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ENGINEERING SUPPLEMENT
ES-679
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TECHNICAL DATA FOR VANEAXIAL ADJUSTABLE PITCH FANS

This document provides supplementary data concerning Vaneaxial Adjustable Pitch (VXAP) Fan design, construction, and performance.
A practical discussion of typical applications is included herein. In addition, procedures for selection are outlined in detail.

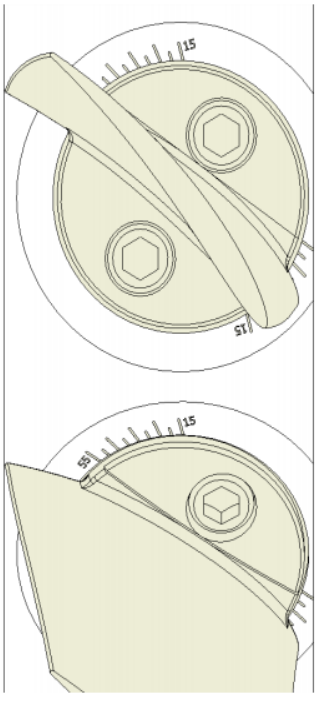
I. Design Features

The VXAP Fan is a direct drive axial fan designed for volumes up to 120,000 CFM and static pressures up to 20" W.G. Typical applications in this high-pressure range include:

1. High-pressure industrial process systems such as combustion air (flare systems), ventilation, spray booths, pulp & paper and power.
2. Applications requiring field adjustment of flow/pressure to fine-tune process requirements.

The VXAP is custom tailored for each specific application. This means that the motor requirements, vane size, and tube length may vary with each fan selection. Therefore, each fan and motor combination is designed for each specific application.

The VXAP wheel's adjustable blade angle (15°-55°) allows the fans performance to be manually adjusted in the field at rest to accommodate changes in process requirements without the need for an adjustable speed drive.



Blade shown at 55°

Blade Hardware Torques

Size	Torque [lbf-ft]
21	29
24	29
27	67
29	135
32	135
36	135
38	135
42	135
48	236
54	236
60	570

Adjustments to blade angle may be limited to existing motor HP capability. In addition, due to the motor located directly in the gas stream, the VXAP is intended to be typically used in clean air applications

II. Performance

The typical performance range of the Series VXAP Fan involves consideration of a number of factors. Major considerations should be recognized and include temperature, altitude and point of operation on the fan curve. In addition, resistance from various accessories must also be factored into the fan selection due to high gas stream velocities.

The performance curves (see pages 3 through 13) give fan performance based on air at 70°F. at sea level at a density of .075 lb./cu.ft. If the airstream density is other than .075 lb/cu.ft., corrections must be made to static pressure and brake horsepower. (See charts I & II)

Fan-to-Size Online (F2S-O) at www.nyb.com/online-fan-selection-software/ should be used to generate fan performance curves which can be corrected for blade angle, motor speed, non-standard gas stream conditions as well as corrections resulting from the addition of fan accessories. Fan-to-Size online is also capable of determining sound performance for your selection.

III. Density Corrections

Calculating Fans at Temperatures other than 70°F. Chart I gives factors for correcting pressure and brake horsepower for temperatures other than 70°F.

EXAMPLE:

1. Require 10,000 CFM at 15"SP at -25°F. at sea level.
2. Chart I indicates s 0.82 factor for -25°F.
3. Select the fan for 12.3" SP [15" x 0.82] at 70°F.
4. Divide 70°F. brake horsepower by 0.82 to determine BHP at conditions.

CHART I
SP AND BHP CORRECTION FACTORS FOR TEMPERATURE [°F.]

Temperature	Factor
-25°	.82
0°	.87
20°	.91
40°	.94
60°	.98
70°	1.00
80°	1.02
105°	1.06

Calculating Fans at Altitude other than Sea Level Correction for altitudes is the same as for temperature except using the factors in Chart II.

EXAMPLE:

1. Require 10,000 CFM at 15" SP at 5000 feet above sea level.
2. Chart II indicates a 1.20 factor for 5000 feet above sea level.
3. Select the fan for 18" SP [15" x 1.20] at 70° F. and sea level.
4. Divide the sea level brake horsepower by 1.20 to determine BHP at conditions.

CHART II
SP AND BHP CORRECTION FACTORS FOR ALTITUDE [FEET]

Altitude	Factor	Altitude	Factor
0	1.00	5000	1.20
500	1.02	5500	1.22
1000	1.04	6000	1.25
1500	1.06	6500	1.27
2000	1.08	7000	1.30
2500	1.10	7500	1.32
3000	1.12	8000	1.35
3500	1.14	9000	1.40
4000	1.16	10000	1.45
4500	1.18		

Handling Gases Other than Air
Whenever the fan airstream is made up of gases other than standard air, the density of the airstream must be determined for accurate fan selection. Engineering handbook reference is frequently required to calculate the densities in such applications. Consult your **nyb** representative for assistance.

