceiling effect (where the total air glides along the surface of the ceiling).
- 5) The heating & cooling load design - Depends on buildings' construction type, application, size and interior design. Both, type and location of outlets can be determined when local sources of heat gain or loss which promotes convection currents (effects of radiation) are being studied. Outlets would hence be located where any undesirable convection currents are evident (ie. counteraction by directing cool air towards the heat source and/or positioning an exhaust or return grille adjacent to it).
- 6) The desired air diffusion criterias (ie. permissible noise, pattern of distribution, supplied air volumes, pressure loss, required throw) and the actual technical performance of the grille (Part II of this section).

In other words, proper air diffusion would have been categorised into two different tasks.

- To obtain an acceptable entrainment of room air by the primary airstream. To monitor air motion and temperature differences to the required limits before the air enters the zone of occupancy.
- The counteraction or neutralization of any undesirable convection currents or effects due to radiation within the space.



WONG BROTHERS



SELECTION/LOCATION OF REGISTERS/GRILLES

Part II Actual Performance of Grille

- 1) The following performance data are the results of actual tests conducted by VIPAC Engineers and Scientists Ltd. (Registered under the National Association of Testing Authorities). The test set up was in general accordance with Air Diffusion Council (USA) Equipment Test Code 1062: GRD - 84.

Acoustics -	Australian standards 1217.2 - 1985. "Acoustic - Determination of Sound Power levels of Noise Sources Part 2 - Precision methods of broad band sources in reverberation rooms"
Airflow -	Air Diffusion Council (USA) Equipment test code 1062: GRD - 84
Throw & Static	
Pressure Drop -	Air Diffusion Council (USA) Equipment test code 1062: GRD - 84

- 2) For each given Air volume (l/s), the static pressure drop (Pa), noise rating (dB) and throw (m) are provided for a range of sizes. The individual Neck Velocities can be achieved by dividing the air volume by the neck area. The following results were obtained without the addition of any accessories.

In the event where an Opposed blade damper is installed, both the pressure and the noise level would increase.

The following table outlines the approximate variations of both noise level and pressure drop.

Effective Damper Opening	100%	80%	70%	50%
Total Pressure	1	1.15	2	4
dB Increase	0	4.5	8	16

For instance, to obtain the approximate value for damper opening at 80%,

- (i) Take pressure drop multiply by 1.15
- (ii) Add 4.5dB to actual value





Diffuser Sizes For Which Nomogram Predictions Are Provided

Using The Nomograms:

The tables below outline the various sizes of diffusers for which data prediction and Nomograms have been presented.

For example if you wish to determine the data corresponding to a diffuser with a nominal neck size of 400mm x 400mm, then Category D should be used.

For sizes not listed below, the nearest corresponding size can be used as an approximation, although some discrepancies may occur between the predicted data and that obtained in practice.

Nominal Face Size		Nominal Neck Size		Category
(mm)	(mm)	(mm)	(mm)	
150	150	90	90	A1
150	250	90	190	A2
150	350	90	290	A3
150	450	90	390	A4
150	550	90	490	A5
150	650	90	590	A6
150	750	90	690	A7
150	850	90	790	A8

Nominal Face Size		Nominal Neck Size		Category
(mm)	(mm)	(mm)	(mm)	
250	250	190	190	B1
250	350	190	290	B2
250	450	190	390	B3
250	550	190	490	B4
250	650	190	590	B5
250	750	190	690	B6
250	850	190	790	B7
250	950	190	890	B8

Nominal Face Size		Nominal Neck Size		Category
(mm)	(mm)	(mm)	(mm)	
350	350	290	290	C1
350	450	290	390	C2
350	550	290	490	C3
350	650	290	590	C4
350	750	290	690	C5
350	850	290	790	C6
350	950	290	890	C7
350	1050	290	990	C8

Nominal Face Size		Nominal Neck Size		Category
(mm)	(mm)	(mm)	(mm)	
450	450	390	390	D1
450	550	390	490	D2
450	650	390	590	D3
450	750	390	690	D4
450	850	390	790	D5
450	950	390	890	D6
450	1050	390	990	D7
450	1150	390	1090	D8



WONG BROTHERS



Diffuser Sizes For Which Nomogram Predictions Are Provided

Nominal Face Size (mm)	Nominal Neck Size (mm)	Category
550	490	E1
550	590	E2
550	690	E3
550	790	E4
550	890	E5
550	990	E6
550	1090	E7
550	1190	E8

Nominal Face Size (mm)	Nominal Neck Size (mm)	Category
650	650	F1
650	750	F2
650	850	F3
650	950	F4
650	1050	F5
650	1150	F6
650	1250	F7
650	1350	F8

Nominal Face Size (mm)	Nominal Neck Size (mm)	Category
750	690	G1
750	790	G2
750	890	G3
750	990	G4
750	1090	G5
750	1190	G6
750	1290	G7
750	1390	G8

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category A)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	225		
A1	NND 90x90	Pressure Drop (Pa)	44.5	68.5	98.0	132.0	171.5	215.5	264.5	319.0	377.5	441.5	510.0	583.0	661.5	744.0	832.0	924.0	1021.5			
	NFD 150x150	Noise Rating*	2	7	11	15	18	21	23	26	29	32	35	38	40	43	45	47	49			
		Throw** (m)	6.6	7.4	8.0	8.6	9.0	9.4	9.8	10.0	10.4	10.6	10.8	11.2	11.4	11.6	11.8	12.0	12.0			
A2	NND 90x190	Pressure Drop (Pa)		22.0	30.0	38.5	48.5	59.5	72.0	85.0	99.5	115.0	131.5	149.0	167.5	187.5	208.0	230.0	289.5			
	NFD 150x250	Noise Rating*		4	7	10	13	15	18	20	21	23	25	26	28	31	33	35	39			
		Throw** (m)		6.0	6.6	7.0	7.4	7.8	8.2	8.4	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.6			
A3	NND 90x290	Pressure Drop (Pa)			13.0	17.0	21.0	26.0	31.0	37.0	43.0	50.0	57.0	64.5	73.0	81.5	90.5	100.0	125.5			
	NFD 150x350	Noise Rating*			3	6	9	11	13	15	17	19	20	22	23	24	26	27	31			
		Throw** (m)			5.4	6.0	6.4	6.8	7.0	7.4	7.6	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.6			
A4	NND 90x390	Pressure Drop (Pa)				9.5	12.0	14.5	17.5	20.5	24.0	28.0	32.0	36.0	40.5	45.5	50.5	56.0	70.0			
	NFD 150x450	Noise Rating*				3	5	8	10	12	14	16	17	19	20	21	23	24	27			
		Throw** (m)				5.2	5.6	6.0	6.4	6.6	6.8	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.8			
A5	NND 90x490	Pressure Drop (Pa)					6.0	7.5	9.0	11.0	13.0	15.5	18.0	20.5	23.0	26.0	29.0	32.5	35.5	45.0		
	NFD 150x550	Noise Rating*					0	3	6	8	10	12	13	15	16	18	19	20	21	24		
		Throw** (m)					4.6	5.0	5.4	5.6	6.0	6.2	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.2		
A6	NND 90x590	Pressure Drop (Pa)						5.0	6.5	7.5	9.0	10.5	12.5	14.0	16.0	18.0	20.0	22.5	25.0	31.0		
	NFD 150x650	Noise Rating*						1	4	6	8	10	11	13	14	16	17	18	19	22		
		Throw** (m)						4.4	4.8	5.2	5.6	5.8	6.0	6.2	6.6	6.8	7.0	7.2	7.4	7.8		
A7	NND 90x690	Pressure Drop (Pa)							4.5	5.5	6.5	8.0	9.0	10.5	12.0	13.5	15.0	16.5	18.0	23.0		
	NFD 150x750	Noise Rating*							2	4	6	8	10	11	13	14	15	17	18	21		
		Throw** (m)							4.4	4.8	5.0	5.4	5.6	5.8	6.2	6.4	6.6	6.8	6.8	7.2		
A8	NND 90x790	Pressure Drop (Pa)								3.5	4.5	5.0	6.0	7.0	8.0	9.0	10.0	11.5	12.5	14.0	17.5	
	NFD 150x850	Noise Rating*								1	3	5	7	8	10	11	13	14	15	16	19	
		Throw** (m)								4.0	4.4	4.8	5.0	5.2	5.6	5.8	6.0	6.2	6.4	6.6	7.0	

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category A)

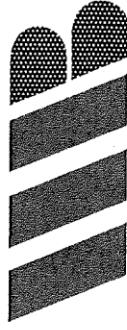
- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	250	275	300	325	350	375	400	425	450	475	500	600	700	800	900	1000	1250
A1	NND 90x90	Pressure Drop (Pa)																	
	NFD 150x150	Noise Rating*																	
		Throw** (m)																	
A2	NND 90x190	Pressure Drop (Pa)	355.5	428.0	507.0														
	NFD 150x250	Noise Rating*	43	47	50														
		Throw** (m)	11.0	11.4	11.6														
A3	NND 90x290	Pressure Drop (Pa)	154.5	185.5	220.0	257.0	297.0	340.0	385.5	433.5	484.5	538.5	595.0						
	NFD 150x350	Noise Rating*	35	39	42	45	48	51	53	56	58	60	62						
		Throw** (m)	10.0	10.2	10.6	10.8	11.0	11.4	11.6	11.8	12.0	12.2	12.4						
A4	NND 90x390	Pressure Drop (Pa)	86.0	104.0	123.0	143.5	166.0	190.0	215.5	242.0	271.0	301.0	332.5	474.0					
	NFD 150x450	Noise Rating*	30	33	37	40	43	45	48	50	52	54	56	63					
		Throw** (m)	9.2	9.4	9.8	10.0	10.4	10.6	10.8	11.0	11.2	11.4	11.6	12.2					
A5	NND 90x490	Pressure Drop (Pa)	55.0	66.5	78.5	92.0	106.0	121.5	137.5	155.0	173.0	192.5	212.5	303.0	409.0	531.0			
	NFD 150x550	Noise Rating*	27	30	32	35	38	41	43	46	48	50	52	59	65	70			
		Throw** (m)	8.6	8.8	9.2	9.4	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.6	12.2	12.6			
A6	NND 90x590	Pressure Drop (Pa)	38.5	46.0	54.5	64.0	73.5	84.5	95.5	107.5	120.5	133.5	147.5	210.5	284.5	369.0	464.0		
	NFD 150x650	Noise Rating*	25	27	30	32	35	37	40	42	44	47	49	56	61	67	71		
		Throw** (m)	8.0	8.4	8.8	9.0	9.2	9.4	9.6	10.0	10.2	10.4	11.2	11.6	12.2	12.6			
A7	NND 90x690	Pressure Drop (Pa)	28.0	34.0	40.0	47.0	54.5	62.0	70.5	79.0	88.5	98.5	108.5	155.0	209.5	271.5	341.5	419.5	
	NFD 150x750	Noise Rating*	23	25	28	30	32	35	37	39	42	44	46	53	59	64	68	72	
		Throw** (m)	7.6	8.0	8.2	8.6	8.8	9.0	9.2	9.6	9.8	10.0	10.8	11.2	11.8	12.2	12.6		
A8	NND 90x790	Pressure Drop (Pa)	21.5	26.0	31.0	36.0	41.5	47.5	54.0	61.0	68.0	75.5	83.5	119.0	160.5	208.5	262.0	322.0	
	NFD 150x850	Noise Rating*	22	24	26	29	31	33	35	37	39	41	43	50	56	61	66	70	
		Throw** (m)	7.4	7.6	8.0	8.2	8.4	8.8	9.0	9.2	9.4	9.6	9.8	10.4	10.8	11.4	11.8	12.2	

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s





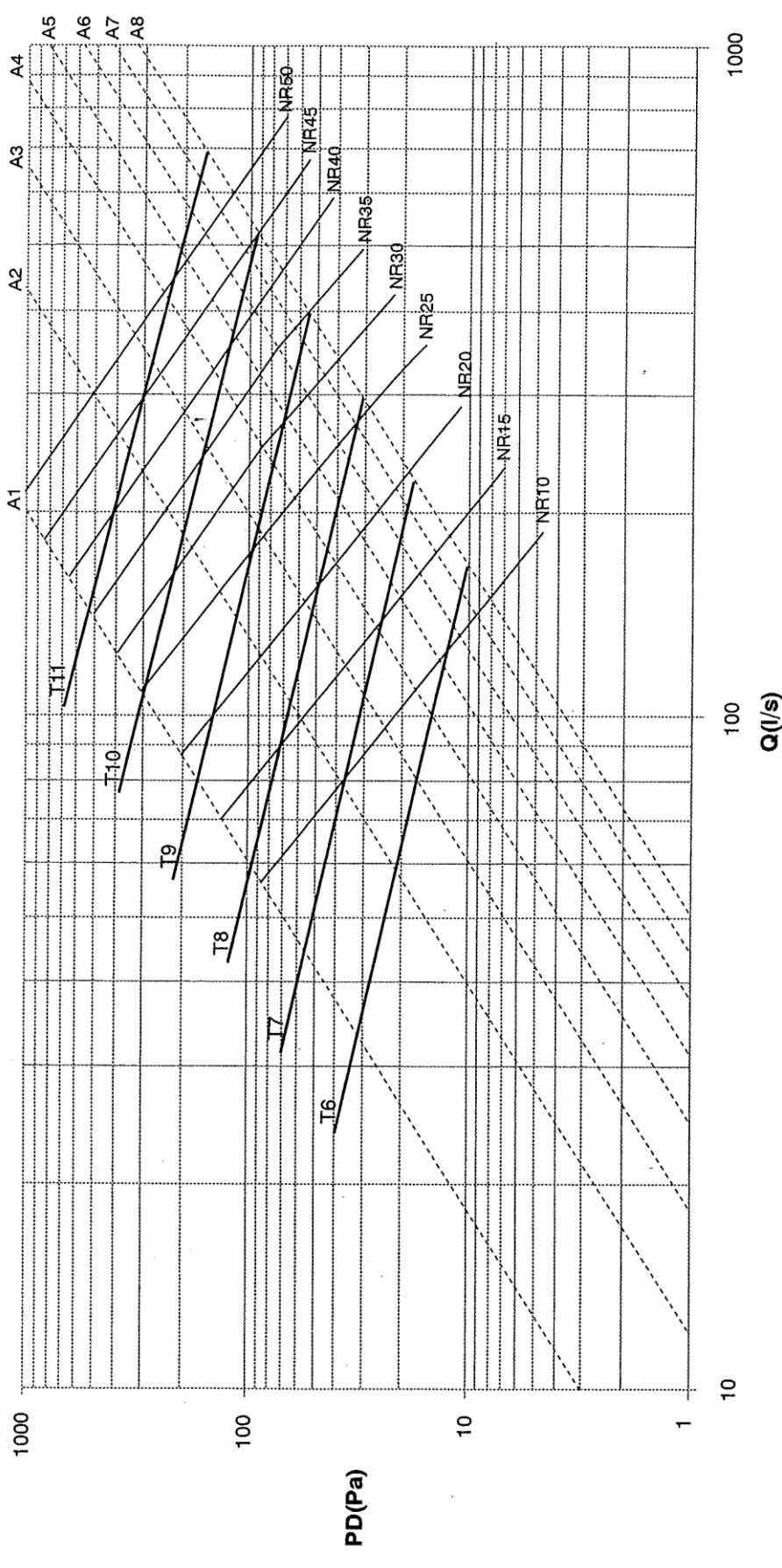
WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category A)

