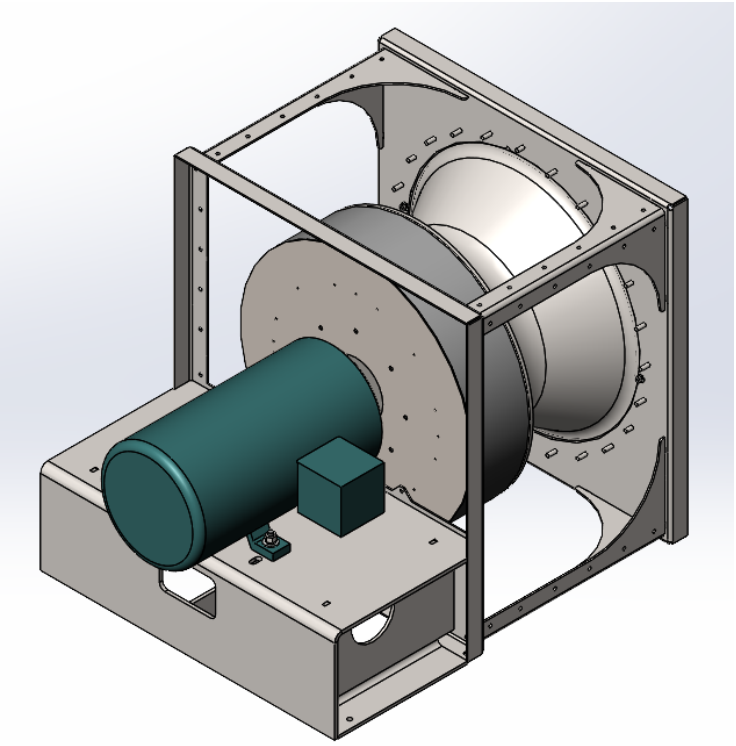
Design 51 Direct Drive Plenum Fans

Design 51 Plenum

Chicago Blower Design 51 Plenum direct drive fans come with an airfoil fan wheel and are compact with this wheel directly coupled to the motor shaft. The wheel is an all steel construction, continuously welded with a hyperbolic spun wheel cone.

With several decades of installs, the plenum fan has a well earned reputation for exceptional quality and long term reliability. Without the need of a coupling, bearings, or belts or sheaves, the motor and fan wheel are left as the only rotating part making maintenance easier as well as more cost effective.

Also available in A/3, A/3S, A/3T and A/3H belt driven applications.



Features

Rugged Construction

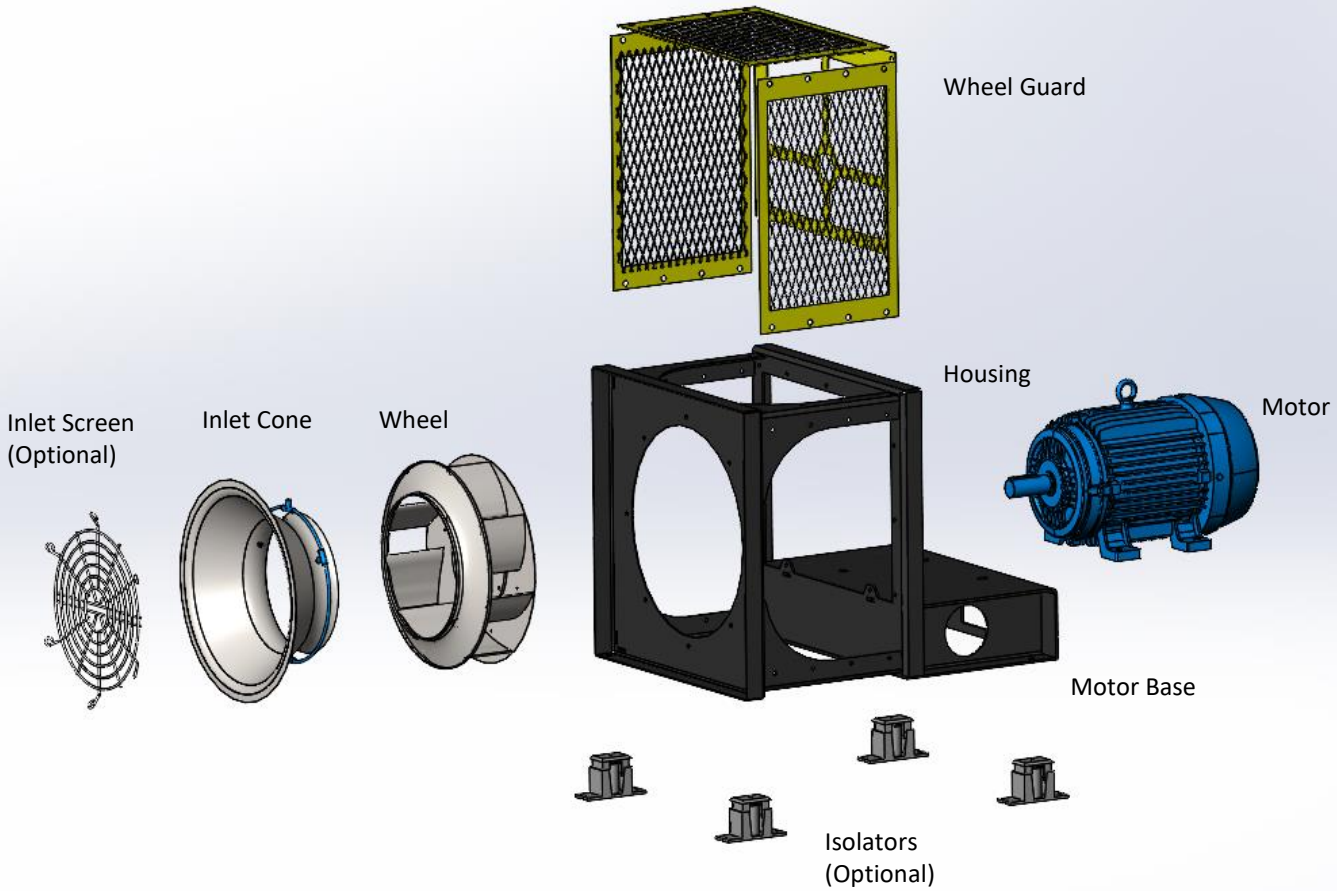
Heavy gauge steel housings are welded by AWS welders to assure structural integrity with extended durability.