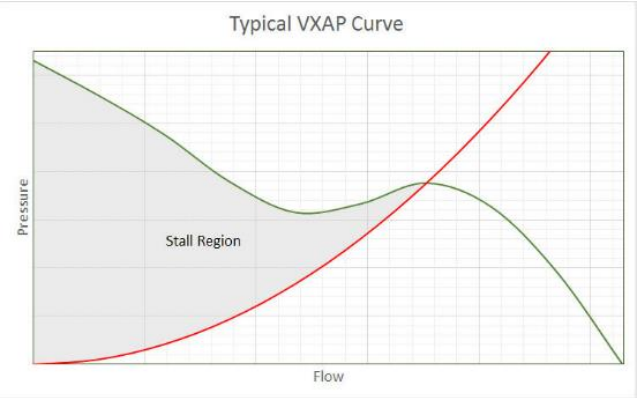
IV. Accessory Pressure Drop

The capacity curves for VXAP Fans reflect performances at standard conditions without accessories. Resistance is added to a system by the addition of an inlet silencer, external inlet vane damper, inlet guard, outlet silencer and outlet guard. Each of these accessories changes the static pressure requirement for the fan and the corrected SP must be determined in order to make a proper selection.

Consult Fan-to-Size Online (F2S-0) at http://www.nyb.com/online-fan-selection-software/ for performance corrections resulting from the addition of fan accessories

V. VXAP Selection

Care must be taken to not select an axial fan at an unstable operating point (stall region). The stall region is characterized as an area of extreme instability to the left of the "hump" in the middle of the curve.



The curves included in this supplement have been cropped to avoid unintentional selection in this region.

VI. Motor Requirements

VXAP fans are designed to be used with the following motors:

• C-Face PAD mount TEAO designed motors from 182TC to 365TSC frame size (certain frame sizes may require the front PADS to be machined).

• C-Face Footed with front feet (shaft side) removed from 404TC to 449TC frame size.

Note that for Size 42 and 54 VXAP fans with 254/256 frame motors require a shaft extension for proper hub engagement.

Standard C-Face motors can be substituted for PAD mount motors as long as the motor cooling fins and front feet do not interfere with the ID of the motor support band. If so, these components will need to be removed.

D-face motors and IEC flange mounted motors need to be reviewed per application since the flange diameter may affect the size of the band that connects the motor support structure to the vanes (see Chart IV).

Motor thrust loads are orientation dependent and need to be reviewed to ensure that the motors maximum permissible thrust load capability is not exceeded in Chart IV. Note that when reviewing vertical installations, the weight of the wheel must be added to upblast VXAP fans and deducted to downblast VXAP fans. Consult nyb when thrust loads are exceeded for additional motor modifications.

Motor conduit boxes are removed and the electrical leads are extended outside the fan to an external

junction box for all motors with the exception of those with except explosion proof requirements. For explosion proof motors or motors requiring the conduit boxes inside the gas stream, the fans overall performance needs to be derated accordingly to accommodate the airstream obstruction (consult nyb).

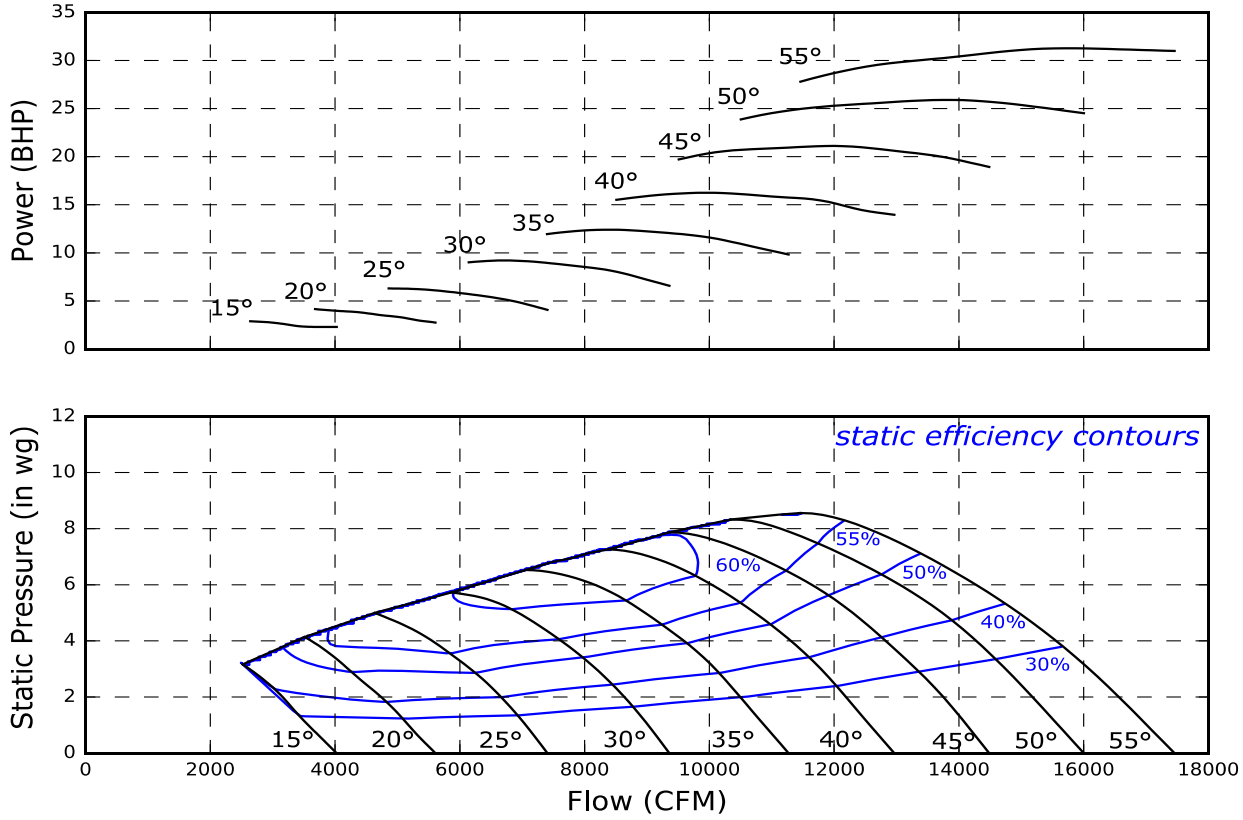
In additional to identifying maximum permissible thrust loads, Chart IV (pg.17) identifies maximum motor diameter and minimum motor shaft lengths for each NEMA motor frame size. To avoid potential interference issues, 3D motor drawings are required for all motors not supplied by nyb.