- = PD vs flow
- = Throw, metres
- = NR, 10-50



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category B)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	80	90	100	110	120	130	140	150	160	170	180	190	200	225	250	275	300	325
B1	NND 190x190	Pressure Drop (Pa)	8.5	11.0	13.5	16.0	19.0	22.5	26.0	29.5	33.5	38.0	42.0	47.0	52.0	65.0	80.0	96.5	114.0	133.5
	NFD 250x250	Noise Rating*	2	5	7	10	12	13	15	17	18	20	21	22	23	26	29	33	36	39
		Throw** (m)	5.0	5.4	5.8	6.2	6.6	6.8	7.0	7.2	7.6	7.8	8.0	8.2	8.6	9.0	9.4	9.6	10.0	
B2	NND 190x290	Pressure Drop (Pa)	5.0	6.0	7.0	8.5	9.5	11.0	13.0	14.5	16.5	18.5	20.5	22.5	28.5	35.0	42.0	49.5	58.0	
	NFD 250x350	Noise Rating*	1	3	5	7	9	11	12	14	15	17	18	19	22	24	27	29	32	
		Throw** (m)	4.4	4.8	5.0	5.4	5.6	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.6	8.0	8.2	8.6	8.8	
B3	NND 190x390	Pressure Drop (Pa)			4.0	4.5	5.5	6.5	7.0	8.0	9.0	10.0	11.5	12.5	16.0	19.5	23.5	27.5	32.5	
	NFD 250x450	Noise Rating*			2	4	6	8	9	11	12	14	15	16	19	21	23	26	28	
		Throw** (m)			4.2	4.6	4.8	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.8	7.2	7.4	7.8	8.0	
B4	NND 190x490	Pressure Drop (Pa)			3.0	3.5	4.0	4.5	5.0	6.0	6.5	7.5	8.0	10.0	12.5	15.0	17.5	20.5		
	NFD 250x550	Noise Rating*			2	4	5	7	8	10	11	12	14	16	19	21	23	25		
		Throw** (m)			4.0	4.2	4.4	4.8	5.0	5.2	5.4	5.6	5.8	6.2	6.6	6.8	7.2	7.4		
B5	NND 190x590	Pressure Drop (Pa)				2.5	3.0	3.0	3.5	4.0	4.5	5.0	5.5	7.0	8.5	10.5	12.5	14.5		
	NFD 250x650	Noise Rating*				2	3	5	7	8	9	10	12	14	17	19	21	23		
		Throw** (m)				3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.6	6.0	6.4	6.6	7.0		
B6	NND 190x690	Pressure Drop (Pa)					2.0	2.5	2.5	3.0	3.5	3.5	4.0	5.0	6.5	7.5	9.0	10.5		
	NFD 250x750	Noise Rating*					2	3	5	6	8	9	10	13	15	17	19	21		
		Throw** (m)					3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.2	5.6	6.0	6.2	6.6		
B7	NND 190x790	Pressure Drop (Pa)						2.0	2.0	2.5	2.5	3.0	3.0	4.0	5.0	6.0	7.0	8.0		
	NFD 250x850	Noise Rating*						2	4	5	6	7	9	11	14	16	18	20		
		Throw** (m)						3.4	3.6	3.8	4.0	4.2	4.4	4.8	5.2	5.6	6.0	6.2		
B8	NND 190x890	Pressure Drop (Pa)							1.5	1.5	2.0	2.0	2.5	2.5	3.0	4.0	4.5	5.5	6.5	
	NFD 250x950	Noise Rating*							1	2	4	5	6	7	10	13	15	17	19	
		Throw** (m)							3.0	3.4	3.6	3.8	4.0	4.2	4.6	5.0	5.2	5.6	5.8	

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category B)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	350	375	400	425	450	475	500	600	700	800	900	1000	1250	1500	1750	2000	2500
B1	NND 190x190	Pressure Drop (Pa)	154.0	176.0	200.0	225.0	251.5	279.5	309.0	440.5	594.5								
	NFD 250x250	Noise Rating*	42	45	47	49	52	54	56	63	69								
		Throw** (m)	10.2	10.4	10.6	10.8	11.0	11.2	11.4	12.2	12.6								
B2	NND 190x290	Pressure Drop (Pa)	67.0	76.5	87.0	97.5	109.0	121.5	134.0	191.0	258.0	335.0	421.5	517.0					
	NFD 250x350	Noise Rating*	34	37	39	41	44	46	48	55	61	66	70	74					
		Throw** (m)	9.2	9.4	9.6	9.8	10.0	10.2	10.4	11.0	11.6	12.0	12.4	12.8					
B3	NND 190x390	Pressure Drop (Pa)	37.5	43.0	48.5	54.5	61.0	68.0	75.0	107.0	144.0	187.0	235.5	289.0	446.0	636.5			
	NFD 250x450	Noise Rating*	30	32	34	36	38	40	42	49	55	60	65	69	77	84			
		Throw** (m)	8.4	8.6	8.8	9.0	9.2	9.4	9.6	10.2	10.8	11.2	11.6	12.0	12.8	13.6			
B4	NND 190x490	Pressure Drop (Pa)	24.0	27.5	31.0	35.0	39.0	43.5	48.0	68.5	92.0	119.5	150.5	184.5	285.0	407.0	549.0		
	NFD 250x550	Noise Rating*	27	29	31	33	35	36	38	45	51	56	60	64	73	80	86		
		Throw** (m)	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.6	10.2	10.6	11.0	11.4	12.2	12.8	13.4		
B5	NND 190x590	Pressure Drop (Pa)	16.5	19.0	21.5	24.0	27.0	30.0	33.5	47.5	64.0	83.0	104.5	128.5	198.0	282.5	381.5	495.0	
	NFD 250x650	Noise Rating*	25	27	29	31	32	34	35	41	47	52	57	61	69	76	82	88	
		Throw** (m)	7.2	7.4	7.6	8.0	8.2	8.2	8.4	9.2	9.6	10.2	10.6	10.8	11.6	12.4	13.0	13.4	
B6	NND 190x690	Pressure Drop (Pa)	12.0	14.0	16.0	18.0	20.0	22.0	24.5	35.0	47.0	61.0	77.0	94.5	146.0	208.0	281.0	364.5	563.0
	NFD 250x750	Noise Rating*	23	25	27	29	30	32	33	39	44	49	54	58	67	74	79	85	93
		Throw** (m)	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.6	9.2	9.6	10.0	10.4	11.2	12.0	12.4	13.0	13.8
B7	NND 190x790	Pressure Drop (Pa)	9.5	10.5	12.0	13.5	15.5	17.0	19.0	27.0	36.0	47.0	59.0	72.5	112.0	159.5	215.5	279.5	432.0
	NFD 250x850	Noise Rating*	21	23	25	27	29	30	32	37	42	47	51	55	64	71	77	82	91
		Throw** (m)	6.4	6.6	7.0	7.2	7.4	7.6	7.6	8.4	8.8	9.4	9.8	10.2	10.8	11.6	12.0	12.6	13.4
B8	NND 190x890	Pressure Drop (Pa)	7.5	8.5	9.5	11.0	12.0	13.5	15.0	21.0	28.5	37.0	47.0	57.5	88.5	126.5	171.0	221.0	342.0
	NFD 250x950	Noise Rating*	20	22	24	25	27	29	30	36	40	45	49	53	62	69	75	80	88
		Throw** (m)	6.2	6.4	6.6	6.8	7.0	7.2	7.4	8.0	8.6	9.0	9.4	9.8	10.6	11.2	11.8	12.2	13.0

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s



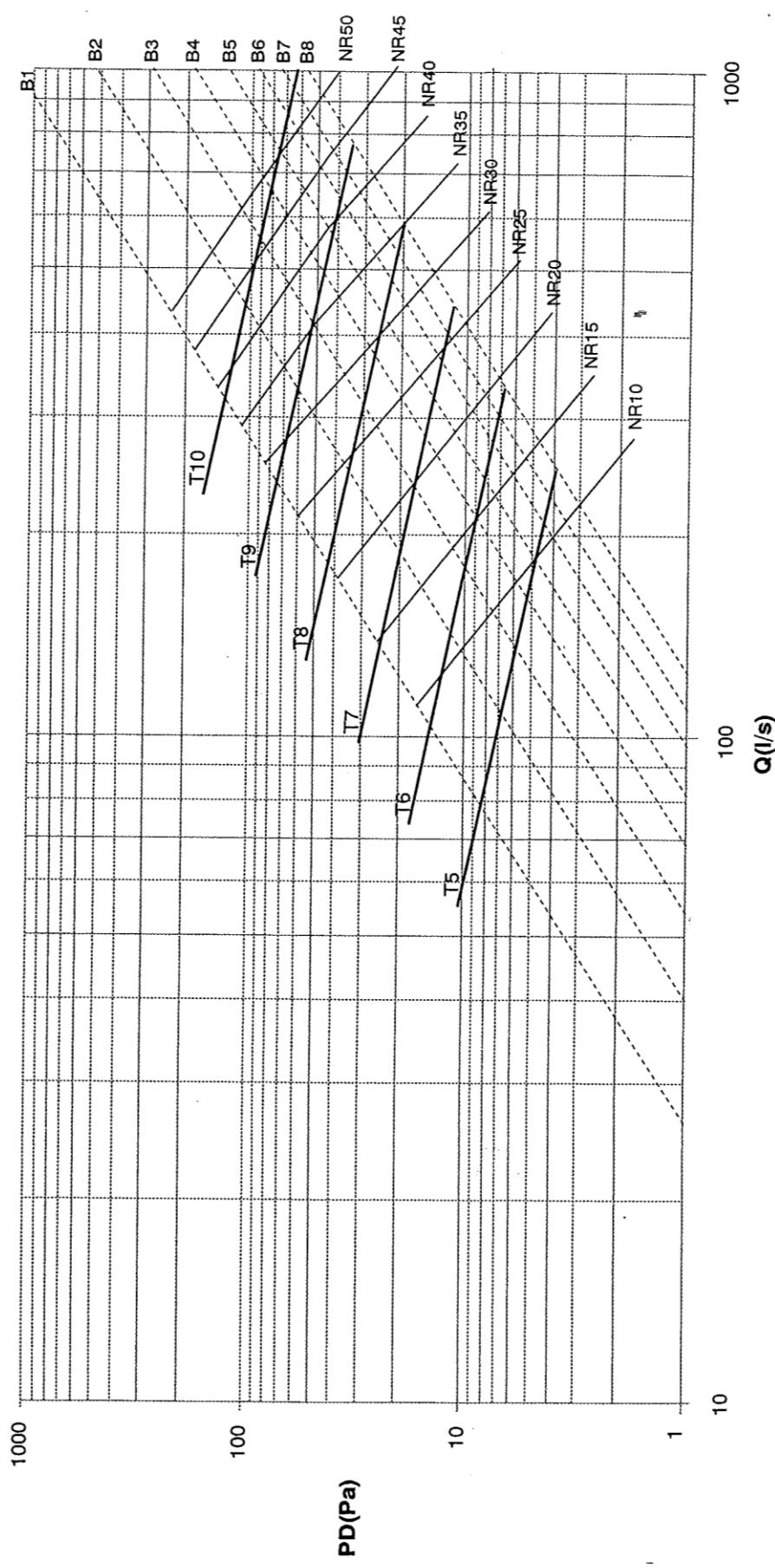
WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category B)

- = PD vs flow
- = Throw, metres
- = NR, 10-50



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category C)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)																
			110	120	130	140	150	160	170	180	190	200	225	250	275	300	325	350
C1	NND 290x290	Pressure Drop (Pa)	3.0	3.5	4.0	5.0	5.5	6.5	7.0	8.0	9.0	10.0	12.5	15.0	18.0	21.5	25.0	29.0
	NFD 350x350	Noise Rating*	1	3	5	6	8	9	11	12	13	15	17	20	22	24	26	28
		Throw** (m)	3.8	4.2	4.4	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.4	6.8	7.2	7.4	7.8	8.0
C2	NND 290x390	Pressure Drop (Pa)			2.5	2.5	3.0	3.5	4.0	4.5	5.0	5.5	7.0	8.5	10.0	12.0	14.0	16.0
	NFD 350x450	Noise Rating*			2	3	5	6	8	9	10	12	14	17	19	21	23	25
		Throw** (m)			3.6	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.6	6.0	6.4	6.6	7.0	7.2
C3	NND 290x490	Pressure Drop (Pa)				1.5	2.0	2.5	2.5	3.0	3.0	3.5	4.5	5.5	6.5	7.5	9.0	10.5
	NFD 350x550	Noise Rating*				1	3	4	5	7	8	9	12	14	16	18	20	22
		Throw** (m)				3.4	3.6	3.8	4.0	4.2	4.4	4.6	5.0	5.4	5.8	6.0	6.4	6.6
C4	NND 290x590	Pressure Drop (Pa)					1.5	1.5	2.0	2.0	2.0	2.5	3.0	3.5	4.5	5.5	6.0	7.0
	NFD 350x650	Noise Rating*					1	2	4	5	6	7	10	12	15	17	18	20
		Throw** (m)					3.0	3.2	3.6	3.8	4.0	4.0	4.6	5.0	5.2	5.6	5.8	6.0
C5	NND 290x690	Pressure Drop (Pa)						1.0	1.5	1.5	1.5	2.0	2.0	3.0	3.5	4.0	4.5	5.5
	NFD 350x750	Noise Rating*						1	2	3	4	6	8	11	13	15	17	18
		Throw** (m)						2.8	3.0	3.2	3.4	3.6	4.0	4.4	4.8	5.2	5.4	5.6
C6	NND 290x790	Pressure Drop (Pa)							1.0	1.0	1.0	1.5	1.5	2.0	2.5	3.0	3.5	4.0
	NFD 350x850	Noise Rating*							1	2	3	4	7	9	12	14	15	17
		Throw** (m)							2.6	2.8	3.0	3.2	3.8	4.0	4.4	4.8	5.0	5.4
C7	NND 290x890	Pressure Drop (Pa)								1.0	1.0	1.0	1.5	1.5	2.0	2.5	3.0	3.0
	NFD 350x950	Noise Rating*								1	2	3	6	8	10	12	14	16
		Throw** (m)								2.6	2.8	3.0	3.4	3.8	4.2	4.4	4.8	5.0
C8	NND 290x990	Pressure Drop (Pa)									1.0	1.0	1.0	1.5	1.5	2.0	2.5	2.5
	NFD 350x1050	Noise Rating*									1	2	5	7	9	11	13	15
		Throw** (m)									2.4	2.6	3.0	3.4	3.8	4.2	4.4	4.6

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category C)

• NND - Nominal Neck Dimensions

• NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)																		
			375	400	425	450	475	500	600	700	800	900	1000	1250	1500	1750	2000	2500		
C1	NND 290x290	Pressure Drop (Pa)	33.0	37.5	42.5	47.5	52.5	58.0	83.0	112.0	145.0	183.0	224.5	347.0	494.5					
	NFD 350x350	Noise Rating*	30	32	34	36	38	40	47	53	58	62	66	75	82					
		Throw** (m)	8.2	8.4	8.6	8.8	9.0	9.2	9.8	10.4	10.8	11.2	11.6	12.4	13.2					
C2	NND 290x390	Pressure Drop (Pa)	18.5	21.0	23.5	26.5	29.5	32.5	46.5	62.5	81.0	102.0	125.5	193.5	276.5	373.0	484.0			
	NFD 350x450	Noise Rating*	27	29	30	32	34	35	41	47	52	57	61	69	76	82	87			
		Throw** (m)	7.4	7.6	7.8	8.0	8.2	8.4	9.0	9.6	10.0	10.4	10.8	11.6	12.4	12.8	13.4			
C3	NND 290x490	Pressure Drop (Pa)	12.0	13.5	15.0	17.0	19.0	21.0	29.5	40.0	52.0	65.5	80.0	124.0	176.5	238.5	309.5	477.5		
	NFD 350x550	Noise Rating*	24	26	28	29	31	32	38	43	48	52	56	65	72	78	83	92		
		Throw** (m)	6.8	7.0	7.2	7.4	7.6	7.8	8.4	9.0	9.4	9.8	10.2	11.0	11.6	12.2	12.8	13.6		
C4	NND 290x590	Pressure Drop (Pa)	8.0	9.5	10.5	12.0	13.0	14.5	20.5	28.0	36.0	45.5	55.5	86.0	122.5	165.5	215.0	332.0		
	NFD 350x650	Noise Rating*	22	23	25	27	29	30	35	40	44	49	53	61	69	74	80	88		
		Throw** (m)	6.4	6.6	6.8	7.0	7.2	7.4	8.0	8.6	9.0	9.4	9.8	10.6	11.2	11.8	12.2	13.0		
C5	NND 290x690	Pressure Drop (Pa)	6.0	7.0	7.5	8.5	9.5	10.5	15.0	20.5	26.5	33.5	41.0	63.5	90.5	122.0	158.0	244.5		
	NFD 350x750	Noise Rating*	20	22	23	25	27	28	33	38	42	46	50	59	66	71	77	85		
		Throw** (m)	6.0	6.2	6.4	6.6	6.8	7.0	7.6	8.0	8.6	9.0	9.4	10.0	10.8	11.2	11.8	12.6		
C6	NND 290x790	Pressure Drop (Pa)	4.5	5.5	6.0	6.5	7.5	8.0	11.5	15.5	20.5	25.5	31.5	48.5	69.5	93.5	121.5	187.5		
	NFD 350x850	Noise Rating*	19	20	22	23	25	26	32	36	40	44	47	56	63	69	74	83		
		Throw** (m)	5.6	5.8	6.0	6.2	6.4	6.6	7.2	7.8	8.2	8.6	9.0	9.8	10.4	11.0	11.4	12.2		
C7	NND 290x890	Pressure Drop (Pa)	3.5	4.9	4.5	5.5	6.9	6.5	9.0	12.5	16.0	20.5	25.0	38.5	55.0	74.0	96.0	148.5		
	NFD 350x950	Noise Rating*	17	19	20	22	23	25	30	35	39	42	45	54	61	67	72	80		
		Throw** (m)	5.2	5.4	5.6	5.8	6.0	6.2	6.8	7.4	7.8	8.2	8.6	9.4	10.0	10.6	11.0	11.8		
C8	NND 290x990	Pressure Drop (Pa)	3.0	3.5	4.0	4.5	5.0	5.0	7.5	10.0	13.0	16.5	20.5	31.5	44.5	60.0	78.0	120.5		
	NFD 350x1050	Noise Rating*	16	18	19	21	22	24	29	34	37	41	44	52	59	65	70	78		
		Throw** (m)	5.0	5.2	5.4	5.6	5.8	6.0	6.6	7.2	7.6	8.0	8.4	9.2	9.8	10.2	10.8	11.6		