Inlet Cone

Streamlined, spun steel inlet cone optimizes the smooth stable air flow across the entire operating range.

Wheels

Heavy gauge steel wheels with a hyperbolic wheel cone. Wheel continuously welded with weep holes to reduce moisture entrapment



Options

Inlet Screen
Welded steel wire or equal. In throat of inlet cone or optional oversize for bolt on outside of fan. Screen for inlet volume control is outside of control louvers and is horizontally split. Extended grease tube fittings are recommended with this accessory.

Wheel Guard
Heavy duty expanded metal surrounds the fan. Panels are removable for access to the wheel. Includes extended grease leads.

Isolators
Spring or Rubber-in-shear. Range of deflections from ½" to 1".

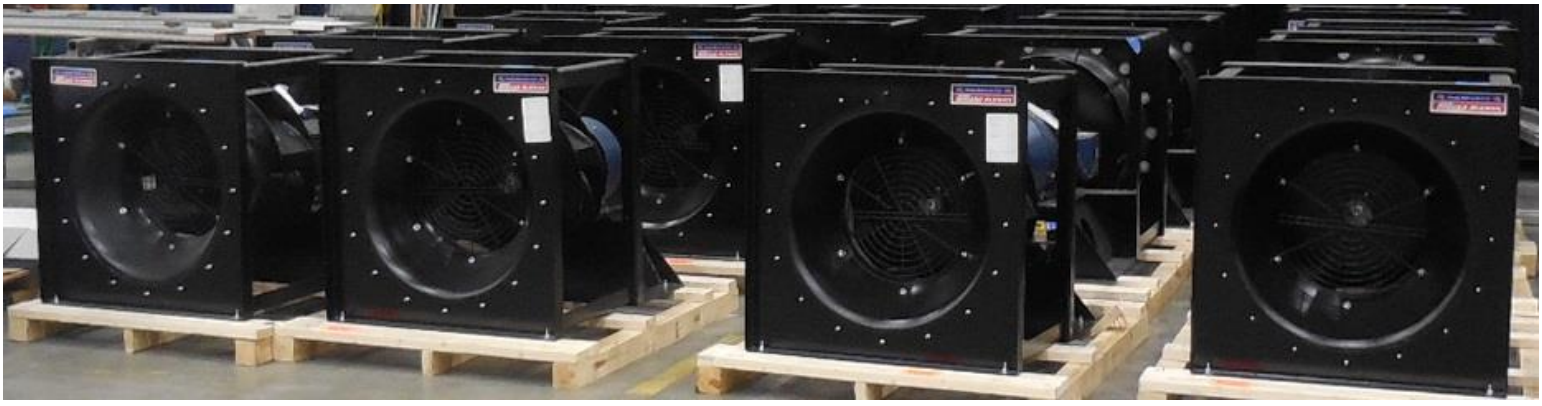
VOLU – Probe
Mounted inside the throat of the inlet cone are pressure measuring probes with external LCD monitor displaying flow, pressure, and velocity

Flanged Inlet/Slip Inlet
For meeting any installation requirements.

Piezometer Ring
Mounted around the outside of the inlet cone throat, includes low and high pressure taps.

Inlet Vane Control Damper
Variable inlet vanes suitable for manual or automatic operation. Includes lever and quadrant for manual operation.

Spark Resistant Construction
AMCA Type B or C spark resistant construction. Type B includes an aluminum wheel and steel inlet cone. Type C includes steel wheel and aluminum inlet cone.



Sound Levels

Table lists estimated sound levels (dBA) for each size at various speeds within the fan's normal operating range. To determine dBA for a selected fan, locate the intersection of the fan size and the closest RPM.

FAN SIZE	Fan Speed (RPM)																	
	400	500	600	700	800	900	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3600
135	-	-	-	-	37	40	43	48	52	55	59	61	64	66	69	71	73	77
150	-	-	-	36	39	42	45	50	55	58	61	64	67	69	71	73	75	79
165	-	-	34	38	42	45	48	52	57	60	63	63	69	71	73	75	77	82
182	-	-	40	44	47	50	53	58	62	65	68	71	73	75	75	79	81	-
200	-	34	39	43	47	50	53	58	62	65	68	71	73	76	79	80	81	-
222	-	37	42	46	50	53	56	60	65	68	71	74	76	79	80	83	-	-
245	34	40	45	49	52	55	58	63	67	71	74	77	79	82	83	-	-	-
270	37	43	48	52	55	59	61	66	70	74	77	80	82	85	-	-	-	-
300	40	46	51	55	59	62	65	70	74	77	79	83	86	-	-	-	-	-
330	42	48	53	57	61	64	67	72	76	79	82	-	-	-	-	-	-	-
365	44	50	55	60	63	66	69	74	78	82	-	-	-	-	-	-	-	-
402	46	53	58	62	66	69	72	77	81	-	-	-	-	-	-	-	-	-
445	55	61	66	70	74	77	74	84	-	-	-	-	-	-	-	-	-	-
490	58	64	69	73	77	80	77	-	-	-	-	-	-	-	-	-	-	-
452	61	67	72	76	80	83	84	-	-	-	-	-	-	-	-	-	-	-
600	64	70	75	79	83	86	-	-	-	-	-	-	-	-	-	-	-	-
660	67	73	78	82	86	-	-	-	-	-	-	-	-	-	-	-	-	-
730	70	76	81	85	89	-	-	-	-	-	-	-	-	-	-	-	-	-
807	73	70	84	88	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

