



THE NEW YORK BLOWER COMPANY
7660 Quincy Street
Willowbrook, IL 60527-5530

Visit us on the Web: <http://www.nyb.com>
Phone: (800) 208-7918 Email: nyb@nyb.com

ENGINEERING SUPPLEMENT

ES-863

June 2007

SPECIAL-DIAMETER AND SPECIAL-WIDTH SERIES 20, 30 AND 45 GI FANS

When selecting a direct-drive fan, the required performance may be different from that produced by a fan with a standard wheel at the standard motor RPM. In order to broaden the available performance range, special-diameter and special-width wheels are available:

GI Fans with DH Wheels - Sizes 194 through 854 are available with special wheel diameter.

GI Fans with LS and RIM Wheels - Sizes 194 through 854 are available with special wheel width and diameter.

SPECIAL-DIAMETER GI FANS with DH WHEELS . . . broaden the available performance range by holding CFM constant and varying SP, to 65% of full-diameter SP, at a given motor speed. Special diameter is limited to 88% (12% reduction).

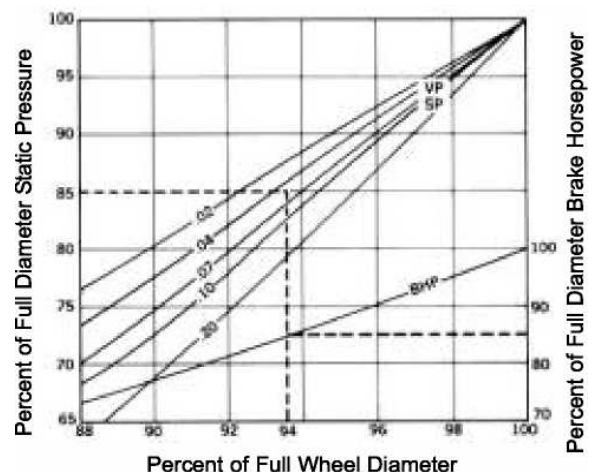
Fan performance with special-diameter DH wheels can be determined as follows:	Steps	Example: A fan is required to handle 26,092 CFM @ 22" SP.
Select a fan based on the desired CFM and a static pressure equal to or greater than the desired static pressure at the required motor speed. Note the full-diameter static pressure, brake horsepower and outlet velocity (OV).	1	A size 574 Series 30 GI Fans with DH wheel gives 26,092 CFM, 26" SP, 152 BHP at 1175 RPM. OV is 4400 FPM.
Based on the outlet velocity shown for the desired CFM, determine the velocity pressure from Chart 1.	2	At 4400 FPM, the VP is 1.21".
Divide the velocity pressure from Step 2 by the desired static pressure to determine the VP/SP factor.	3	VP divided by desired SP = 1.21/22 = .055 VP/SP factor.
Divide the desired static pressure by the full-diameter static pressure determined in Step 1.	4	Desired SP divided by full-diameter SP: 22/26 = 85% of full-diameter SP.
Using Chart 2, read horizontally from the percent of full-diameter static pressure as calculated in Step 4 to the point of intersection with the curve representing the VP/SP factor determined in Step 3. Read downward to determine the percent of full diameter. From the point of intersection of the vertical drop and the BHP curve, read horizontally to the right to determine the percent of full-diameter BHP.	5	Reading horizontally from 85% of full-diameter SP to the .055 VP/SP curve and reading downward to the percent of full diameter, the required wheel diameter is 93.5%. Reading horizontally from the point of intersection with the BHP curve, the BHP is 85% of the full-diameter BHP.
The desired wheel diameter is expressed in percent of full diameter. The required BHP is calculated by multiplying the full-diameter BHP by the percentage determined in Step 5.	6	The desired wheel diameter is 93.5% of the full diameter. The correct BHP for the special-diameter wheel is 85% of the full-diameter BHP or 0.85 x 152 = 129 BHP.

The 574 Series 30 GI Fans with 93.5% diameter DH wheel is selected for 26,092 CFM, 22" SP, 1175 RPM, 129 BHP.