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s



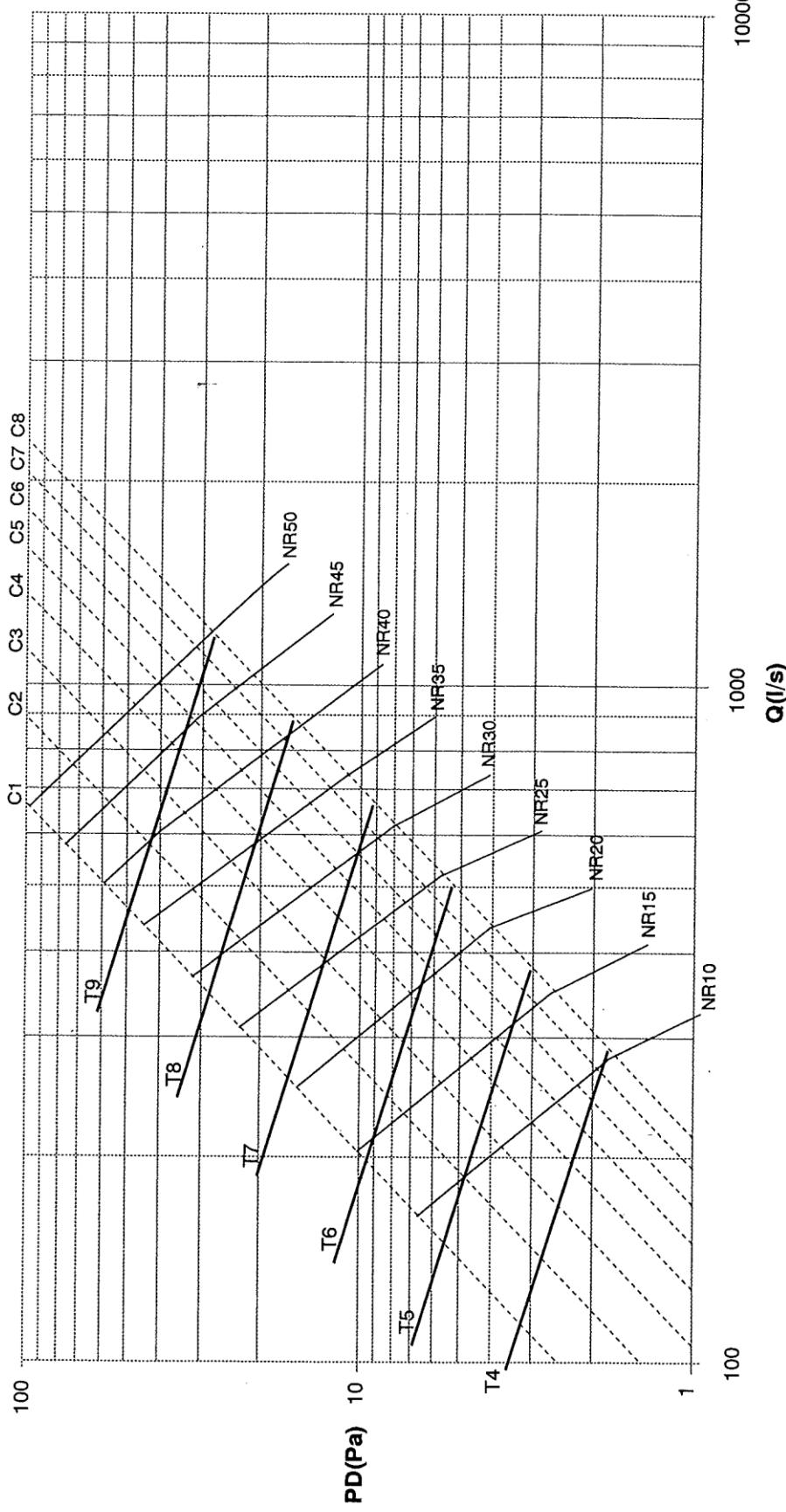
WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category C)

- =PD vs flow
- =Throw, metres
- =NR, 10-50



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category D)

• NND - Nominal Neck Dimensions

• NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)															
			140	150	160	170	180	190	200	225	250	275	300	325	350	375	400
D1	NND 390x390	Pressure Drop (Pa)	1.5	1.5	2.0	2.0	2.5	3.0	3.0	4.0	4.5	5.5	6.5	8.0	9.0	10.5	12.0
	NFD 450x450	Noise Rating*	0	2	3	5	6	7	8	11	14	16	18	20	21	23	25
		Throw** (m)	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.8	5.2	5.6	5.8	6.2	6.4	6.5	6.8
D2	NND 390x490	Pressure Drop (Pa)			1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.5	4.5	5.0	6.0	6.5	7.5
	NFD 450x550	Noise Rating*			1	2	4	5	6	0	11	13	15	17	19	21	22
		Throw** (m)			3.0	3.2	3.4	3.6	3.8	4.2	4.6	5.0	5.2	5.6	5.8	6.0	6.2
D3	NND 390x590	Pressure Drop (Pa)				1.0	1.0	1.0	1.5	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	NFD 450x650	Noise Rating*				0	2	3	4	7	9	11	13	15	17	19	20
		Throw** (m)				2.6	2.8	3.0	3.2	3.6	4.0	4.4	4.8	5.0	5.2	5.6	5.8
D4	NND 390X690	Pressure Drop (Pa)					1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.5	3.0	3.5	4.0
	NFD 450x750	Noise Rating*					0	1	3	5	8	10	12	14	15	17	18
		Throw** (m)					2.4	2.6	2.8	3.2	3.6	4.0	4.4	4.6	4.8	5.2	5.4
D5	NND 390x790	Pressure Drop (Pa)						.5	1.0	1.0	1.0	1.5	1.5	2.0	2.5	2.5	3.0
	NFD 450x850	Noise Rating*						0	1	4	6	8	10	12	14	16	17
		Throw** (m)						2.2	2.4	2.8	3.2	3.6	4.0	4.2	4.4	4.8	5.0
D6	NND 390x890	Pressure Drop (Pa)							.5	1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.5
	NFD 450x950	Noise Rating*							0	3	5	8	10	11	13	15	16
		Throw** (m)							2.2	2.6	3.0	3.2	3.6	4.0	4.2	4.4	4.6
D7	NND 390x990	Pressure Drop (Pa)								.5	1.0	1.0	1.0	1.5	1.5	1.5	2.0
	NFD 450x1050	Noise Rating*								2	5	7	9	11	12	14	16
		Throw** (m)								2.2	2.6	3.0	3.4	3.6	3.8	4.2	4.4
D8	NND 390x1090	Pressure Drop (Pa)								.5	.5	1.0	1.0	1.0	1.0	1.5	1.5
	NFD 450x1150	Noise Rating*								2	4	6	8	10	12	14	16
		Throw** (m)								2.0	2.4	2.8	3.0	3.4	3.6	3.8	4.0

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

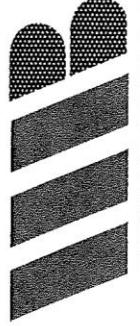
Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category D)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow ('/s)	425	450	475	500	600	700	800	900	1000	1250	1500	1750	2000	2500	3000
D1	NND 390x390	Pressure Drop (Pa)	13.0	15.0	16.5	18.0	26.0	35.0	45.5	57.0	70.0	108.0	154.5	208.5	270.5	417.5	
	NFD 450x450	Noise Rating*	27	28	30	32	37	41	47	51	55	64	71	77	82	90	
		Throw** (m)	7.0	7.2	7.4	7.6	8.2	8.8	9.2	9.6	10.0	10.8	11.4	12.0	12.6	13.4	
D2	NND 390x490	Pressure Drop (Pa)	8.5	9.5	10.5	11.5	16.5	22.5	29.0	36.5	45.0	69.0	98.5	133.0	173.0	267.0	
	NFD 450x550	Noise Rating*	24	26	27	29	34	39	43	47	52	59	66	72	77	86	
		Throw** (m)	6.4	6.6	6.8	7.0	7.6	8.2	8.6	9.0	9.4	10.2	10.8	11.4	11.8	12.8	
D3	NND 390x590	Pressure Drop (Pa)	6.0	6.5	7.5	8.0	11.5	15.5	20.0	25.5	31.0	48.0	68.5	92.5	120.0	185.5	
	NFD 450x650	Noise Rating*	22	23	25	26	32	36	40	44	47	56	63	69	74	83	
		Throw** (m)	6.0	6.2	6.4	6.6	7.2	7.8	8.2	8.6	9.0	9.8	10.4	10.8	11.4	12.2	
D4	NND 390X690	Pressure Drop (Pa)	4.5	5.0	5.5	6.0	8.5	11.5	15.0	18.5	23.0	35.5	50.5	68.0	88.5	136.5	
	NFD 450x750	Noise Rating*	20	21	23	24	30	34	38	42	45	53	60	66	71	80	
		Throw** (m)	5.6	5.8	6.0	6.2	6.8	7.2	7.8	8.2	8.6	9.2	10.0	10.4	11.0	11.8	
D5	NND 390x790	Pressure Drop (Pa)	3.5	3.5	4.0	4.5	6.5	9.0	11.5	14.5	17.5	27.0	38.5	52.5	68.0	105.0	
	NFD 450x850	Noise Rating*	18	20	22	23	28	33	37	41	44	52	57	63	69	77	
		Throw** (m)	5.2	5.4	5.6	5.8	6.4	7.0	7.4	7.8	8.2	9.0	9.6	10.0	10.6	11.4	
D6	NND 390x890	Pressure Drop (Pa)	2.5	3.0	3.5	3.5	5.0	7.0	9.0	11.5	14.0	21.5	30.5	41.5	53.5	83.0	118.5
	NFD 450x950	Noise Rating*	18	20	21	23	28	32	37	41	44	51	57	62	67	75	82
		Throw** (m)	4.8	5.0	5.2	5.4	6.0	6.6	7.0	7.4	7.8	8.6	9.2	9.8	10.2	11.0	11.6
D7	NND 390x990	Pressure Drop (Pa)	2.0	2.5	2.5	3.0	4.0	5.5	7.5	9.0	11.5	17.5	25.0	33.5	43.5	67.5	96.0
	NFD 450x1050	Noise Rating*	18	19	21	22	28	32	37	40	44	52	57	62	66	74	80
		Throw** (m)	4.6	4.8	5.0	5.2	5.8	6.4	6.8	7.2	7.6	8.4	9.0	9.4	10.0	10.8	11.4
D8	NND 390x1090	Pressure Drop (Pa)	2.0	2.0	2.0	2.5	3.5	4.5	6.0	7.5	9.5	14.5	20.5	28.0	36.0	56.0	79.5
	NFD 450x1150	Noise Rating*	17	19	21	22	27	32	37	40	44	52	57	62	66	74	80
		Throw** (m)	4.4	4.6	4.8	4.8	5.6	6.0	6.6	7.0	7.4	8.0	8.6	9.2	9.6	10.4	11.2

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s



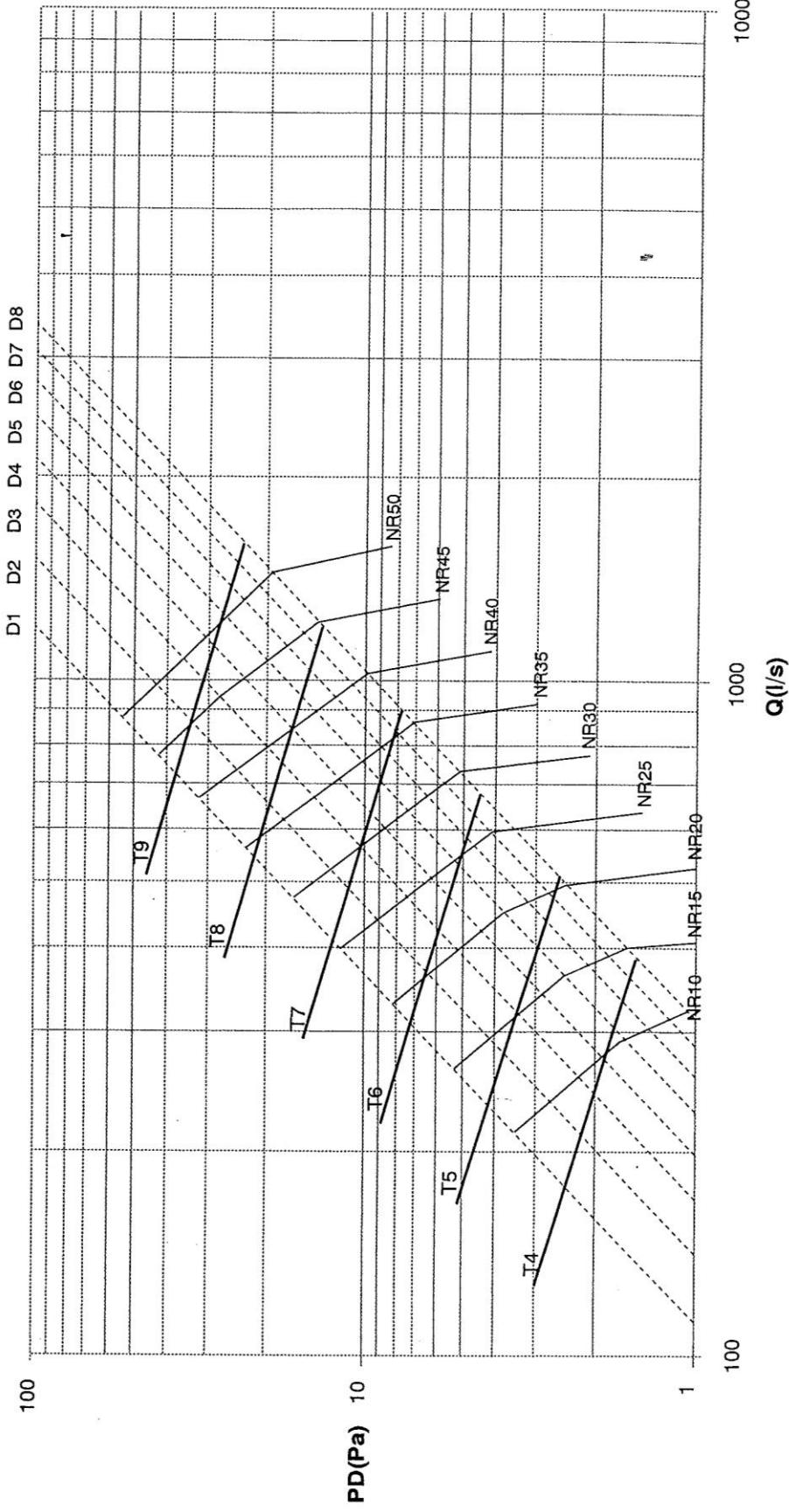
WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category D)

- = PD vs flow
- = Throw, metres
- = NR, 10-50



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category E)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	170	180	190	200	225	250	275	300	325	350	375	400	425	450
E1	NND 490x490	Pressure Drop (Pa)	1.0	1.0	1.0	1.0	1.5	2.0	2.5	2.5	3.0	3.5	4.0	5.0	5.5	6.0
	NFD 550x550	Noise Rating*	0	1	3	4	6	9	11	13	15	17	18	20	21	23
		Throw** (m)	2.6	2.8	3.0	3.2	3.6	4.0	4.4	4.6	5.0	5.2	5.4	5.6	5.8	6.0
E2	NND 490x590	Pressure Drop (Pa)			1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.5	3.0	3.5	4.0	4.0
	NFD 550x650	Noise Rating*			1	2	5	7	9	11	13	15	16	18	19	20
		Throw** (m)			2.4	2.6	3.0	3.4	3.8	4.2	4.4	4.6	5.0	5.2	5.4	5.6
E3	NND 490x690	Pressure Drop (Pa)				.5	1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.5	3.0	3.0
	NFD 550x750	Noise Rating*				0	3	6	8	10	12	13	15	16	18	20
		Throw** (m)				2.2	2.6	3.0	3.4	3.6	4.0	4.2	4.4	4.8	5.0	5.2
E4	NND 490X790	Pressure Drop (Pa)					.5	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.5
	NFD 550x850	Noise Rating*					2	5	7	9	11	12	14	16	18	19
		Throw** (m)					2.2	2.6	3.0	3.4	3.6	3.8	4.2	4.4	4.6	4.8
E5	NND 490x890	Pressure Drop (Pa)					.5	.5	.5	1.0	1.0	1.0	1.5	1.5	1.5	2.0
	NFD 550x950	Noise Rating*					1	4	6	8	10	12	14	16	17	19
		Throw** (m)					2.0	2.2	2.6	3.0	3.2	3.6	3.8	4.0	4.2	4.4
E6	NND 490x990	Pressure Drop (Pa)					.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.5	1.5
	NFD 550x1050	Noise Rating*					1	3	5	7	9	11	13	15	17	19
		Throw** (m)					1.6	2.0	2.4	2.6	3.0	3.2	3.6	3.8	4.0	4.2
E7	NND 490x1090	Pressure Drop (Pa)						.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.5
	NFD 550x1150	Noise Rating*						2	5	7	9	11	13	15	17	18
		Throw** (m)						1.8	2.0	2.4	2.8	3.0	3.2	3.4	3.6	3.8
E8	NND 490x1190	Pressure Drop (Pa)						.5	.5	.5	.5	.5	.5	1.0	1.0	1.0
	NFD 550x1250	Noise Rating*						2	4	6	9	11	13	15	16	18
		Throw** (m)						1.4	1.8	2.2	2.4	2.8	3.0	3.2	3.4	3.6