1. Sound levels are based on tests conducted in accordance with AMCA Standard 300.
2. Sound level computations are based on a distance of 3' from the fan's open Inlet in a free field environment.
3. Specific octave band sound power levels and sound pressure levels available on request.
4. Sound levels of installed fans can vary greatly from laboratory tests. The dBA ratings are only to be used as estimates. Any comparisons and any detailed calculations should be based on sound power levels, which are independent of the installation.
5. AMCA Certified Ratings Seal applies to air performance only.

Selection Corrections

The following pages contain multi-rating tables for Design 51 Plenum fans. Each section provides data for a particular motor speed. Under each pressure (SP) rating, the volume (CFM) and horsepower (BHP) is listed for each fan size. For pressures not provided in the tables, simply interpolate between two given pressures.

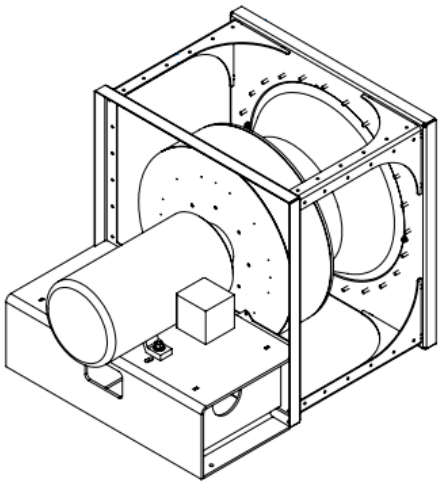
Example: 5000CFM, 150°F, 1000' elevation, 5" WG SP

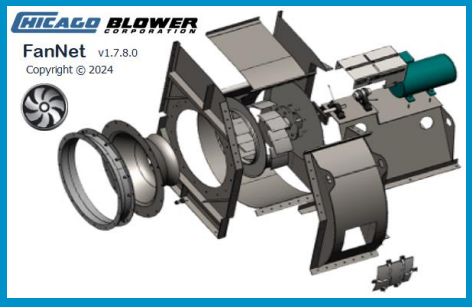
1. From the correction table, the correction factor for 150°F and 1000' elevation is 1.19 (Rounded to 1.20 for easy conversion.)
2. The equivalent SP at 70°F and sea level equals 5" SP x 1.20 = 6"SP.
3. Enter the table at 6"SP. You would select a size 165 at 3600RPM at 5546CFM, requiring 9.43BHP
4. To correct BHP to 150F and 1000' elevation, divide by the same correction factor 9.43/1.20 = 7.85BHP.

TEMPERATURE AND ALTITUDE CORRECTION

AIR TEMP (F°)	ALTITUDE (feet) with BAROMETRIC PRESSURE (HG)									
	0 29.92	500 29.38	1000 28.86	1500 28.33	2000 27.82	2500 27.31	3000 26.82	3500 26.32	4000 25.84	5000 24.90
-15	.79	.81	.82	.84	.85	.87	.88	.90	.96	1.00
0	.87	.88	.90	.92	.93	.95	.97	.99	1.00	1.04
70	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.20
100	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.27
150	1.15	1.17	1.19	1.22	1.24	1.26	1.28	1.31	1.33	1.38
200	1.25	1.27	1.29	1.32	1.34	1.36	1.39	1.42	1.44	1.50
250	1.34	1.36	1.39	1.41	1.44	1.47	1.49	1.52	1.55	1.61
300	1.43	1.46	1.49	1.51	1.54	1.57	1.60	1.63	1.66	1.72
350	1.53	1.56	1.58	1.61	1.64	1.67	1.70	1.74	1.77	1.84
400	1.62	1.65	1.68	1.71	1.75	1.78	1.81	1.84	1.88	1.95
500	1.81	1.84	1.88	1.91	1.95	1.98	2.02	2.06	2.10	2.18
600	2.00	2.04	2.07	2.11	2.15	2.19	2.23	2.27	2.32	2.40
650	2.09	2.13	2.17	2.21	2.25	2.29	2.34	2.38	2.43	2.52
700	2.19	2.23	2.27	2.31	2.35	2.40	2.44	2.49	2.53	2.63
800	2.38	2.42	2.48	2.51	2.56	2.60	2.65	2.70	2.75	2.86

Chicago Blower Corporation certifies that the Design 51 Plenum fans shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program