CHART 1
Velocity Pressures vs. Outlet Velocities Based on Standard Air

Velocity in FPM	Velocity Pressure in Inches Water	Velocity in FPM	Velocity Pressure in Inches Water
1000	.062	3600	.808
1200	.090	3800	.900
1400	.122	4000	1.00
1600	.160	4200	1.10
1800	.202	4400	1.21
2000	.249	4800	1.44
2200	.302	5200	1.69
2400	.359	5600	1.96
2600	.422	6000	2.24
2800	.489	6400	2.55
3000	.561	6800	2.88
3200	.638	7200	3.23
3400	.721	7600	3.60

CHART 2



SPECIAL-DIAMETER CONSTRUCTION FOR GI FANS WITH LS AND RIM WHEELS

Special-diameter LS and RIM wheels in direct-drive fans offer the advantage of maintaining a constant CFM and varying SP at a given motor speed.

Fan performance with special-diameter LS and RIM wheels can be determined as follows:

1. Select a fan that will deliver the desired performance at a belted-fan speed that is within 90% to 105% of the desired direct-drive speed.
2.
$$\text{Standard wheel diameter} \times \frac{\text{Belted RPM}}{\text{Direct Drive RPM}} = \text{New Wheel Diameter}$$
3. Brake horsepower will be the same as selected in Step 1.

Note: If the new wheel diameter is larger than standard and the direct-drive speed is higher than 95% of the maximum safe speed shown for the standard wheel, check the application with the Marketing Department.

Larger-than-standard-diameter wheels may require split-housing construction to allow wheel installation and removal.

EXAMPLE 1 - Smaller-Than-Standard-Diameter Wheel

A fan is required to handle 5910 CFM at 16" SP at 70°F.

1. A334 Series 20 GI Fan with LS wheel delivers 5910 CFM at 16" SP at 70°F., 1644 RPM and 25.2 BHP (1644 RPM is 92.9% of a 1770 RPM motor).
2.
$$33" \text{ standard wheel diameter} \times \frac{1644}{1770} = 30.7" \text{ diameter.}$$
3. Select a 334 Arrangement 8 Series 20 GI Fan with special 30.7" diameter LS wheel direct connected to a 1770 RPM motor to deliver 5910 CFM at 16" SP, 25.2 BHP.

EXAMPLE 2 - Larger-Than-Standard-Diameter Wheel

A fan is required to handle 29,650 CFM at 26" SP at 70°F.

1. A574 Series 30 GI Fan with RIM wheel delivers 29,650 CFM at 26" SP at 70°F., 1203 RPM, and 189 BHP (1203 RPM is 102.4% of an 1175 RPM motor).
2.
$$57\frac{1}{2}" \text{ standard wheel diameter} \times \frac{1203}{1175} = 58.9" \text{ diameter.}$$
3. The maximum safe speed of a Size ~~574~~ ⁵⁷⁴ Series 30 GI Fan with RIM wheel is 1325 RPM. $1175 \div 1325 = 88.7\%$. Thus, the direct-drive speed is less than 95% of the maximum safe speed, making this a valid larger-than-standard-diameter fan selection.
4. Select a 574 Arrangement 8 Series 30 GI Fan with special 58.9" diameter RIM wheel direct-connected to an 1175 RPM motor to deliver 29,650 CFM at 26" SP, 189 BHP. The application should be checked by the Willowbrook office to determine if a split housing is necessary to install and remove the fan wheel.

NARROW-WIDTH CONSTRUCTION FOR GI FANS WITH LS AND RIM WHEELS

In order to broaden the available performance range of direct-drive Arrangement 8 Fans, special-width LS/RIM wheel construction is offered in Sizes 194 through 854. Special-width construction on direct-drive fans provides a change of CFM for a constant SP at given motor speeds. Narrow-width construction is limited to 30% (70% reduction). Housing widths are narrowed by the reduction in wheel-blade width in all cases.