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category E)

• NND - Nominal Neck Dimensions

• NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	475	500	600	700	800	900	1000	1250	1500	1750	2000	2500	3000
E1	NND 490x490	Pressure Drop (Pa)	6.5	7.5	10.5	14.5	18.5	23.5	28.5	44.0	63.0	85.0	110.5	170.5	
	NFD 550x550	Noise Rating*	24	26	31	36	40	43	47	55	62	68	73	82	
		Throw** (m)	6.2	6.4	7.0	7.6	8.0	8.4	8.8	9.6	10.2	10.8	11.2	12.0	
E2	NND 490x590	Pressure Drop (Pa)	4.5	5.0	7.5	10.0	13.0	16.0	20.0	30.5	44.0	59.0	76.5	118.5	
	NFD 550x650	Noise Rating*	22	23	29	33	37	41	44	52	59	65	70	78	
		Throw** (m)	5.8	6.0	6.6	7.2	7.6	8.0	8.4	9.2	9.8	10.2	10.8	11.6	
E3	NND 490x690	Pressure Drop (Pa)	3.5	4.0	5.5	7.5	9.5	12.0	14.5	22.5	32.5	43.5	56.5	87.0	124.5
	NFD 550x750	Noise Rating*	21	23	28	33	37	41	44	51	57	62	67	75	82
		Throw** (m)	5.4	5.6	6.2	6.6	7.2	7.6	8.0	8.6	9.4	9.8	10.4	11.0	11.8
E4	NND 490X790	Pressure Drop (Pa)	2.5	3.0	4.0	5.5	7.5	9.0	11.0	17.5	25.0	33.5	43.5	67.0	95.5
	NFD 550x850	Noise Rating*	21	22	28	32	37	40	44	51	57	62	66	74	80
		Throw** (m)	5.0	5.2	5.8	6.4	6.8	7.2	7.6	8.4	9.0	9.4	10.0	10.8	11.4
E5	NND 490x890	Pressure Drop (Pa)	2.0	2.5	3.5	4.5	6.0	7.5	9.0	13.5	19.5	26.5	34.5	53.0	75.5
	NFD 550x950	Noise Rating*	20	22	27	32	36	40	44	51	57	62	66	74	80
		Throw** (m)	4.6	4.8	5.4	6.0	6.4	6.8	7.2	8.0	8.6	9.2	9.6	10.4	11.0
E6	NND 490x990	Pressure Drop (Pa)	1.5	2.0	2.5	3.5	4.5	6.0	7.0	11.0	16.0	21.5	28.0	43.0	61.5
	NFD 550x1050	Noise Rating*	20	22	27	32	36	40	44	51	57	62	66	73	79
		Throw** (m)	4.4	4.6	5.2	5.8	6.2	6.6	7.0	7.8	8.4	8.8	9.4	10.2	10.8
E7	NND 490x1090	Pressure Drop (Pa)	1.5	1.5	2.0	3.0	4.0	5.0	6.0	9.5	13.0	18.0	23.0	35.5	51.0
	NFD 550x1150	Noise Rating*	20	21	27	32	36	40	43	51	57	62	66	73	79
		Throw** (m)	4.0	4.2	5.0	5.4	6.0	6.4	6.8	7.4	8.0	8.6	9.0	9.8	10.4
E8	NND 490x1190	Pressure Drop (Pa)	1.0	1.5	2.0	2.5	3.5	4.0	5.0	8.0	11.0	15.0	19.5	30.0	43.0
	NFD 550x1250	Noise Rating*	20	21	27	32	36	40	43	51	57	62	66	73	79
		Throw** (m)	3.8	4.0	4.6	5.2	5.8	6.2	6.4	7.2	7.8	8.4	8.8	9.6	10.2

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

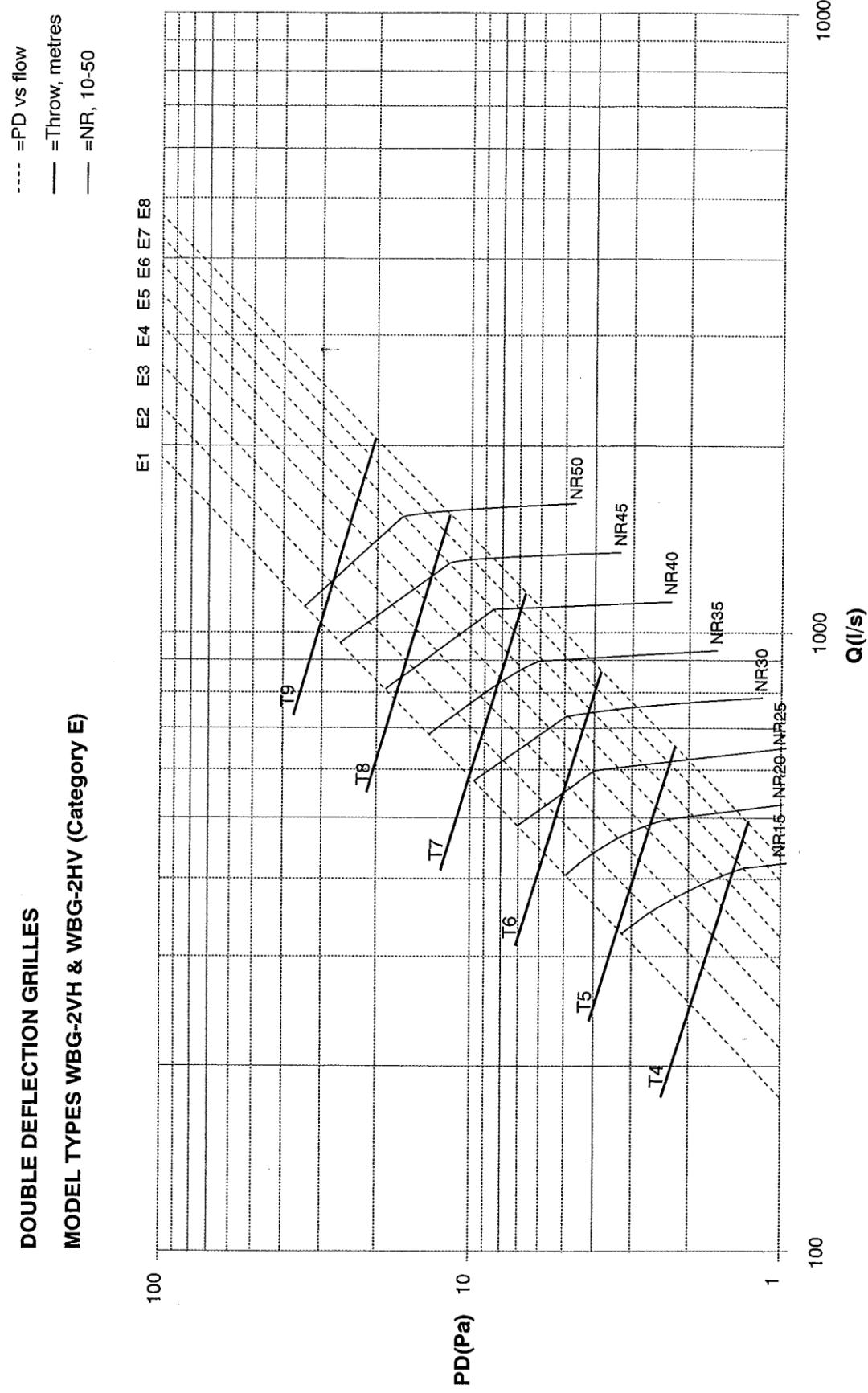


WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category E)



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category F)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (cfm)	200	225	250	275	300	325	350	375	400	425	450	475
F1	NND 590x590	Pressure Drop (Pa)	.5	1.0	1.0	1.0	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0
	NFD 650x650	Noise Rating*	0	3	5	8	10	11	13	15	16	18	20	21
		Throw** (m)	2.0	2.6	3.0	3.2	3.6	3.8	4.2	4.4	4.6	4.8	5.0	5.2
F2	NND 590x690	Pressure Drop (Pa)	.5	.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.5
	NFD 650x750	Noise Rating*	2	4	6	9	10	12	14	16	18	19	21	
		Throw** (m)	2.0	2.4	2.8	3.2	3.4	3.8	4.0	4.2	4.4	4.6	4.8	
F3	NND 590x790	Pressure Drop (Pa)	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0
	NFD 650x850	Noise Rating*	1	3	6	8	9	11	13	15	17	19	20	
		Throw** (m)	1.8	2.2	2.4	2.8	3.0	3.4	3.6	3.8	4.0	4.2	4.4	
F4	NND 590X890	Pressure Drop (Pa)	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5
	NFD 650x950	Noise Rating*	0	3	5	7	9	11	13	15	17	18	20	
		Throw** (m)	1.4	1.8	2.2	2.4	2.8	3.0	3.2	3.6	3.8	4.0	4.2	
F5	NND 590x990	Pressure Drop (Pa)	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.0
	NFD 650x1050	Noise Rating*	2	4	6	9	11	13	15	16	18	20		
		Throw** (m)	1.4	1.8	2.2	2.4	2.8	3.0	3.2	3.4	3.6	3.8		
F6	NND 590x1090	Pressure Drop (Pa)	.5	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0
	NFD 650x1150	Noise Rating*	1	3	6	8	10	12	14	16	18	19		
		Throw** (m)	1.2	1.6	1.8	2.2	2.4	2.8	3.0	3.2	3.4	3.6		
F7	NND 590x1190	Pressure Drop (Pa)	0.0	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	1.0
	NFD 650x1250	Noise Rating*	0	3	6	8	10	12	14	16	17	19		
		Throw** (m)	1.0	1.4	1.6	2.0	2.2	2.4	2.8	3.0	3.2	3.4		
F8	NND 590x1290	Pressure Drop (Pa)	0.0	0.0	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
	NFD 650x1350	Noise Rating*	0	3	5	8	10	12	14	15	17	19		
		Throw** (m)	.8	1.0	1.4	1.8	2.0	2.2	2.4	2.8	3.0	3.2		

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s

TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category F)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

Cat.	Size (mm)	Flow (l/s)	500	600	700	800	900	1000	1250	1500	1750	2000	2500	3000
F1	NND 590x590	Pressure Drop (Pa)	3.5	5.0	7.0	9.0	11.5	14.0	21.5	30.5	41.0	53.5	82.5	117.5
	NFD 650x650	Noise Rating*	23	28	32	37	41	44	51	57	62	67	75	82
		Throw** (m)	5.4	6.0	6.6	7.0	7.4	7.8	8.6	9.2	9.8	10.2	11.0	11.6
F2	NND 590x690	Pressure Drop (Pa)	2.5	4.0	5.0	6.5	8.5	10.0	15.5	22.5	30.5	39.5	60.5	86.5
	NFD 650x750	Noise Rating*	22	27	32	37	40	44	51	57	62	66	74	80
		Throw** (m)	5.0	5.6	6.2	6.6	7.0	7.4	8.2	8.8	9.4	9.8	10.6	11.2
F3	NND 590x790	Pressure Drop (Pa)	2.0	3.0	4.0	5.0	6.5	8.0	12.0	17.0	23.0	30.0	46.5	66.5
	NFD 650x850	Noise Rating*	22	27	32	36	40	44	51	57	62	66	73	79
		Throw** (m)	4.6	5.2	5.8	6.2	6.6	7.0	7.8	8.4	9.0	9.4	10.2	10.8
F4	NND 590x890	Pressure Drop (Pa)	1.5	2.5	3.0	4.0	5.0	6.0	9.5	13.5	18.5	24.0	37.0	52.5
	NFD 650x950	Noise Rating*	21	27	32	36	40	43	52	57	62	66	73	79
		Throw** (m)	4.4	5.0	5.6	6.0	6.4	6.8	7.6	8.2	8.6	9.2	9.8	10.6
F5	NND 590x990	Pressure Drop (Pa)	1.5	2.0	2.5	3.5	4.0	5.0	8.0	11.0	15.0	19.5	30.0	42.5
	NFD 650x1050	Noise Rating*	21	27	32	36	40	43	51	57	62	66	73	79
		Throw** (m)	4.0	4.6	5.2	5.6	6.2	6.4	7.2	7.8	8.4	8.8	9.6	10.2
F6	NND 590x1090	Pressure Drop (Pa)	1.0	1.5	2.0	2.5	3.5	4.0	6.5	9.0	12.5	16.0	25.0	35.5
	NFD 650x1150	Noise Rating*	21	27	32	36	40	43	50	56	61	66	73	79
		Throw** (m)	3.8	4.4	5.0	5.4	5.8	6.2	7.0	7.6	8.2	8.6	9.4	10.0
F7	NND 590x1190	Pressure Drop (Pa)	1.0	1.5	2.0	2.5	3.0	3.5	5.5	7.5	10.5	13.5	21.0	30.0
	NFD 650x1250	Noise Rating*	20	26	31	36	40	43	50	56	61	66	73	79
		Throw** (m)	3.6	4.2	4.8	5.2	5.6	6.0	6.8	7.4	7.8	8.4	9.2	9.8
F8	NND 590x1290	Pressure Drop (Pa)	1.0	1.0	1.5	2.0	2.5	3.0	4.5	6.5	9.0	11.5	18.0	25.5
	NFD 650x1350	Noise Rating*	20	26	31	36	40	43	50	56	61	66	73	79
		Throw** (m)	3.4	4.0	4.6	5.0	5.4	5.8	6.6	7.2	7.6	8.2	8.8	9.6

* Based upon a 10 dB Room absorption
 ** To a terminal air velocity of 0.5 m/s



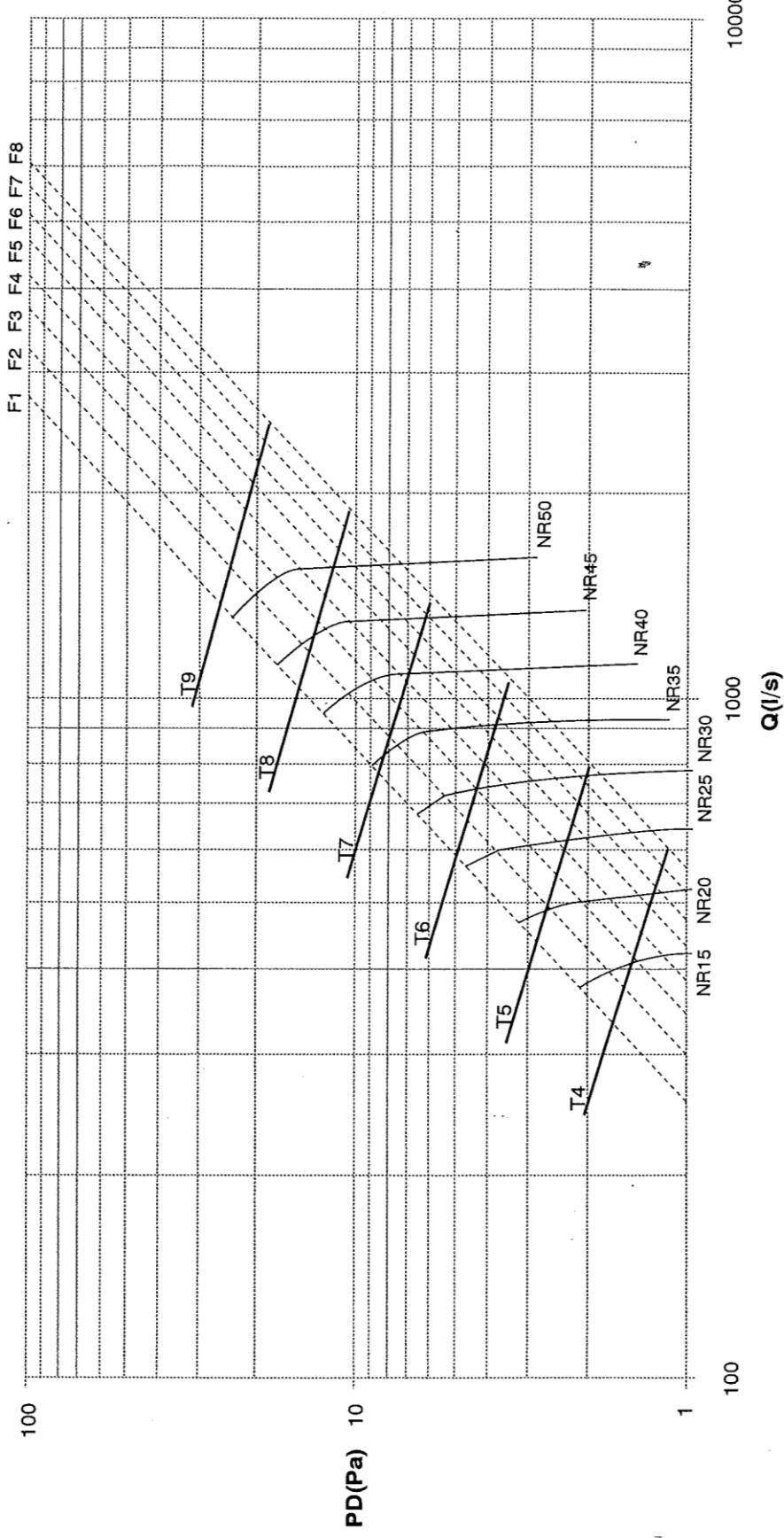
WONG BROTHERS

**SELECTION NOMOGRAM
PRESSURE DROP vs FLOW vs THROW vs NR**

DOUBLE DEFLECTION GRILLES

MODEL TYPES WBG-2VH & WBG-2HV (Category F)