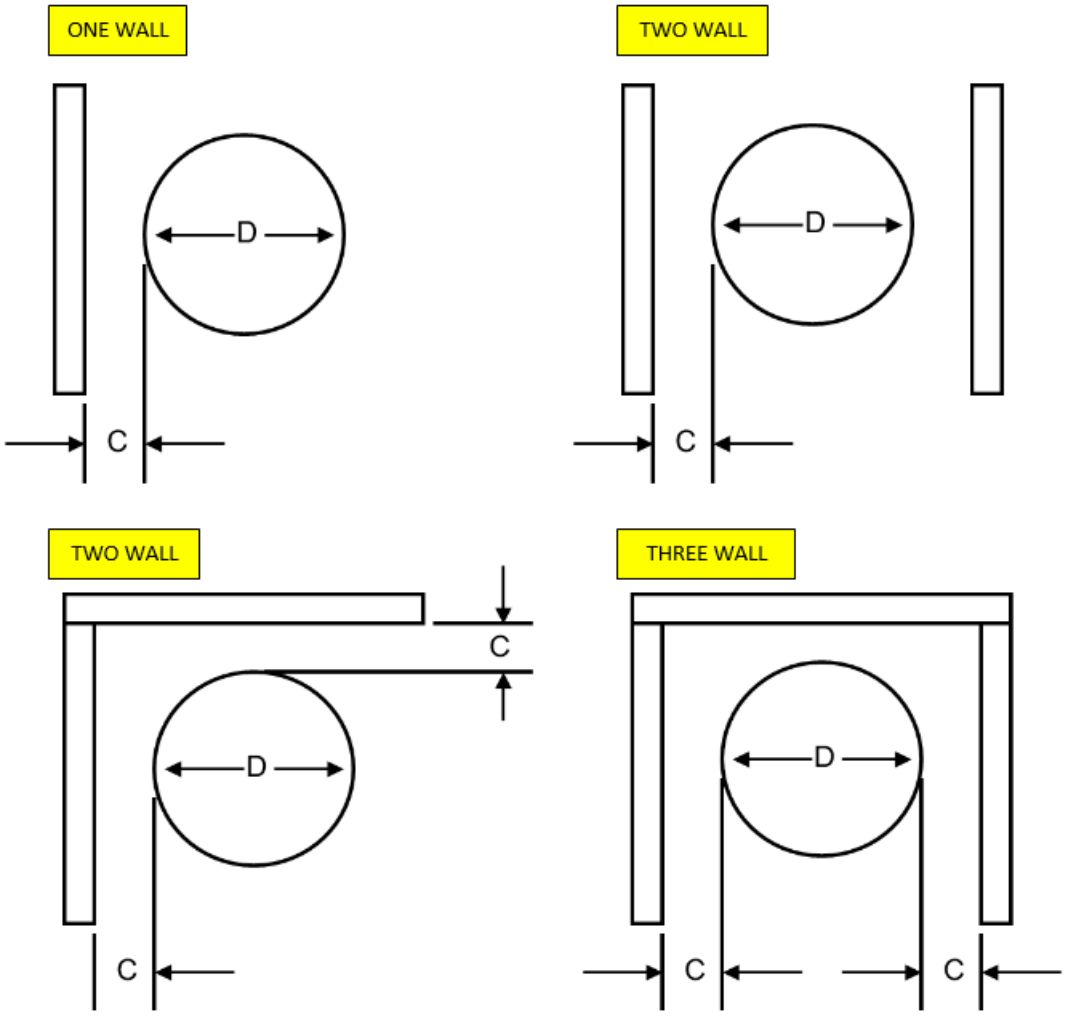


Refer to Chicago Blower's FanNet for performance, fan curves and sound data.

For software and assistance, visit www.chicagoblower.com

Plenum Wall Affects

Plenum wall affects refer to the influence that the walls of a plenum chamber have on the performance and behavior of air moving equipment within the chamber. The walls of the plenum can affect airflow patterns, pressure distribution, noise levels, and overall system efficiency.



The chart above helps us describe the clearance of the wall in relation to the wheel diameter based on the number of walls. This information is used on the next page in order to determine what factor might need to be added to your fan selection to account for the affects of the walls.

Plenum Wall Affects

% WOV	FACTOR	C = D/8			C = D/4			C = D/2		
		ONE WALL	TWO WALL	THREE WALL	ONE WALL	TWO WALL	THREE WALL	ONE WALL	TWO WALL	THREE WALL
95	CFM	1.02	1.03	1.09	1.01	1.02	1.06	1.02	1.01	1.03
	SP	1.04	1.05	1.19	1.03	1.04	1.13	1.01	1.01	1.05
85	CFM	1.02	1.02	1.08	1.01	1.02	1.06	1.01	1.01	1.03
	SP	1.03	1.05	1.17	1.02	1.03	1.12	1.01	1.01	1.05
75	CFM	1.01	1.02	1.07	1.01	1.02	1.05	1.00	1.01	1.02
	SP	1.03	1.04	1.15	1.02	1.03	1.10	1.01	1.01	1.05
65	CFM	1.01	1.02	1.06	1.01	1.01	1.04	1.00	1.01	1.02
	SP	1.03	1.04	1.12	1.02	1.03	1.09	1.01	1.01	1.04
55	CFM	1.01	1.02	1.05	1.01	1.01	1.04	1.00	1.01	1.02
	SP	1.02	1.03	1.10	1.01	1.02	1.08	1.01	1.01	1.03
45	CFM	1.01	1.01	1.04	1.01	1.01	1.03	1.00	1.00	1.01
	SP	1.01	1.03	1.08	1.01	1.02	1.06	1.01	1.01	1.03