Fan performance with narrow-width wheel construction can be determined as follows:	Steps	Example:
Select a fan based on the required SP and RPM (motor speed) with CFM equal to or greater than the required CFM.	1	A fan is required to handle 7112 CFM @ 18" SP. A 334 Series 20 GI Fan with LS wheel is selected for 7112 CFM at 18" SP to be direct-connected to a 1770 RPM motor.
Determine full-width CFM, OV and BHP at the desired RPM and SP from the capacity tables.	2	The 334 Series 20 GI Fan with LS wheel will deliver 7486 CFM at 3800 OV at 35.7 BHP at 18" SP at 1771 RPM.
Divide the desired CFM by the full-width CFM found in Step 2 to determine a performance factor.	3	The performance factor = $7112/486 = 0.95$.
The full-width BHP will be reduced by the performance factor calculated in Step 3.	4	The new BHP = $35.7 \times 0.95 = 33.9$ BHP.
Based on the outlet velocity found in Step 2, refer to Chart 1 to determine BP (velocity pressure). Divide BP by the required SP to determine VP/SP.	5	For 3800 OV, the BP is 0.90. At 18" SP, $VP/SP = 0.90 \div 18 = 0.05$.
From Chart 4, determine the required blade-width percentage by establishing the point of intersection between the performance factor from Step 3 and the BP/SP from Step 5 . . . interpolate if necessary.	6	From Chart 4, the blade-width percentage = 91%.
The effective-blade width must be reduced to the percentage found in Step 6, and the housing must be reduced by the same number of inches as the effective-blade width ...refer to Chart 3.	7	Effective blade width = $133/8" \times 0.91 = 121/8"$. Housing-width reduction = $133/8" - 121/8" = 11/4"$. New housing-width = $155/8" - 11/4" = 143/8"$.
A new outlet velocity must be determined: New outlet area equals new housing width divided by full housing width times outlet area shown in Chart 3.	8	To determine the new outlet velocity: A. New outlet area = $(143/8 \div 155/8) \times 1.97 = 1.81$ sq. ft. B. New OV = $7112 \text{ CFM} \div 1.81 = 3929$ FPM.

NOTE: The order write-up should indicate performance and percent width only.

CHART 3
Full Width Dimensions

Size	Blade Width (inches)		Housing "M" Dimension (inches)	Outlet Area (Square Feet)		
	Series 20	Series 30 & 45*		Series 20	Series 30	Series 45
144	65/8	NA	77/8	0.45	NA	NA
174	8	NA	91/2	0.67	NA	NA
194	81/4	81/4	93/4	0.69	0.64	0.64
224	93/16	93/16	103/4	0.93	0.91	0.91
264	109/16	109/16	123/8	1.24	1.21	1.21
294	12	12	14	1.59	1.56	1.54
334	133/8	133/8	155/8	1.97	1.95	1.92
364	1413/16	1413/16	171/4	2.41	2.39	2.35
404	16	151/2	19	2.90	2.90	2.86
454	18	171/2	213/8	3.69	3.69	3.64
504	201/16	199/16	237/8	4.62	4.57	4.57
574	223/4	221/4	271/8	5.99	5.93	5.93
644	257/16	2415/16	301/2	7.51	7.48	7.48
714	281/8	275/8	335/8	9.20	9.17	9.17
784	3011/16	303/16	367/8	11.1	11.06	11.06
854	331/2	33	401/8	13.17	13.13	13.13

* Blade width dimensions are for LS in Sizes 194 through 364 and RIM in Sizes 404 through 854.

NA - Not Available

**CHART 4
Percent-Width Factors For GI Wheels**

LS Wheel

VP/ SP	Performance Factors															Blade Width %
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Up to .03	*	*	*	*	75	75	76	77	78	79	81	83	86	91	100	Blade Width %
0.06	47	48	49	51	54	57	61	66	72	77	80	83	86	91	100	
0.08	41	42	44	47	51	55	60	66	71	76	80	83	87	92	100	
0.1	34	36	39	43	48	53	58	64	70	75	80	83	87	92	100	
0.15	--	32	36	40	44	48	53	59	66	72	77	80	85	92	100	
0.25	--	--	32	37	42	47	52	57	62	67	73	79	85	92	100	
.40 & Over	--	--	31	36	40	45	50	55	60	65	71	77	83	91	100	

RIM Wheel

VP/ SP	Performance Factors															Blade Width %
	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Up to .03	*	*	*	*	75	75	75	76	77	78	80	83	86	91	100	Blade Width %
0.06	34	36	39	42	46	52	59	65	70	75	78	81	84	91	100	
0.08	31	35	38	41	45	49	53	58	64	71	77	81	85	92	100	
0.1	30	33	37	40	44	48	52	57	62	68	75	80	85	92	100	
0.15	--	32	36	40	44	48	52	57	62	68	73	79	86	93	100	
0.25	--	30	33	38	42	47	51	56	61	67	73	79	86	93	100	
.40 & Over	--	--	30	35	40	45	50	55	61	67	73	79	86	93	100	

* At VP/SP less than .06, SP decreases with width . . . therefore, narrow-width construction is not recommended.

Form 607 GAW