- = PD vs flow
- = Throw, metres
- = NR, 10-50



TECHNICAL PERFORMANCE DATA

Unit Type: DOUBLE DEFLECTION GRILLE MODELS WBG 2HV/2VH (Category G)

- NND - Nominal Neck Dimensions
- NFD - Nominal Face Dimensions

	Size Cat. (mm)	Flow (l/s)	225	250	275	300	325	350	375	400	425	450	475	500
G1	NND 690x690	Pressure Drop (Pa)	.5	.5	.5	.5	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0
	NFD 750x750	Noise Rating*	1	3	5	7	9	11	13	15	17	19	20	22
		Throw** (m)	1.6	2.0	2.4	2.8	3.0	3.2	3.6	3.8	4.0	4.2	4.4	4.6
G2	NND 690x790	Pressure Drop (Pa)		.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.5	1.5
	NFD 750x850	Noise Rating*		2	4	7	9	11	13	15	17	18	20	21
		Throw** (m)		1.6	2.0	2.4	2.6	3.0	3.2	3.4	3.6	3.8	4.0	4.2
G3	NND 690x890	Pressure Drop (Pa)		.5	.5	.5	.5	.5	.5	1.0	1.0	1.0	1.0	1.0
	NFD 750x950	Noise Rating*		1	4	6	8	11	13	14	16	18	19	21
		Throw** (m)		1.4	1.6	2.0	2.4	2.6	2.8	3.0	3.4	3.6	3.8	3.8
G4	NND 690X990	Pressure Drop (Pa)		0.0	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0
	NFD 750x1050	Noise Rating*		0.0	.5	.5	.5	.5	.5	.5	.5	1.0	1.0	1.0
		Throw** (m)		1.0	1.4	1.8	2.0	2.2	2.6	2.8	3.0	3.2	3.4	3.6
G5	NND 690x1090	Pressure Drop (Pa)		0.0	0.0	.5	.5	.5	.5	.5	.5	.5	.5	1.0
	NFD 750x1150	Noise Rating*		0	3	5	8	10	12	14	15	17	19	20
		Throw** (m)		.8	1.2	1.4	1.8	2.0	2.2	2.6	2.8	3.0	3.2	3.4
G6	NND 690x1190	Pressure Drop (Pa)			0.0	0.0	.5	.5	.5	.5	.5	.5	.5	.5
	NFD 750x1250	Noise Rating*			3	5	7	10	12	13	15	17	19	20
		Throw** (m)			.8	1.2	1.6	1.8	2.0	2.2	2.6	2.8	3.0	3.2
G7	NND 690x1290	Pressure Drop (Pa)			0.0	0.0	0.0	.5	.5	.5	.5	.5	.5	.5
	NFD 750x1350	Noise Rating*			2	5	7	9	11	13	15	17	18	20
		Throw** (m)			.6	1.0	1.2	1.6	1.8	2.0	2.2	2.6	2.8	2.8
G8	NND 690x1390	Pressure Drop (Pa)			0.0	0.0	0.0	0.0	.5	.5	.5	.5	.5	.5
	NFD 750x1450	Noise Rating*			2	5	7	9	11	13	15	17	18	20
		Throw** (m)			.4	.8	1.0	1.4	1.6	1.8	2.0	2.2	2.4	2.6

* Based upon a 10 dB Room absorption

** To a terminal air velocity of 0.5 m/s



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since 1965



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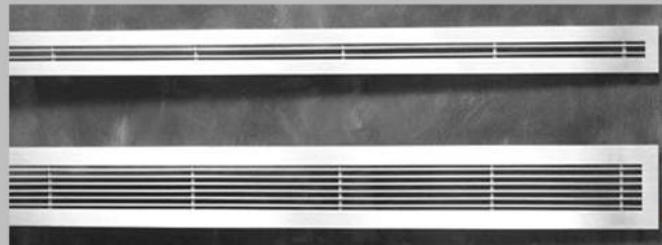
form function reliability



Linear Bar Grilles

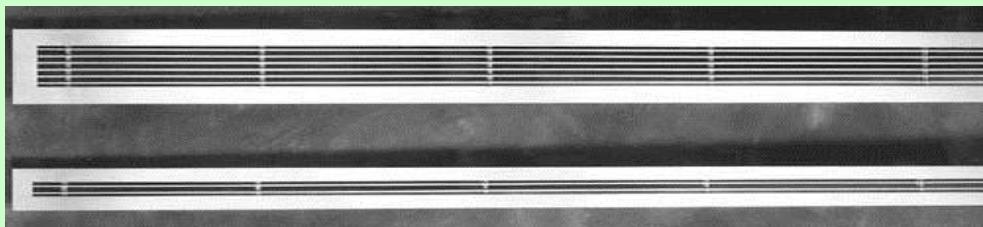
Air distribution & Architectural

Model WBL-BGA



THE CRISP LOOK

Architectural Bar Grilles



**Model : WBL-BGA 6 (6° blade angle)
WBL-BGA 19 (19° blade angle)**

Straight Through Air Pattern
True Angled Air Pattern



WB Air

air distribution products

Form Function Reliability



Description

The WBL-BGA linear bar grilles are specially designed for supply and return air for various HVAC design applications. It is also ideal for air displacement through floors, steps and most occupied zone air distribution. Its versatile design meets all type of requirements: with different air throw angles, to different materials to different frame styles, there is a WBL-BGA model for your application

Material Options

Aluminum Extruded Profile

The aluminum extruded profile is the most common material choice for bar grille. It is light, sturdy and highly corrosion resistant.

Besides that, our aluminum extruded bar grille can come in our custom blended "anti condensation" finish as an option. With this layer of coating, it helps to reduce/eliminate the chance of condensation on the surface of the bar grilles.

Wood-Plastic Composite (WPC)

WPC is a revolutionary choice for treating condensation on our WBL-BGA bar grille. It is extruded by fusing wood composites and thermoplastics together and hence forming a rigid and light weight material which drastically reduces the chances of condensation because of its low thermal conductivity. Besides that, WPC is environmental friendly and anti-corrosive.

Wood

For the classic look with its low thermal conductivity properties, our WBL-BGA bar grill can be constructed of raw wood finish which can then be painted to most standard non gloss paints or left unfinished.

Construction

Size : Width : Maximum up to 200 mm (others width please discuss with our WB Air sales)

Length : Maximum one piece construction up to 3600 mm

Frame Style : 28 mm, 20 mm, 15 mm, 8 mm and 5 mm flat bar design

Custom panel frame is available upon request

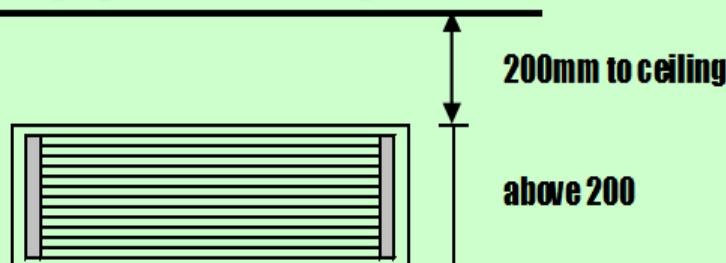
Finishes : Standard powder coated white finish. Other finishes are also available upon request

Additional Accessories : Pattern Controller (Model: WBL-BGA / PC)

OBD Opposed Blade Damper (Model :WBL-BGA / D)

Notes

- For sidewall installations, it is recommended to have a space of 200 mm from ceiling to top of grille
- Width above 200 mm shall have retaining angles at both ends of the grilles



THE CRISP LOOK

Architectural Bar Grilles

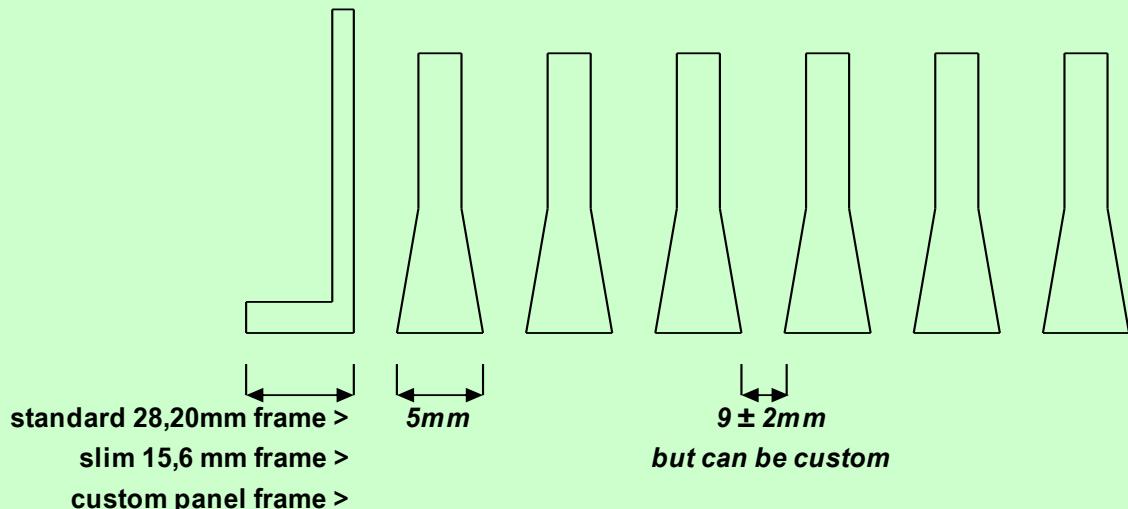


air distribution products
Form Function Reliability

Dimensional Details

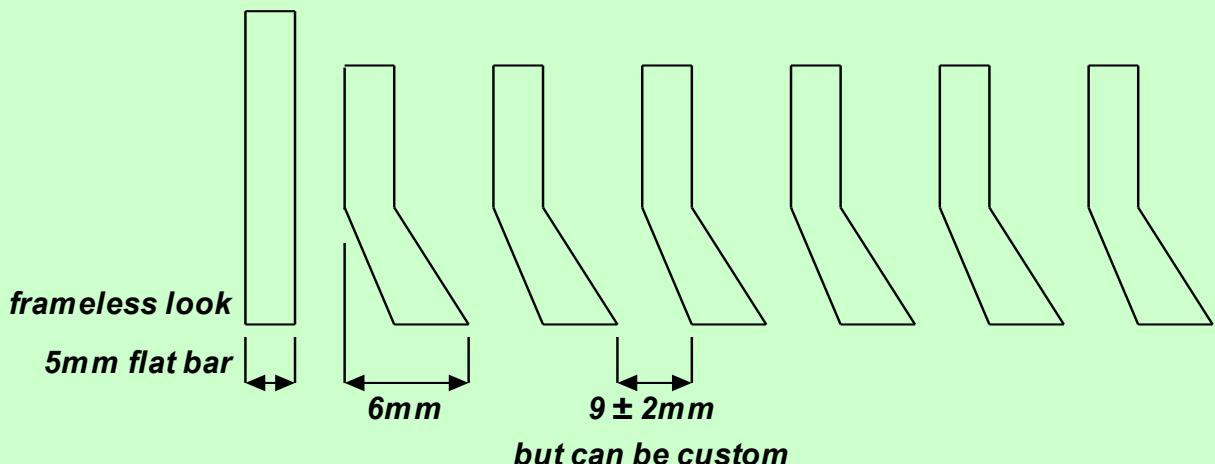
Model : WBL-BGA 6

Straight Through Air Pattern



Model : WBL-BGA 19

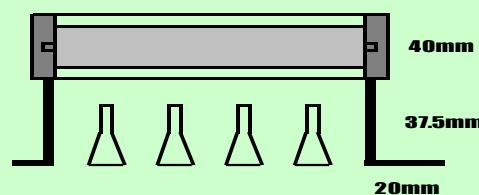
True Angled Air Pattern



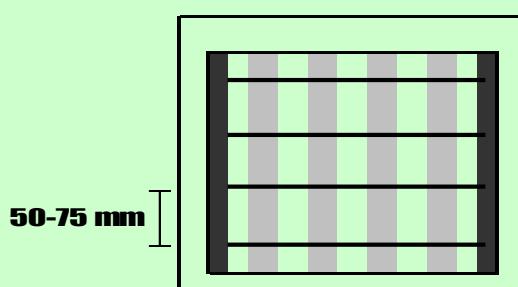
MODEL : WBL - BGA / PC

Incorporate Pattern Controller

Matt Black EG Pattern
Controller attachment



Section View



Back View

MODEL : WBL - BGA6 Straight Through Air Pattern

PERFORMANCE DATA

1200 x 50		m/s	1.38	2.08	2.77	3.46	4.15	4.85	5.54	6.23
	Q (L/s)		41.36	62.04	82.72	103.40	124.08	144.76	165.44	186.12
	Q (cmh)		149.51	224.27	299.02	373.78	448.54	523.29	598.05	672.80
	Q (cfm)		88.00	132.00	176.00	220.00	264.00	308.00	352.00	396.00
	SP(pa)		5.00	8.00	10.00	15.00	20.00	28.00	35.58	45.29
	NC		18.00	21.00	23.00	26.00	29.00	31.00	33.00	37.00
Side Wall	T (horizontal)		1.81	2.90	3.99	5.07	6.16	6.88	7.61	7.97
	Drop		0.69	1.04	1.36	1.62	1.91	2.07	2.28	2.39
Ceiling	T (vertical)		2.20	3.52	4.85	6.17	7.49	8.37	9.25	9.69
	Spread		0.71	1.13	1.55	1.98	2.40	2.68	2.97	3.11

1200 x 100		m/s	1.76	2.61	3.49	4.37	5.25	6.14	6.98	7.87
	Q (L/s)		105.28	156.04	208.68	261.32	313.96	366.60	417.36	470.00
	Q (cmh)		380.58	564.07	754.36	944.64	1134.93	1325.22	1508.71	1699.00
	Q (cfm)		224.00	332.00	444.00	556.00	668.00	780.00	888.00	1000.00
	SP(pa)		5.00	8.00	10.00	15.00	20.00	28.00	35.58	45.29
	NC		18.00	21.00	23.00	26.00	29.00	31.00	33.00	37.00
Side Wall	T (horizontal)		2.90	4.71	6.16	7.25	9.06	10.14	10.87	12.68
	Drop		1.10	1.70	2.09	2.32	2.81	3.04	3.26	3.80
Ceiling	T (vertical)		3.52	5.73	7.49	8.81	11.01	12.33	13.21	15.42
	Spread		1.13	1.84	2.40	2.83	3.53	3.96	4.24	4.95

1200 x 150		m/s	1.85	2.79	3.71	4.64	5.56	6.50	7.43	8.35
	Q (L/s)		165.44	250.04	332.76	415.48	498.20	582.80	665.52	748.24
	Q (cmh)		598.05	903.87	1202.89	1501.92	1800.94	2106.76	2405.78	2704.81
	Q (cfm)		352.00	532.00	708.00	884.00	1060.00	1240.00	1416.00	1592.00
	SP(pa)		5.00	8.00	10.00	15.00	20.00	28.00	35.58	45.29
	NC		19.00	22.00	24.00	27.00	30.00	32.00	34.00	38.00
Side Wall	T (horizontal)		4.35	5.80	7.25	8.70	10.51	11.96	12.68	14.49
	Drop		1.65	2.09	2.46	2.78	3.26	3.59	3.80	4.35
Ceiling	T (vertical)		5.29	7.05	8.81	10.57	12.77	14.54	15.42	17.62
	Spread		1.70	2.26	2.83	3.39	4.10	4.66	4.95	5.65

1200 x 200		m/s	1.54	2.32	3.10	3.86	4.63	5.42	6.19	6.96
	Q (L/s)		183.77	277.77	369.89	461.54	553.66	647.66	739.31	831.43
	Q (cmh)		664.31	1004.11	1337.11	1668.42	2001.42	2341.22	2672.53	3005.53
	Q (cfm)		391.00	591.00	787.00	982.00	1178.00	1378.00	1573.00	1769.00
	SP(pa)		5.00	8.00	10.00	15.00	20.00	28.00	35.58	45.29
	NC		20.00	23.00	25.00	28.00	31.00	33.00	35.00	39.00
Side Wall	T (horizontal)		4.59	6.12	7.65	9.18	11.09	12.62	13.39	15.30
	Drop		1.74	2.20	2.60	2.94	3.44	3.79	4.02	4.59
Ceiling	T (vertical)		5.58	7.44	9.30	11.16	13.49	15.35	16.28	18.60
	Spread		1.79	2.39	2.98	3.58	4.33	4.92	5.22	5.97

Note: for sidewall diffusion of BGA6, take 25% of drop as upward spread of air above grille centreline.