Where
D= Wheel Diameter
C = Clearance from plenum wall
WOV = Wide open volume

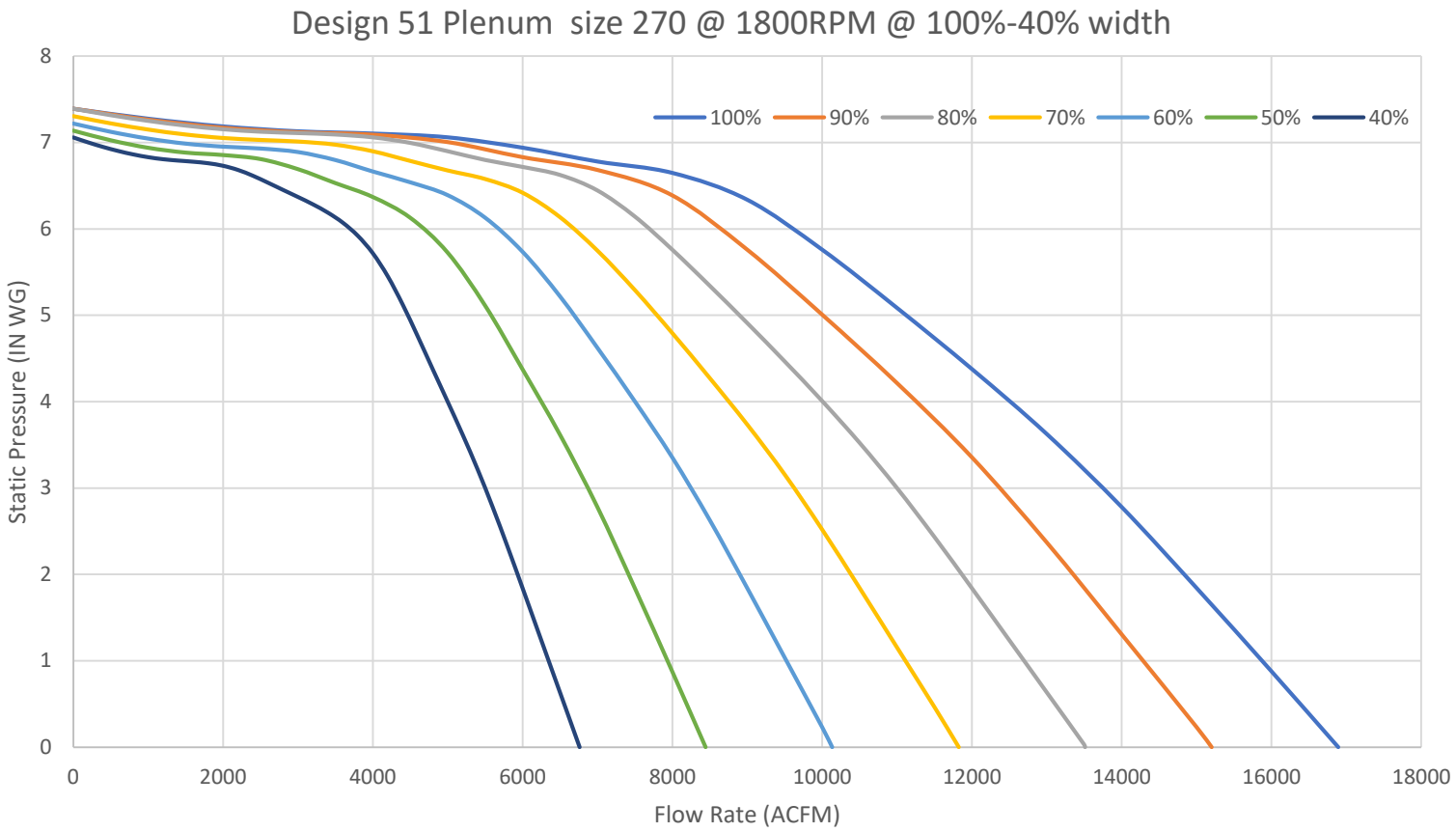
Before selecting your fan, refer to the table above.

Using the table calculate your WOV% based on your flow compared to flow at 0”SP. In our example, a size 165 @ 3600RPM has a WOV of 7496CFM, making our WOV% = 5000/7496 = 66.7%

Using your number of walls, C to D ratio, and WOV on the chart above, you will be provided with factors to add to your performance values before making a selection to account for these affects.

This table can be used for belt drive selections as well. Refer to your local Chicago Blower Representative, or the factory, to learn more.

Percentage Width



The performance tables on the following pages show performance at 100% width. On direct drive fans, fan manufacturers will vary the width on the fan in order to provide selections for fans.

By varying the width of the fan, the fan curve is adjusted and able to achieve points not able to be met with a 100% width fan.

Pictured above is a Design 51 Plenum at varying widths to show how flow and pressure change as the width changes.

This is due to the fan being direct drive and selections being made at motor direct drive speeds.

While available on belt driven fans as well, with the ability to change drive sets to accommodate different speeds it is less common. However, it still allows for the ability to adjust the curve as shown above.

For performances unable to be achieved with a 100% width fan, inquire with your local representative, our FanNet selection software ,or directly with the Chicago Blower factory.

Performance Ratings

3600 RPM

Fan Size	0"SP		2"SP		4"SP		6"SP		8"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
135	3955	2.76	3476	3.23	2941	3.57	2262	3.63		
150	5333	3.97	4738	4.71	4140	5.30	3442	5.65	2537	5.40
165	7496	6.81	6866	7.86	6233	8.75	5546	9.43	4733	9.77
182	10196	12.47	9460	13.81	8769	14.99	8072	15.99	7273	16.66
200	13907	18.10	13139	20.17	12352	22.05	11533	23.68	10656	24.98

Fan Size	10"SP		12"SP		14"SP		16"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
165	3627	9.10						
182	6352	16.84	5202	16.12				
200	10740	25.25	8586	26.38	7286	25.89	2080	15.43

Caution: Fan must not operate left of peak pressure curve, except for start-up

Performance Ratings

1800 RPM

Fan Size	0"SP		1"SP		2"SP		3"SP		4"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
135	1977	0.34	1470	0.45						
150	2666	0.50	2070	0.66	1269	0.67				
165	3748	0.85	3117	1.09	2367	1.22				
182	5098	1.56	4371	1.87	3600	2.08	2541	1.99		
200	6953	2.26	6156	2.75	5287	3.11	4229	3.28	933	1.85

Fan Size	0"SP		2"SP		4"SP		6"SP		8"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
222	9426	3.68	7638	4.91	5328	5.25				
245	13140	6.09	11201	7.80	8859	8.78	2229	5.17		
270	16890	9.40	14830	11.68	12499	13.28	9581	13.68		
300	23406	15.99	21090	19.15	18567	21.66	15568	23.03	11370	21.80
330	31991	27.16	29498	31.21	26738	34.89	23789	37.59	20155	38.69
365	41952	42.14	39246	47.89	36360	53.04	33279	57.29	30013	60.59
402	57961	66.67	54845	75.71	51573	83.64	48142	90.09	44506	95.01

Fan Size	10"SP		12"SP		14"SP		16"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
330	13937	34.34						
365	26073	61.71	19232	55.86				
402	40493	98.51	35962	99.84	30635	97.17		

Caution: Fan must not operate left of peak pressure curve, except for start-up

1200 RPM

Fan Size	0"SP		1"SP		2"SP		3"SP		4"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
135	1318	0.10								
150	1777	0.15								
165	2498	0.25	1431	0.36						
182	3398	0.46	2250	0.62						
200	4635	0.67	3364	0.94						
222	6284	1.09	4925	1.49	3000	1.47				

Fan Size	0"SP		1"SP		2"SP		4"SP		6"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
245	8760	1.80	7291	2.36	5425	2.62				
270	11260	2.78	9711	3.53	7883	4.01				
300	15604	4.74	13858	5.78	11920	6.57	480	2.48		
330	21327	8.05	19449	9.4	17347	10.58	12038	11.3		
365	27968	12.49	25881	14.38	23626	16.01	18528	18.1		
402	38641	19.76	36210	22.73	33651	25.21	28068	28.57	20896	28.72

Caution: Fan must not operate left of peak pressure curve, except for start-up

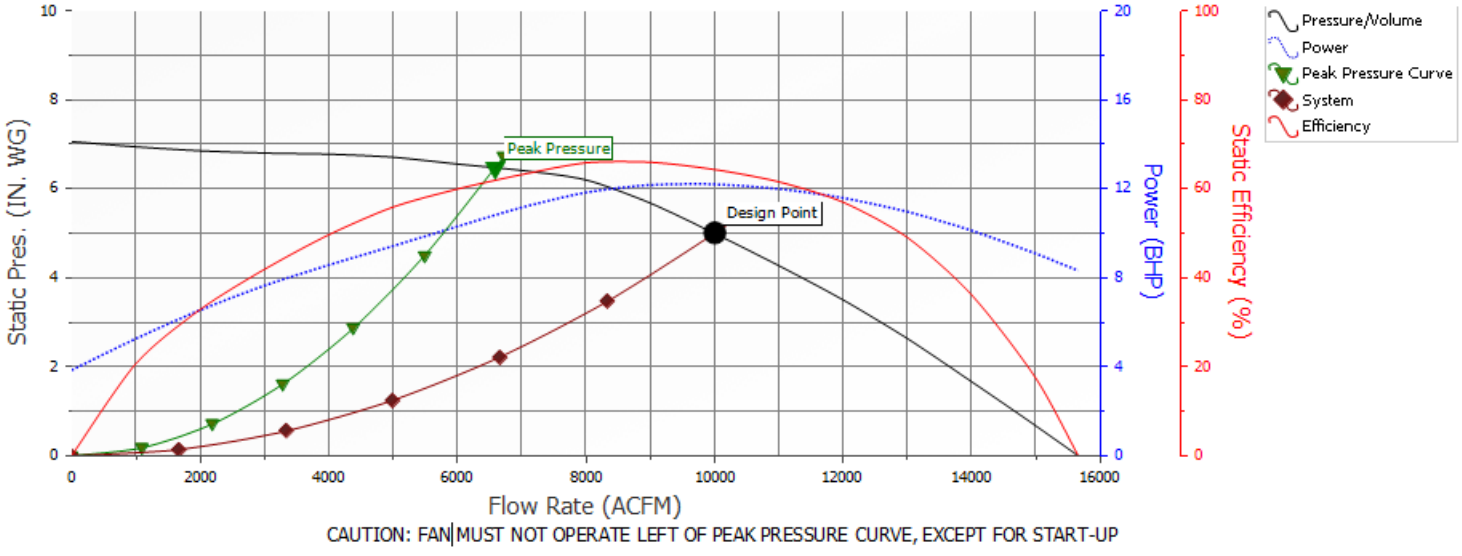
1200 RPM Cont'd

Fan Size	0"SP		2"SP		4"SP		6"SP		8"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
445	51350	32.15	45672	39.62	39421	45.37	31605	47.81	13061	35.23
490	69290	52.98	63057	63.25	56378	71.65	48819	77.85	39017	77.63
542	92618	85.93	85813	100.00	78571	111.72	70801	121.58	61717	127.52
600	125436	142.45	118136	161.67	110540	178.98	102456	193.71	93723	206.19