NC corrections

Length	1500	1800	2100	2400	3000
Correction	+1	+2	+3	+4	+5

MODEL : WBL - BGA19 True Angled Air Pattern**PERFORMANCE DATA**

1200 x 50		m/s	1.38	2.08	2.77	3.46	4.15	4.85	5.54	6.23
Q (L/s)		41.36	62.04	82.72	103.40	124.08	144.76	165.44	186.12	
Q (cmh)		149.51	224.27	299.02	373.78	448.54	523.29	598.05	672.80	
Q (cfm)		88.00	132.00	176.00	220.00	264.00	308.00	352.00	396.00	
SP(pa)		8.60	12.20	15.40	20.70	24.50	32.20	43.40	49.20	
NC		19.60	22.80	25.60	28.90	33.00	35.20	37.50	42.00	
Side Wall	T (horizontal)	1.49	2.38	3.27	4.16	5.05	5.64	6.24	6.54	
	Drop	1.15	1.63	1.99	2.39	2.65	2.87	3.08	3.23	
Ceiling	T (vertical)	1.78	2.84	3.91	4.97	6.04	6.75	7.46	7.82	
	Spread	0.68	1.08	1.49	1.90	2.30	2.57	2.84	2.98	

1200 x 100		m/s	1.76	2.61	3.49	4.37	5.25	6.14	6.98	7.87
Q (L/s)		105.28	156.04	208.68	261.32	313.96	366.60	417.36	470.00	
Q (cmh)		380.58	564.07	754.36	944.64	1134.93	1325.22	1508.71	1699.00	
Q (cfm)		224.00	332.00	444.00	556.00	668.00	780.00	888.00	1000.00	
SP(pa)		8.60	12.20	15.40	20.70	24.50	32.20	43.40	49.20	
NC		20.20	23.10	25.90	29.20	33.30	35.50	37.70	42.00	
Side Wall	T (horizontal)	2.38	3.86	5.05	5.94	7.43	8.32	8.91	10.40	
	Drop	1.84	2.65	3.08	3.41	3.90	4.23	4.41	5.14	
Ceiling	T (vertical)	2.84	4.62	6.04	7.10	8.88	9.95	10.66	12.43	
	Spread	1.08	1.76	2.30	2.71	3.38	3.79	4.06	4.74	

1200 x 150		m/s	1.85	2.79	3.71	4.64	5.56	6.50	7.43	8.35
Q (L/s)		165.44	250.04	332.76	415.48	498.20	582.80	665.52	748.24	
Q (cmh)		598.05	903.87	1202.89	1501.92	1800.94	2106.76	2405.78	2704.81	
Q (cfm)		352.00	532.00	708.00	884.00	1060.00	1240.00	1416.00	1592.00	
SP(pa)		8.60	12.20	15.40	20.70	24.50	32.20	43.40	49.20	
NC		20.70	23.90	26.70	30.00	34.10	36.40	38.60	43.20	
Side Wall	T (horizontal)	3.57	4.75	5.94	7.13	8.62	9.80	10.40	11.88	
	Drop	2.75	3.26	3.62	4.09	4.52	4.98	5.14	5.88	
Ceiling	T (vertical)	4.26	5.68	7.10	8.53	10.30	11.72	12.43	14.21	
	Spread	1.62	2.17	2.71	3.25	3.93	4.47	4.74	5.41	

1200 x 200		m/s	1.54	2.32	3.10	3.86	4.63	5.42	6.19	6.96
Q (L/s)		183.77	277.77	369.89	461.54	553.66	647.66	739.31	831.43	
Q (cmh)		664.31	1004.11	1337.11	1668.42	2001.42	2341.22	2672.53	3005.53	
Q (cfm)		391.00	591.00	787.00	982.00	1178.00	1378.00	1573.00	1769.00	
SP(pa)		8.60	12.20	15.40	20.70	24.50	32.20	43.40	49.20	
NC		21.70	25.00	27.80	31.10	35.20	37.50	39.80	44.30	
Side Wall	T (horizontal)	3.76	5.02	6.27	7.53	9.10	10.35	10.98	12.55	
	Drop	2.91	3.44	3.83	4.32	4.78	5.26	5.43	6.20	
Ceiling	T (vertical)	4.50	6.00	7.50	9.00	10.88	12.38	13.13	15.00	
	Spread	1.72	2.29	2.86	3.43	4.14	4.72	5.00	5.72	

Notes

Units are tested with air plenum boxes in accordance to Air Diffusion Council ADC Code 1062: GRD-84 and ASHRAE 70-72 .

Throw in meters with a cooling temperature differential of 20 deg F at a terminal velocity of 100fpm , 0.5m/s . Pressures in Pascal .

NC values based on room absorption of 10dB re10 to power 12 watts.

For return applications, add 4 to NC and multiply 0.8 for negative static pressure.

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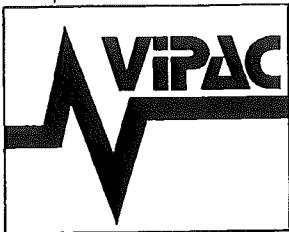
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TEST CERTIFICATE NO. 1

ACOUSTIC AND AIRFLOW PERFORMANCE TEST OF WONG BROTHERS
DOUBLE DEFLECTION GRILLES MODEL WBG-2VH & WBG-2HV

NOMINAL NECK DIMENSIONS: 190mm x 290mm

NOMINAL FACE DIMENSIONS: 250mm x 350mm

SUPPLIED BY: WONG BROTHERS

TESTED BY VIPAC ENGINEERS & SCIENTISTS LTD: 9/8/1993

PROJECT SCIENTIST - DAVID WREN

CLIENT:  **WONG BROTHERS**
7 TOA PAYOH INDUSTRIAL PARK #01-1245 SINGAPORE

SOUND POWER RESULTS

TEST CONDITIONS				SOUND POWER LEVEL, dB re 10 ⁻¹² W OCTAVE BAND CENTRE FREQUENCY (Hz)						
Q _s (l/s)	P _s (Pa)	T (m)	N R	1 2 5	2 5 0	5 0 0	1 0 0 0	2 0 0 0	4 0 0 0	8 0 0 0
50	1.5	2.1	-	-	-	-	-	-	-	-
100	6.0	4.4	-	-	-	-	-	-	-	-
150	13.0	>7.0	-	-	-	-	-	-	-	-
200	22.0	>7.0	22	36.0	36.5	35.5	29.5	23.5	18.5	<16.0
250	35.5	>7.0	28	42.5	42.5	40.0	37.5	33.5	31.0	20.5
300	49.0	>7.0	33	46.0	45.5	44.5	43.0	39.5	38.0	30.0

Q_s - Air Flow Rate (l/s)

P_s - Static Pressure Drop (Pa)

T - Average Throw to terminal velocity of 0.5 m/s (m)

N R - Noise Rating number based on 10dB room absorption

- - Insufficient margin above background noise to allow any determination

< - Insufficient margin above background to allow an accurate determination


DAVID WREN

SENIOR PROJECT SCIENTIST



MICHAEL SMITH
N.A.T.A. SIGNATORY

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The tests reported herein have been performed in accordance with its terms of registration.

N.A.T.A. Report No.: 38427-6



TEST CERTIFICATE NO. 4

ACOUSTIC AND AIRFLOW PERFORMANCE TEST OF WONG BROTHERS DOUBLE DEFLECTION GRILLES MODEL WBG-2VH &WBG-2HV

NOMINAL NECK DIMENSIONS: 290mm x 590mm

NOMINAL FACE DIMENSIONS: 350mm x 650mm

SUPPLIED BY: WONG BROTHERS

TESTED BY VIPAC ENGINEERS & SCIENTISTS LTD: 9/8/1993

PROJECT SCIENTIST - DAVID WREN

CLIENT:  **WONG BROTHERS**
7 TOA PAYOH INDUSTRIAL PARK #01-1245 SINGAPORE

SOUND POWER RESULTS

TEST CONDITIONS			SOUND POWER LEVEL, dB re 10 ⁻¹² W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Q _s (l/s)	P _s (Pa)	T (m)	N R	1 2 5	2 5 0	5 0 0	1 0 0 0	2 0 0 0	4 0 0 0	8 0 0 0
200	2.5	4.1	-	-	-	-	-	-	-	-
300	5.5	5.4	-	-	-	-	-	-	-	-
400	9.5	>7.0	21	45.0	39.5	34.0	30.5	23.5	17.5	<16.0
500	14.5	>7.0	28	49.5	44.5	40.0	38.0	32.0	28.0	19.0
600	19.0	>7.0	34	56.0	50.0	46.0	44.0	49.5	36.5	28.5
700	26.5	>7.0	39	61.0	54.0	50.0	48.5	44.5	43.5	36.5

Q_s - Air Flow Rate (l/s)

P_s - Static Pressure Drop (Pa)

T - Average Throw to terminal velocity of 0.5 m/s (m)

NR - Noise Rating number based on 10dB room absorption

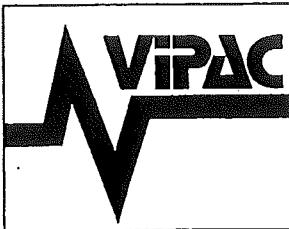
- - Insufficient margin above background noise to allow any determination

< - Insufficient margin above background to allow an accurate determination

David Wren
DAVID WREN
SENIOR PROJECT SCIENTIST


MICHAEL SMITH
N.A.T.A. SIGNATORY

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TEST CERTIFICATE NO. 5

ACOUSTIC AND AIRFLOW PERFORMANCE TEST OF WONG BROTHERS
DOUBLE DEFLECTION GRILLES MODEL WBG-2VH &WBG-2HV

NOMINAL NECK DIMENSIONS: 190mm x 490mm

NOMINAL FACE DIMENSIONS: 250mm x 550mm

SUPPLIED BY: WONG BROTHERS

TESTED BY VIPAC ENGINEERS & SCIENTISTS LTD: 9/8/1993

PROJECT SCIENTIST - DAVID WREN

CLIENT: **WONG BROTHERS**
7 TOA PAYOH INDUSTRIAL PARK #01-1245 SINGAPORE

SOUND POWER RESULTS

TEST CONDITIONS			SOUND POWER LEVEL, dB re 10 ⁻¹² W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Q _s (l/s)	P _s (Pa)	T (m)	N R	1 2 5	2 5 0	5 0 0	1 0 0 0	2 0 0 0	4 0 0 0	8 0 0 0
100	2.0	3.5	-	-	-	-	-	-	-	-
200	8.5	5.9	-	-	-	-	-	-	-	-
300	18.0	>7.0	21	40.0	37.5	35.0	29.5	22.5	17.5	<16.0
400	31.0	>7.0	30	47.0	44.5	42.0	39.5	34.5	31.5	22.0
500	48.0	>7.0	37	51.0	50.0	48.0	47.0	42.5	40.5	32.5

Q_s - Air Flow Rate (l/s)

P_s - Static Pressure Drop (Pa)

T - Average Throw to terminal velocity of 0.5 m/s (m)

N R - Noise Rating number based on 10dB room absorption

- - Insufficient margin above background noise to allow any determination

< - Insufficient margin above background to allow an accurate determination

DAVID WREN
SENIOR PROJECT SCIENTIST

MICHAEL SMITH
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TEST CERTIFICATE NO. 6

ACOUSTIC AND AIRFLOW PERFORMANCE TEST OF WONG BROTHERS
DOUBLE DEFLECTION GRILLES MODEL WBG-2VH & WBG-2HV

NOMINAL NECK DIMENSIONS: 390mm x 790mm

NOMINAL FACE DIMENSIONS: 450mm x 850mm

SUPPLIED BY: WONG BROTHERS

TESTED BY VIPAC ENGINEERS & SCIENTISTS LTD: 9/8/1993

PROJECT SCIENTIST - DAVID WREN

CLIENT: **WONG BROTHERS**
7 TOA PAYOH INDUSTRIAL PARK #01-1245 SINGAPORE

SOUND POWER RESULTS

TEST CONDITIONS			SOUND POWER LEVEL, dB re 10 ⁻¹² W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Q _s (l/s)	P _s (Pa)	T (m)	N R	1 2 5	2 5 0	5 0 0	1 0 0 0	2 0 0 0	4 0 0 0	8 0 0 0
300	2.0	4.2	-	-	-	-	-	-	-	-
400	3.0	5.2	-	46.0	-	-	27.0	19.5	-	-
500	4.0	>7.0	25	50.0	43.5	37.0	34.5	28.0	23.5	<16.0
600	5.5	>7.0	31	57.0	49.0	43.5	41.0	35.7	31.0	23.0
700	7.0	>7.0	36	61.5	53.5	47.5	45.5	41.0	37.5	30.0

Q_s - Air Flow Rate (l/s)

P_s - Static Pressure Drop (Pa)

T - Average Throw to terminal velocity of 0.5 m/s (m)

N R - Noise Rating number based on 10dB room absorption

- - Insufficient margin above background noise to allow any determination

< - Insufficient margin above background to allow an accurate determination

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Wong Brothers Pte Ltd

Airflow and Acoustic Research and Development Study of Various Outlets

Report No. 30U-18-0777-TRP-6751768-1

Vipac Engineers & Scientists Ltd
Melbourne, Australia
September 2018



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Page 1 of 16

DOCUMENT CONTROL FORM

Airflow and Acoustic Research and Development Study of Various Outlets

DOCUMENT NO:	REPORT CODE:
30U-18-0777-TRP-6751768-1	TRP
PREPARED FOR:	PREPARED BY:
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PREPARED AND AUTHORISED BY:		
	
	Zarko Drinic	Date: 25 th September 2018
	Authorised Signatory	
REVIEWED BY:		
	
	Xun Li	Date: 25 th September 2018
	Acoustic Consultant	
REVISION HISTORY:		
Issue No.	Date Issued	Reason/Comments
0	September 2018	Original Data
1	September 2018	ADC 1062 Standard Included
DISTRIBUTION:		
This is Copy No.	Issue No.	Location
1	1	Client
2	1	Vipac (Job Control)
KEY WORDS:	Air Flow Rate, Pressure, Noise	

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1.0 INTRODUCTION

This report presents the results of airflow and acoustic tests carried out on various outlets, supplied by "Wong Brothers Pte Ltd", as described below.

2.0 TEST SPECIMEN

The units under tests are detailed in Table 1 below.

Table 1: Units under tests

#	Product Name	Dimensions (mm)
1	Single Deflection Grille	300 x 150
2	Single Deflection Grille	600 x 300
3	Fixed 45° Grille	300 x 150
4	Fixed 45° Grille	600 x 300
5	Egg Crate Grille	600 x 600
6	Air Light Troffer (Vertical Throw)	1200 x 600

Photographs of the Test Units are shown in Figure 1 (5x Grilles) and Figure 2 (Air Light Troffer).



Figure 1: Grilles (2x Fixed 45° Grilles / 2x Single Deflection Grilles / 1x Egg Crate Grille)



Figure 2: Air Light Troffer (Front View – Left Photo & Back View – Right Photo)

3.0 TEST CONDITIONS AND APPLICABLE STANDARDS

3.1 TEST CONDITIONS

The units under (acoustic) tests were supplied with ambient temperature air at the following conditions:

Air Temperature	17 °C	± 3 °C
Barometric Pressure	101 kPa	± 2 kPa
Relative Humidity	50	± 10 %

3.2 APPLICABLE STANDARDS

The units were tested at a range of flow conditions, as shown on the Test Certificates.

The test set ups were in general accordance with ADC 1062 & ANSI/ASHRAE 70-2006 Standard. Measurements were taken in general accordance with the following standards:

ACOUSTICS

AS 1217.2-1985 Acoustics – Determination of sound power levels of noise sources Part 2: Precision methods for broad-band sources in reverberation rooms.

ISO 3741-1999 Acoustics – Determination of sound power levels of noise sources using sound pressure. Precision methods for reverberation rooms.

AIRFLOW

ADC 1062 Test Code for Grilles, Registers and Diffusers

ANSI/ASHRAE 70-2006 – Method of Testing the performance of Air Outlets and Air Inlets

THROW & STATIC PRESSURE DROP

ADC 1062 Test Code for Grilles, Registers and Diffusers

ANSI/ASHRAE 70-2006 – Method of Testing the performance of Air Outlets and Air Inlets

4.0 TEST SET UP AND SPECIFICATION

Vipac's Reverberation Test Room with a volume of 170m³ has been qualified in accordance with the procedures in AS 1217.2-1985 (ISO 3741-1999) for determination of sound power in octave bands with Centre Frequencies from 125 Hz to 8000 Hz.

The units under test were set up in the Air Distribution (Reverberation) Test Chamber and connected to a quiet air supply.