Fan Size	10"SP		12"SP		14"SP		16"SP		18"SP	
	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
445										
490	30310	82.49								
542	62885	131.42	14006	71.977	1049	43.271				
600	93723	206.19	71207	210.52	45558	185.54	7310	87.01		

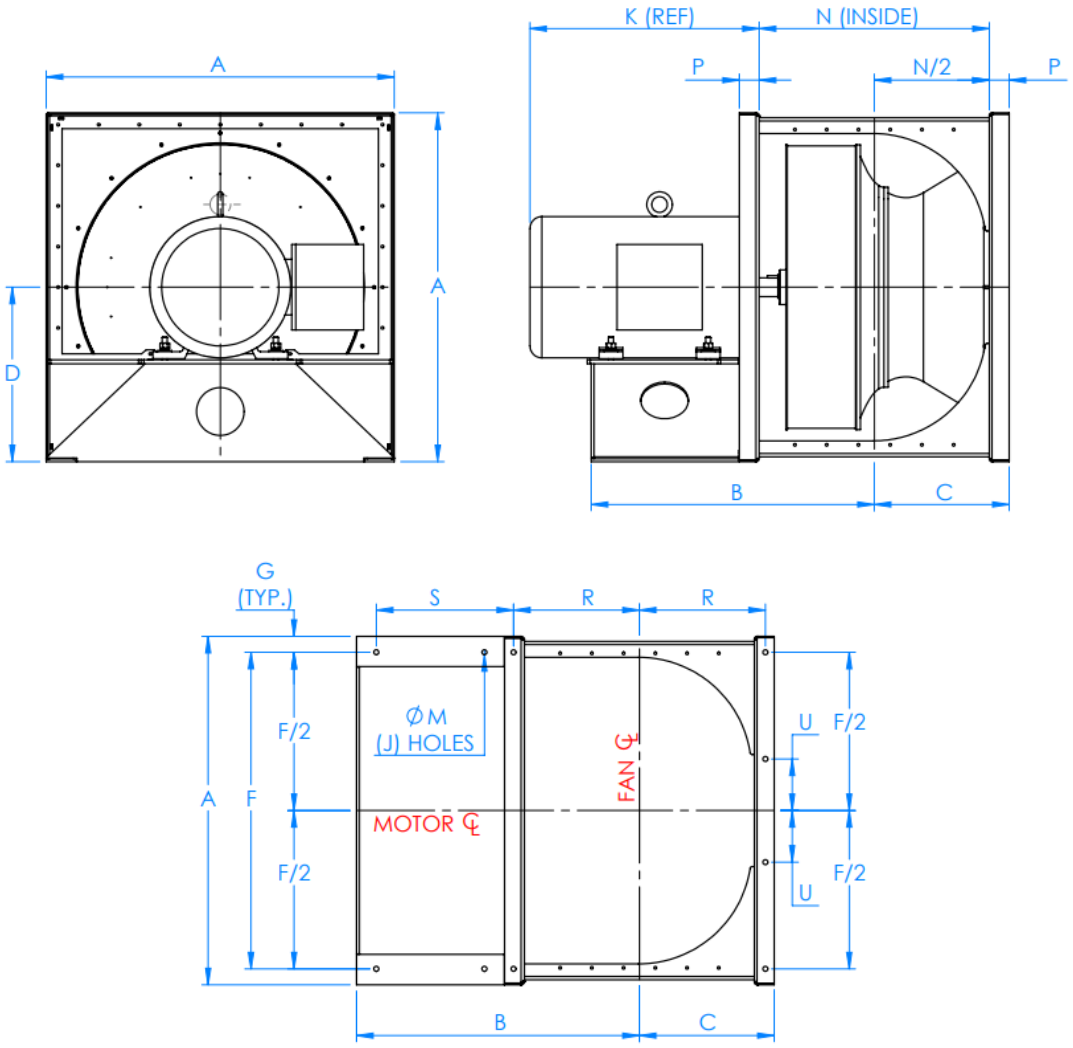
Caution: Fan must not operate left of peak pressure curve, except for start-up