Following calibration checks, sound pressure levels were measured and converted to sound power levels using the comparison method of AS 1217.2 - 1985 (ie. using a reference sound source of known Sound Power to determine room correction).

Airflow rates were measured using Ø150mm orifice plate. Static pressure drops were recorded using a (Static Pressure) probe and a digital manometer. Throw was measured using a hotwire type anemometer. Figures 3 and 4 show the test setups.

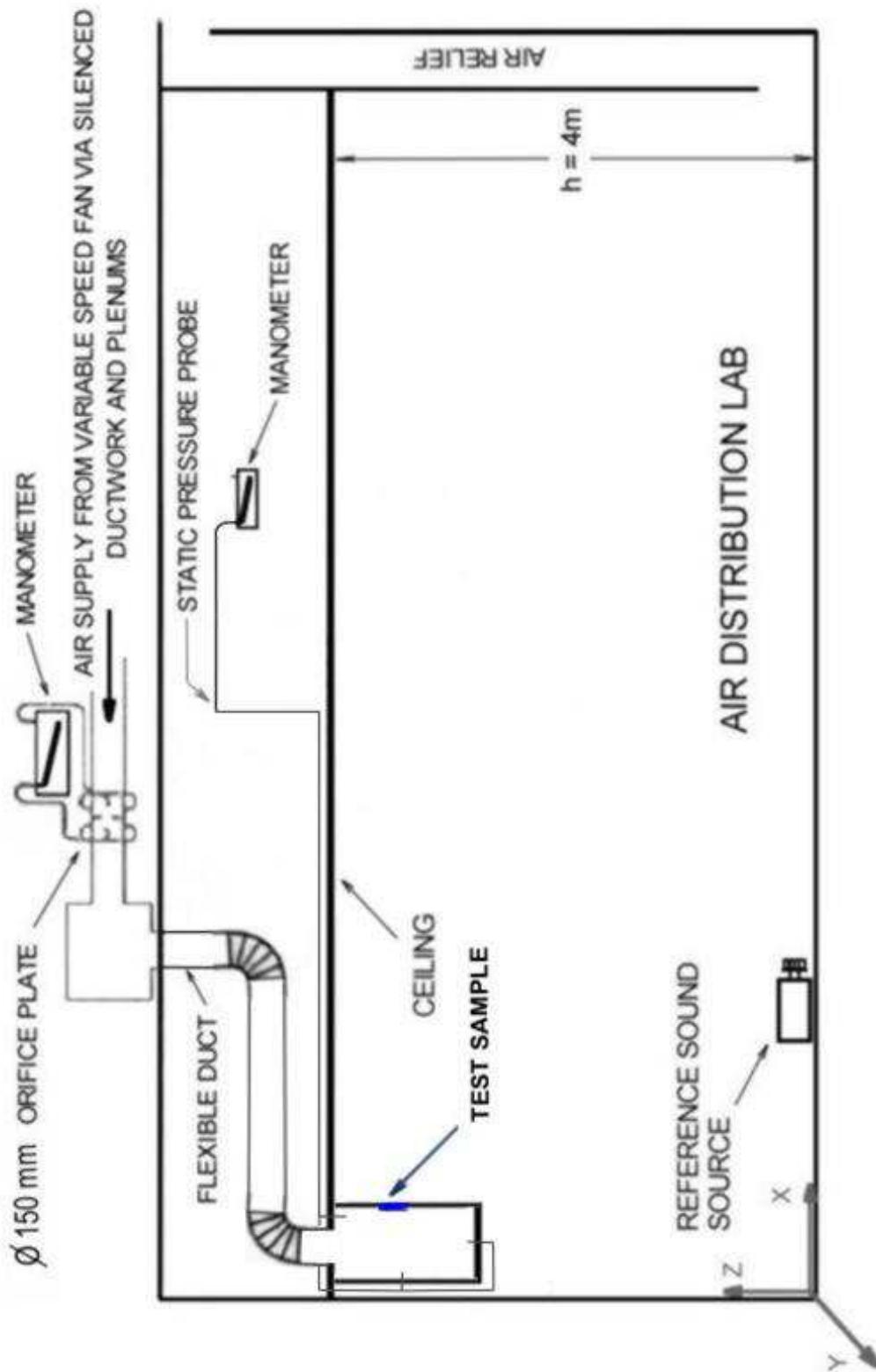


Figure 3: Test Set-up: Grilles (Air Distribution Laboratory)

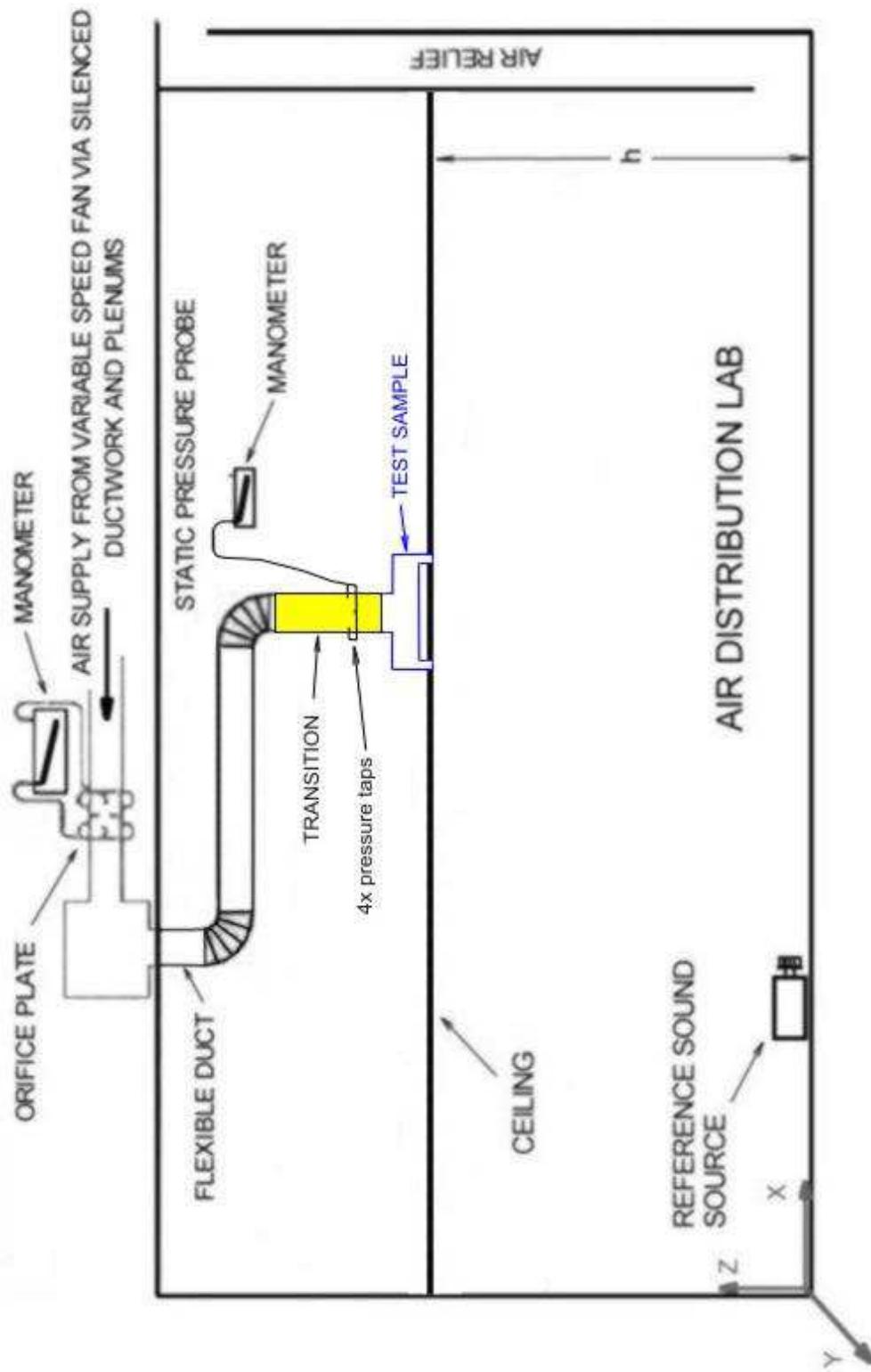


Figure 4: Test Set-up: Air Light Troffer (Air Distribution Laboratory)

5.0 INSTRUMENTATION

INSTRUMENT	MAKE & MODEL	CALIBRATION		SERIAL NO. (Bar Code)
		BY	DATE	
Sound Level Meter Acoustic Calibrator	ONO SOKKI LA-3570 Larson Davis CA250	Vipac Vipac	June 2018 March 2018	26500546 3172
Manometers (2)	TSI (PVM 610) TSI (DP-CALC)	GTS GTS	September 2017 September 2017	PVM610718009 000010147
Orifice Plates	Ø150mm	Vipac	May 2013	-
Airflow Anemometer	TSI 465P	UKAS	April 2018	TA4651210002

6.0 ORDERS OF ACCURACY

<u>Sound Pressure Level:</u>	Octave Band Centre Frequency (Hz)	Standard Deviation (1) (dB)
	125	± 3.0
	250	± 2.0
	500 to 4000	± 1.5
	8000	± 3.0

Pressure Drop: ± 5% or 1 Pa whichever is greater

Airflow: ± 5% or 10 L/s whichever is greater

(1) Uncertainty in determining sound power levels of broadband sources in reverberation rooms (AS1217.2 / Table 1.1 / Page 6)



7.0 RESULTS

The results obtained are shown in the attached Test Certificates.

Report Prepared by:
VIPAC ENGINEERS AND SCIENTISTS LTD.



XUN LI
ACOUSTIC CONSULTANT



ZARKO DRINIC
AUTHORISED SIGNATORY



TEST CERTIFICATE No.1 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Single Deflection Grille
SIZE: 300 mm x 150 mm

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	NC	125	250	500	1000	2000	4000	8000	
124	19	23	-	36.2	38.7	23.1	-	-	-	
147	26	28	-	39.7	43.8	29.5	19.4	-	-	
190	43	34	-	41.4	48.4	44.6	32.4	24.3	-	
219	57	40	41.9	42.5	50.7	50.2	39.0	31.8	23.3	
270	86	46	44.8	45.0	53.6	56.8	48.8	41.1	34.0	

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- - Insufficient margin above background noise to allow accurate determination
- NC - Noise Criterion based upon room absorption of 10 dB



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TEST CERTIFICATE No.2 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Single Deflection Grille
SIZE: 600 mm x 300 mm

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	NC	125	250	500	1000	2000	4000	8000	
324	6	20	50.1	41.5	34.1	28.5	26.4	24.5	-	
373	9	25	53.7	44.9	37.2	33.0	31.1	28.7	20.0	
418	11	30	57.7	47.9	41.1	36.3	34.5	32.0	23.8	
448	13	36	62.6	50.9	43.8	39.3	37.1	34.3	26.7	
512	18	42	66.8	55.4	48.2	43.6	41.4	38.6	31.7	

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- - Insufficient margin above background noise to allow accurate determination
- NC - Noise Criterion based upon room absorption of 10 dB



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TEST CERTIFICATE No.3 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Fixed 45° Grille
SIZE: 300 mm x 150 mm

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	NC	125	250	500	1000	2000	4000	8000	
81	15	23	44.4	45.4	35.5	-	-	-	-	
95	21	28	44.5	49.4	38.7	25.6	-	-	-	
113	29	33	44.8	53.4	42.2	34.1	22.9	-	-	
159	57	38	45.8	54.8	52.7	44.7	36.5	27.7	-	
184	74	43	46.9	54.9	56.8	47.8	41.0	33.2	26.7	

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- - Insufficient margin above background noise to allow accurate determination
- NC - Noise Criterion based upon room absorption of 10 dB

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TEST CERTIFICATE No.4 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Fixed 45° Grille
SIZE: 600 mm x 300 mm

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	NC	125	250	500	1000	2000	4000	8000	
290	10	22	50.8	44.1	33.9	25.4	22.4	19.9	-	
352	15	28	50.8	49.3	40.1	30.4	28.1	25.8	-	
385	18	34	54.3	53.7	43.8	34.5	32.0	30.0	22.3	
483	30	39	60.1	58.0	48.9	43.3	39.2	36.6	29.5	
519	35	44	62.5	63.1	50.9	45.9	41.6	38.7	31.5	

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- - Insufficient margin above background noise to allow accurate determination
- NC - Noise Criterion based upon room absorption of 10 dB



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TEST CERTIFICATE No.5 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Egg Crate Grille
SIZE: 600 mm x 600 mm

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	NC	125	250	500	1000	2000	4000	8000	
192	2	23	43.3	45.3	35.8	0.0	-	-	-	
225	3	28	43.4	49.3	38.9	25.7	-	-	-	
256	4	33	43.6	53.3	42.4	34.2	23.2	-	-	
333	6	38	45.2	55.0	53.0	44.8	36.9	28.0	-	
382	8	43	46.3	55.1	56.8	47.9	41.4	33.5	26.8	

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- - Insufficient margin above background noise to allow accurate determination
- NC - Noise Criterion based upon room absorption of 10 dB



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TEST CERTIFICATE No.6 (J/N: 30U-18-0777)

ACOUSTIC AND AIRFLOW PERFORMANCE TESTS

SUPPLIED BY: WONG BROTHERS PTE LTD
TESTED BY: VIPAC ENGINEERS & SCIENTISTS LTD
TEST DATE: July - August 2018
CLIENT: WONG BROTHERS PTE LTD
UNIT: Air Light Troffer
SIZE: 1200 mm x 600 mm

Ceiling Installation - Vertical THROW

TEST CONDITIONS			SOUND POWER LEVEL, dB re 1E-12 W OCTAVE BAND CENTRE FREQUENCY (Hz)							
Qs (L/s)	Ps (Pa)	T (m)	NC	125	250	500	1000	2000	4000	8000
161	21	4	21	44.4	43.1	36.1	26.3	-	-	-
180	26	>4	26	48.7	47.5	40.9	31.5	26.2	-	-
214	37	>4	32	52.7	52.0	45.7	37.2	33.0	24.7	-
264	57	>4	38	57.5	57.3	51.8	43.8	40.1	33.2	26.5
307	78	>4	43	61.3	61.5	56.7	48.9	45.5	39.4	33.8

LEGEND

- Qs - Primary Air Flow Rate (L/s)
- Ps - Supply Static Pressure (Pa)
- T - Vertical Throw in meters to a terminal velocity of 0.25 m/s (m)
- - Insufficient margin above background noise to allow accurate determination
- > - Length of throw greater than that able to be measured
- NC - Noise Criterion based upon room absorption of 10 dB



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1	Orchard View Condo @ Anguilla	2010	Sanyo Engineering	Grilles & Dampers	
2	78 Shenton Major A&A	2010	Kurihara Kogyo Co., Ltd	Grilles & Dampers/Actuator	
3	Inter Roller @ Boon Lay	2010	Sing Wah Enterprise	Grilles & Dampers/Actuator	
4	Nestoil	2010	APP Engineering	Grilles & Dampers/Actuator	
5	Creates @University Town	2010	Dai Dan CO., Ltd	Grilles & Dampers/Actuator	
6	Heritage Museum	2010	Kurihara Kogyo Co., Ltd	Grilles & Dampers/Actuator	
7	Changi Cove Hotel	2010	Great Resources	Grilles & Dampers/Actuator	
8	United World College @ Tampines	2010	Great Resources	Grilles & Dampers/Actuator	
9	IBP Changi Phase 3	2010	Powen Electrical	Grilles & Dampers/Actuator	
10	DrillQuip Factory @ Tuas	2010	Powen Electrical	Grilles & Dampers/Actuator	
11	Canadian International Sch	2010	Chester Technologies	Grilles & Dampers/Actuator	
12	SRC @ Jurong Island	2011	Kurihara Kogyo Co., Ltd	Grilles & Dampers/Actuator	
13	Heraeus @ Tuas Ave 5	2011	Kurihara Kogyo Co., Ltd	Grilles & Dampers/Actuator	
14	No 8 Claymore Hill Condo	2011	V3 Construction P/L	Grilles & Dampers/Actuator	
15	HSBC @ Mapletree	2011	BWH Engrg P/L	Grilles & Dampers/Actuator	
16	Jln Tepong	2011	BWH Engrg P/L	Grilles & Dampers/Actuator	
17	S.T @ Chin Bee Rd	2011	BWH Engrg P/L	Grilles & Dampers/Actuator	
18	NJC	2011	Double Mechanical Pte Ltd	Grilles & Dampers/Actuator	
19	Jurong Ville Sec Sch	2011	Double Mechanical Pte Ltd	Grilles & Dampers	
20	LV @ MBS	2011	BWH Engrg P/L	Grilles & Dampers	
21	Woh Hup HQ	2011	Powen Electrical	Grilles & Dampers/Actuator	
22	Jotun @ Tuas	2011	Technical Frigecon	Grilles & Dampers/Actuator	
23	Gombak Camp major A & A	2011	TKK Facility Management	Grilles & Dampers/Actuator	
24	Unilever Asia P/L @ Mapletree biz	2011	Hoong Fung Engrg Works	Grilles & Dampers/Actuator	
25	ITE HQ @ AMK	2011	Great Resources	Aluminum Flexible Duct	
26	Seacare Hotel @ Chin Swee Rd	2011	Shan Ming	Aluminum Flexible Duct	
27	Dorsett Hotel	2011	Bintai Kindenko P/L	Grilles & Dampers/Actuator	
28	Sage @ Nassim Hill	2011	Sanyo Engrg	Grilles & Dampers	
29	St Thomas Walk	2011	Powen Electrical	Grilles & Dampers/Actuator	
30	PLB @ Changi T2	2011	Natural Cool A/C & Engrg P/L	Grilles & Dampers	
31	Quayside Isle	2012	Bintai Kindenko P/L	Grilles & Dampers/Actuator	
32	The Pinnacle Collection @ Sentosa	2012	Powen Electrical	Grilles & Dampers/Actuator	