Performance Curve



*Performance Curve depicts Design 51 Plenum fan size 270 at 100% width

Dimensions



FOUNDATION PLAN

SIZE	MAX. MOTOR FRAME	A	D	F	F/2	N	N/2	P	B	C	R	S	T	M	J	G	U	K
SIZE 135	184T	20 3/8	10 3/16	18 3/8	9 3/16	10 7/8	5 7/16	2	15 11/16	7 7/16	6 9/16	6 3/8	NA	1/2	4	1	5	12 7/8
SIZE 150	215T	21 3/4	10 7/8	19 3/4	9 7/8	12	6	2	19 9/16	8	7 1/8	9 11/16	NA	1/2	4	1	5	7 5/16
SIZE 165	256T	23 3/8	11 11/16	21 3/8	10 11/16	13 5/16	6 21/32	2	24	8 11/16	7 13/16	13 1/2	NA	1/2	4	1	5	22 5/16
SIZE 182	256T	25 3/8	12 11/16	23 3/8	11 11/16	14 5/8	7 5/16	2	24 11/16	9 5/16	8 7/16	13 1/2	NA	1/2	4	1	5	22 3/16
SIZE 200	326T	27 1/4	13 5/8	25 1/4	12 5/8	16 1/8	8 1/16	2	28 7/16	10 1/16	9 3/16	16 1/2	NA	1/2	4	1	5	27 1/4
SIZE 222	326T	29 1/4	14 5/8	27 1/4	13 5/8	17 5/8	8 13/16	2	29 1/4	10 13/16	9 15/16	16 9/16	NA	1/2	4	1	5	26 15/16
SIZE 245	326T	31 1/2	15 3/4	29 1/2	14 3/4	19 5/8	9 13/16	2	30 1/4	11 13/16	10 15/16	16 9/16	NA	1/2	4	1	5	26 15/16
SIZE 270	326T	34	17	32	16	21 7/16	10 23/32	2	30 1/8	12 3/4	11 7/8	16 9/16	NA	1/2	4	1	5	27
SIZE 300	326T	37 1/8	18 9/16	33 1/8	16 9/16	23 3/4	11 7/8	2 1/2	32 5/16	14 3/8	13 1/4	16 5/16	NA	5/8	4	2	5 1/2	27
SIZE 330	405T	40 1/2	20 1/4	36 1/2	18 1/4	26 3/8	13 3/16	2 1/2	36 7/8	15 11/16	14 9/16	19 9/16	9 3/4	5/8	6	2	6	34 3/4
SIZE 365	405T	43 7/8	21 15/16	39 7/8	19 15/16	29	14 1/2	2 1/2	38 3/16	17	15 7/8	19 9/16	9 13/16	5/8	6	2	6 1/2	34 13/16
SIZE 402	405T	51 1/4	25 5/8	46	23	32	16	3	39 11/16	19	17 3/4	19 3/16	9 9/16	3/4	6	2 5/8	7 1/2	34 13/16
SIZE 445	445T	54 3/4	27 3/8	48	24	35 1/4	17 5/8	3	45 1/8	20 5/8	19 3/8	23	11 1/2	3/4	6	3 3/8	8	40 15/16
SIZE 490	449T	59 1/2	29 3/4	52 1/2	26 1/4	38 15/16	19 15/32	3	56 1/2	22 1/2	21 1/4	32 1/2	16 1/4	3/4	6	3 1/2	8 3/4	46 15/16
SIZE 542	449T	64 1/4	32 1/8	58	29	42 7/8	21 7/16	4	58 7/16	25 7/16	23 15/16	31 3/4	15 7/8	3/4	6	3 1/8	10	46 7/8

GENERAL: Provide a high performance, low maintenance, centrifugal fan with airfoil wheel and hyperbolic wheel cone. Fan shall be tested according to AMCA Standard 210 for air performance, and AMCA Standard 300 for sound performance. Fans must be manufactured and assembled in the U.S.A. Fans must bear the AMCA seal for air and sound performance. Acceptable vendors: Chicago Blower Corporation.

PERFORMANCE: Performance shall include steep pressure and non-overloading horsepower characteristics. Mechanical efficiency shall be no less than 80%. Wheel inlet cone to be designed to ensure smooth, stable air flow across the entire operating range. System static pressure changes of 30% shall result in no more than 10% volume change.

FRAME STRUCTURE: Heavy gauge, laser cut inlet, side and drive panels shall be welded together with housing support angles. Integral motor pedestal welded to drive panel.

ROTOR: Wheel shall have cast iron hub lock-bolted to a heavy backplate. A minimum of eight blades must be double-skinned airfoil continuously welded to the backplate and hyperbolic wheel cone. Wheels to be dynamically balanced to G 6.3 standards in accordance with ISO 1940/ANSI S2.19 specifications.

MOUNTING: Housing assembly complete with integral mounting angles and motor pedestal for connection to the foundation.

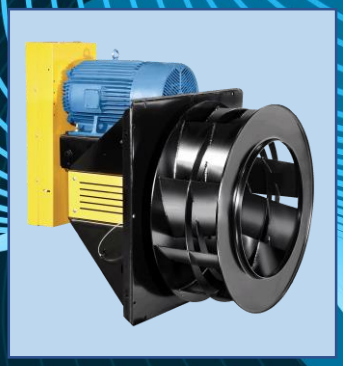
FACTORY MOUNTED MOTORS: Motors to be factory mounted. Unit to be tested at running speed for vibration and balance. Filtered vibration readings not to exceed .15 inches per second over the entire frequency spectrum.

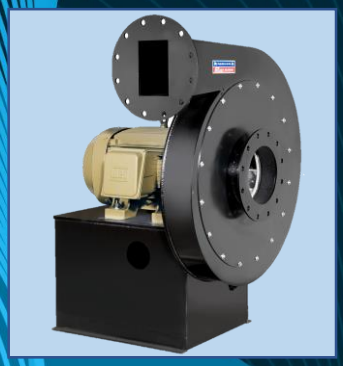
INLET VOLUME CONTROL: (As Required) Inlet volume control (IVC) device shall be totally enclosed within the inlet cone. IVC device shall be 7-bladed, and pre-spin the incoming air to control volume and pressure. Operation of IVC shall be smooth without fluttering of blades. Performance control shall be repeatable and consistent without slip or hunting for required duty.

ACCESSORIES:
Slip fit inlet
Flanged Inlet
Inlet Screen
Wheel Guard
Vibration Isolators – Spring or Rubber-In-Shear
Piezometer Ring
Inlet Volume Control Damper

Chicago Blower Fans are also manufactured worldwide:

Argentina
Australia
Brazil
Chile
China
Estonia
Germany
India
Indonesia
Israel
Malaysia
Netherlands
New Zealand
Norway
Singapore
South Africa
South Korea
Spain
Sweden
Thailand
Taiwan
Venezuela





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