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	PROJECT TITLE	DATE	CONTRACTOR	Remarks	CONSULTANT / ARCHITECT
33	Korean Church	2012	Bintai Kindenko P/L	Grilles & Dampers/Actuator	
34	Centennia Suites @ Kim Seng	2012	Powen Electrical	Grilles & Dampers	
35	Metropolis @ Buona Vista	2012	Powen Electrical	Aluminum Flexible Duct	
36	Metropolis @ Buona Vista	2012	Quantum Automation P/L	VAV Box	
37	LucasFilm @ Fusionopolis	2012	Kurihara Kogyo Co.,Ltd	Grilles & Dampers/Actuator	
38	Anguillia Park Condo	2012	Natural Cool A/C & Engrg P/L	Grilles & Dampers/Actuator	
39	Singapore Turf Club-Contract 3	2012	Luova Engrg P/L	Grilles & Dampers/Actuator	
40	2M2P	2012	Sing Wah Enterprise P/L	Grilles & Dampers/Actuator	
41	Soundstage @ Mediapolis	2012	Evergreen Engrg & Contrt P/L	Grilles & Dampers/Actuator	
42	Super Coffee Factory @ Tuas West	2013	Natural Cool A/C & Engrg P/L	Grilles & Dampers/Actuator	
43	Westgate @ Boon Lay Way	2013	Bintai Kindenko P/L	Grilles & Dampers/Actuator	
44	Holiday Inn Express @ Clemenceau	2013	Guthrie Engrg(S) P/L	Grilles & Dampers/Actuator	
45	Nucleos @ Biopolis 5	2013	Powen Electrical	Grilles & Dampers/Actuator	
46	One KM @ Tanjong Katong	2013	Great Resources	Grilles & Dampers/Actuator	
47	Pixel Red @ Tai Seng	2013	Powen Electrical	Grilles & Dampers/Actuator	
48	Hillier Condo @ Hillview Ave	2013	Great Resources	Grilles & Dampers/Actuator	
49	Palms @ Sixth Ave	2013	Natural Cool A/C & Engrg P/L	Grilles & Dampers	
50	Singapore Turf Club-Contract 4	2013	Natural Cool A/C & Engrg P/L	Aluminum Flexible Duct	
51	Changi Civil Services Club	2014	Powen Electrical	Grilles & Dampers/Actuator	
52	Fusionopolis Way Tower A/B	2014	Kurihara Kogyo Co.,Ltd	Grilles & Dampers/Actuator	
53	Ngee Ann Poly	2014	Luova Engrg P/L	Grilles & Dampers/Actuator	
54	Ripple Bay @ Pasir Ris Dr4	2014	Powen Electrical	Grilles & Dampers/Actuator	Square Mech
55	Marina Sq A&A	2014	Powen Electrical	Grilles & Dampers/Actuator	Meinhardt
56	Essec @ Nepal Park	2014	Kurihara Kogyo Co.,Ltd	Grilles & Dampers/Actuator	
57	DBS A&A	2014	Dai-Dan Co;Ltd	Aluminum Flexible Duct	KTP1
58	Changi Prison	2014	Great Resources	Grilles & Dampers/Actuator	CPG
59	Genting Hotel @ Juring Town Hall Rd	2014	Bintai Kindenko P/L	Grilles & Dampers/Actuator	
60	Carlton Hotel A&A	2014	Powen Electrical	Grilles & Dampers/Actuator	Beca
61	Sky Green Condo @ Macphenson	2014	Powen Electrical	Grilles & Dampers/Actuator	
62	Woodsville Condo @ 18 Woodsville Close	2014	Natural Cool A/C & Engrg P/L	Grilles & Dampers	CPG
63	Keppel Shipyard @ 51 Pioneer Sector 1	2014	Natural Cool A/C & Engrg P/L	Grilles & Dampers/Actuator	
64	Sennett Condo @ Pheng Geck Ave	2014	Natural Cool A/C & Engrg P/L	Grilles & Dampers	T.Y.Lin

PROJECT REFERENCES

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	PROJECT TITLE	DATE	CONTRACTOR	Remarks	CONSULTANT / ARCHITECT
65	PLB @ T1/T2	2014	Natural Cool A/C & Engrg P/L	Grilles & Dampers	CPG
66	Greenwood Mews Condo	2014	Natural Cool A/C & Engrg P/L	Grilles & Dampers/Actuator	Rankine & Hill
67	Kong Meng San @ 88 Brighthill Road	2014	Koyo M&E P/L	Grilles & Dampers/Actuator	
68	Crown Plaza Hotel Extension @ T3	2015	Powen Enrg P/L	Grilles & Dampers/Actuator	Surbana
69	OUE Tower 1 @ 6 Shenton Way	2015	Powen Enrg P/L	Grilles & Dampers/Actuator	KTPI
70	Downtown Line 3 (16 Station)	2015	Bintai Kindenko P/L	Grille/Alum Flex Duct	P.B
71	Mixed Development @ 15 Cairnhill Rd	2015	Powen Enrg P/L	G&D/Alum Flex Duct	Beca
72	Changi T1/T2 Gangway	2015	Trans Equatorial Enrg P/L	WPC Bargrille	
73	Katong Hotel @ 86 East Coast Rd	2015	Great Resources	Grilles & Dampers/Actuator	UPC
74	Lee Kong Chian(Yunnan)@ NTU	2015	Bintai Kindenko P/L	VAV Box	Meinhardt
75	Lee Kong Chian(Novena)@ Mandalay Rd	2015	Bintai Kindenko P/L	VAV Box	Meinhardt
76	Duo @ Rochor/Beach Rd/Ophir Rd	2015	Kurihara Kogyo Co.Ltd	Grilles & Dampers/Actuator	Beca
77	Amore @ Punggol Central	2015	Natural Cool A/C & Enrg P/L	Grilles & Dampers/Actuator	United Project
78	PLB @ T4	2015	Natural Cool A/C & Enrg P/L	Grilles & Dampers	CPG
79	Thomson Three Condo @ Brighthill Drive	2015	Kembla A/C P/L	Grilles & Dampers/Actuator	
80	Link Hotel @ Tiong Bahru	2015	Supersonic A/C Elect.Enrg P/L	Grilles & Dampers/Actuator	
81	The Scotts Tower @ 38 Scotts Rd	2015	Co-AI Enrg Intergrated Services	Grilles & Dampers	
82	The Glade @ Bedok Rise	2016	Powen Enrg P/L	Grilles & Dampers/Actuator	Beca
83	Goodwood Grand @ 28 Balmoral Rd	2016	Natural Cool A/C & Enrg P/L	Grilles & Dampers	Meinhardt
84	DSO @ 12 Science Park Drive	2016	Shan Ming A/C	Aluminum Flex Duct	
85	Bedok Integrated Complex	2016	Bintai Kindenko P/L	VAV Box/Grille & Dampers/Actuator	Rankine & Hill
86	Downtown East @ Pasir Ris Close	2016	Natural Cool A/C & Enrg P/L	Grilles & Dampers/Actuator	Beca
87	Mapletree @ Tai Seng	2016	Powen Enrg P/L	VAV Box/Grille & Dampers/Actuator	Bescon
88	GSK HQ @ Vista Exchange Green	2016	Powen Enrg P/L	VAV Box/Grille & Dampers/Actuator	Squire Mech
89	Kampung Admiralty@Woodlands Close	2016	Powen Enrg P/L	VAV Box/Grille & Dampers/Actuator	Aecom
90	Jurong Town Hall	2016	Sing Wah Enterprise P/L	Grilles & Dampers/Actuator	Parson
91	Pioneer Polyclinic @Jurong West St61	2016	Bintai Kindenko P/L	Grilles & Dampers/Actuator	Mott Mac
92	St Joseph Nursing Home@Jurong West	2016	Natural Cool A/C & Enrg P/L	Grilles & Dampers/Actuator	Bescon
93	NorthPoint Shopping@Yishun Ave 2	2016	Bintai Kindenko P/L	Grilles & Dampers/Actuator	Squire Mech
94	The Gallery Hotel@Nanson Rd	2016	General Thermal Enrg P/L	Grilles & Dampers/Actuator	JRP
95	Coco Palms Condo	2016	SAS M&E P/L	Grilles & Dampers/Actuator	Meinhardt
96	Clifford Center	2016	Powen Enrg P/L	Grilles & Dampers/Actuator	JRP

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97	Singapore Tourism Board	2016	Siew Engineering P/L	VAV Box	
98	NTU SPC L5	2016	Siew Engineering P/L	VAV Box/Grille & Dampers/Actuator	
99	NTU EMB L7	2016	Siew Engineering P/L	VAV Box/Grille & Dampers/Actuator	
100	HDB Punggol NC1	2016	Great Resources	Grille & Dampers/Actuator	Bescon
101	AMK THK Hospital	2017	Quantum Automation P/L	VAV Box	
102	Bayview Hotel@Bencoolen Street	2017	Accon Engrg P/L	Grille & Dampers/Actuator	EWC
103	Farrer Park Hotel	2017	General Thermal Engrg P/L	Grille & Dampers	JRP
104	Raffles Hospital Extension	2017	Powen Engrg P/L	VAV Box/Grille & Dampers/Actuator	JRP
105	ST Omega @ AMK Electronics Park Rd	2017	Powen Engrg P/L	Grille & Dampers/Actuator	BELMAC
106	JTC Space @ 14 Tuas Ave 1	2017	Bintai Kindenko P/L	Grille & Dampers/Actuator	Aecom
107	The Creek Condo@Toh Tuck Road	2017	Great Resources M&E	Grille & Dampers	KTP
108	Shaw Center/Shaw House	2017	Natural Cool A/C & Engrg P/L	Grille & Dampers/Actuator	Bescon
109	Data Centre @ 27 Tampines St 92	2017	Amcool P/L	Grille & Dampers/Actuator	Plan One Engrg Services
110	Data Centre @ 21 Defu Ave 1	2017	Amcool P/L	Grille & Dampers/Actuator	Plan One Engrg Services
111	Data Centre @ 20 Tampines St 92	2017	Amcool P/L	Grille & Dampers/Actuator	CPG
112	German European Sch@Dairy Farm Rd	2017	Great Resources M&E	Grille & Dampers/Actuator	Beca
113	Changi Airport PLB T1E	2017	Natural Cool A/C & Engrg P/L	Grille & Dampers	J.Roger Preston
114	Bus Depot@Seletar RD299	2017	Natural Cool A/C & Engrg P/L	Grille & Dampers/Actuator	Rankine & Hill
115	1&3 Kallang Junction	2017	Accon Engrg P/L	Grille & Dampers/Actuator	Gims & Associate P/L
116	Proxima@Gambas	2017	Accon Engrg P/L	Grille & Dampers/Actuator	PDC Consultant Engrg
117	Bus Depot@Ulu Pandan RD300	2017	Natural Cool A/C & Engrg P/L	Grille & Dampers/Actuator	Rankine & Hill
118	Housing Development@Canberra Link	2017	Natural Cool A/C & Engrg P/L	Grille & Dampers/Actuator	Bescon
119	Maamunagau Maldives	2018	A Venture Engineering Pte Ltd	Grille & Dampers/Actuator	Ace-Tech Design Pte Ltd
120	National Archives Of Spore	2018	BMS Engrg & Trading P/L	VAV Box	Squire Mech
121	Warehouse @ Bulim Ave	2018	Kurihara Kogyo Co;Ltd	Grille & Dampers/Actuator	Squire Mech
122	Stars Of Kovan Condo	2018	Powen Engrg P/L	Grille & Dampers	T.Y.Lin International P/L
123	68 Residence (Myanmar)	2018	Bintai Kindenko P/L	Grille & Dampers/Actuator	
124	Alps Residence	2018	Great Resources M&E	Grille & Dampers/Actuator	UPC Consultant
125	JTC Furniture Hub	2018	Great Resources M&E	VAV Box/Grille & Dampers/Actuator	Arup Spore P/L
126	Boys Complex	2018	Great Resources M&E	Grille & Dampers/Actuator	CPG
127	No1 Gul St5	2018	Powen Engrg P/L	Grille & Dampers/Actuator	Neam Solution/Vincent Han A
128	45 Leng Kee Rd	2018	Natural Cool A/C & Engrg P/L	Grille & Dampers/Actuator	Tritont Consultant LLP

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129	Data Centre @ 15 Defu Ave 1	2018	Amcool P/L	Grille & Dampers/Actuator	Plan-One Building Services
130	Paterson Services Apt	2018	D.I.S A/C & Elect P/L	WPC Bargrille/Grille	JRP
131	YTC office @ Peninsula Plaza	2018	Accon Engrg P/L	WPC Bargrille/Grille	CMP Consultants P/L
132	Bollore Blue Hub @ Sunview Rd	2018	Sing Wah Enterprise P/L	Bspot/Grille & Dampers/Actuator	
133	Marina East Desalination Plant	2018	Bintai Kindenko P/L	Grille & Dampers/Actuator	Mott Macdonald Consultant
134	Outram Community Hospital	2018	Bintai Kindenko P/L	Dampers/PIR Duct	Surbana Jurong Consultant P/L
135	SMU	2019	Quantun Automation P/L	VAV Box	
136	Toa Payoh West CC	2019	Narural Cool A/C&Engrg P/L	Grille & Dampers	HT M&E Consultant
137	The Verge@2 Serangood Road	2019	Powen Engrg P/L	Grille & Dampers/Actuator	KTPI
138	Spore Exam & Assessment Board	2019	BMS Engrg & Trading P/L	VAV Box	
139	Woodland Regional Bus Interchange	2019	Kin Xin Engrg P/L	Grille & Dampers/Actuator	Elead Associate P/L
140	Madrasah Education Institute@toa payoh	2019	Luova Engrg P/L	Grille & Dampers	
141	Huamin Pri Sch	2019	Luova Engrg P/L	Grille & Dampers	Squire Mech P/L
142	Naval Base Pri Sch	2019	Luova Engrg P/L	Grille & Dampers	Squire Mech P/L
143	Orchid Park Sec Sch	2019	Luova Engrg P/L	Grille & Dampers	Squire Mech P/L
144	Tampines Pri Sch	2019	Luova Engrg P/L	Grille & Dampers	Squire Mech P/L
145	PSA @ 34 Harbour Drive	2019	Powen Engrg P/L	VAV Box/Grille & Damper	Surbana Jurong Consultant
146	Temasek Poly	2019	Kin Xin Engrg P/L	VAV Box	
147	Punggol Pri Sch	2019	Natural Cool A/C & Engrg P/L	Grille & Dampers	Arup Spore P/L
148	Chin Cheng Polyclinics	2020	M&C Engrg&Trading P/L	VAV Box	
149	JTC Logistic Hub@Gul Circle	2020	Kimly Construction P/L	Grille & Dampers	Meinhardt
150	Changi T2	2020	A&L Engrg P/L	VAV Box	CAG
151	SJSM @ 30 Dover Ave	2021	Natural Cool A/C & Engrg P/L	Grille & Dampers	Squire Mech P/L
152	Senja Nursing Home	2021	Yitac(S) P/L	VAV Box/Grille & Dampers	Surbana Jurong Consultant
153	JTC-WNC @ Woodland Ave 4&9	2021	Powen Engrg P/L	Grille & Dampers	WSP Consultancy P/L
154	Sembawang Sports Hub	2021	Great Resources M&E	VAV Box/Grille & Dampers	Aecom
155	Tee Yih Jia	2021	Great Resources M&E	Grille & Dampers	Surbana Jurong Consultant
156	Fixed Gangway@ T1/T2/T3	2022	PBT Engrg	WPC Bar Grille	JRP
157	Condo @ 21 Stirling Road	2022	Great Resources M&E	Grille & Dampers	Rankine & Hill
158	JTC-MSRF	2022	Sing Wah Enterprise P/L	Grille & Dampers	JRP
159					
160					

PROJECT REFERENCES

Highlights

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It's not about superficial aesthetics, it's about a perfect unison of form function & reliability

Over the past decades, we have corrected, enhanced and are still

constantly re-engineering our products, services & operations to

meet with the ever demanding and changing economy.

This has led us through numerous projects of different fields &

functions. From small cafes to skyscrapers, bomb shelters to

sewage plants, showrooms to outdoor atriums & Integrated Resorts.

Our Products have been put to test and have humbly met **form, function & reliability**.