VII. Performance Curves

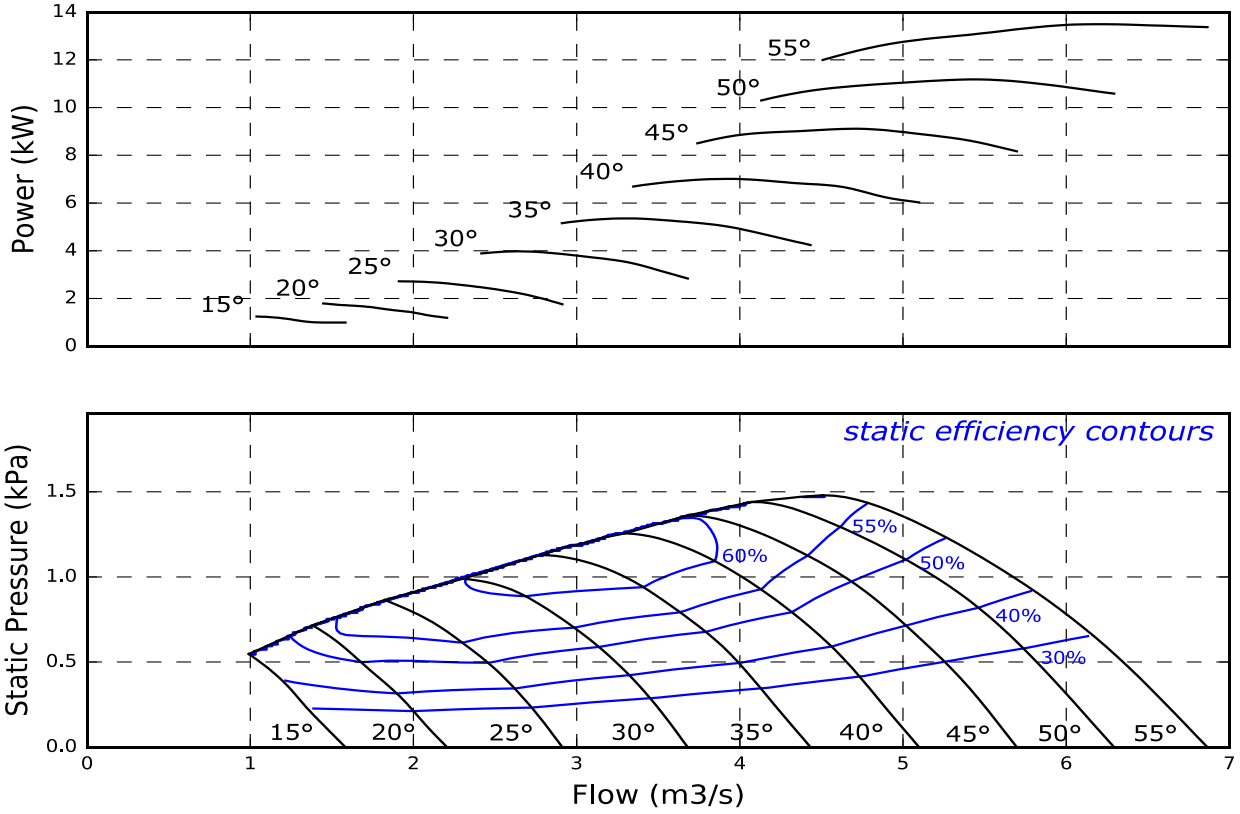
Note that all performance curves listed on the following pages are for installation Type B: Free inlet, ducted outlet at standard conditions (0.075 lbs/ft^3). Performance ratings do not include the effects of appurtenances (accessories).

NOTES

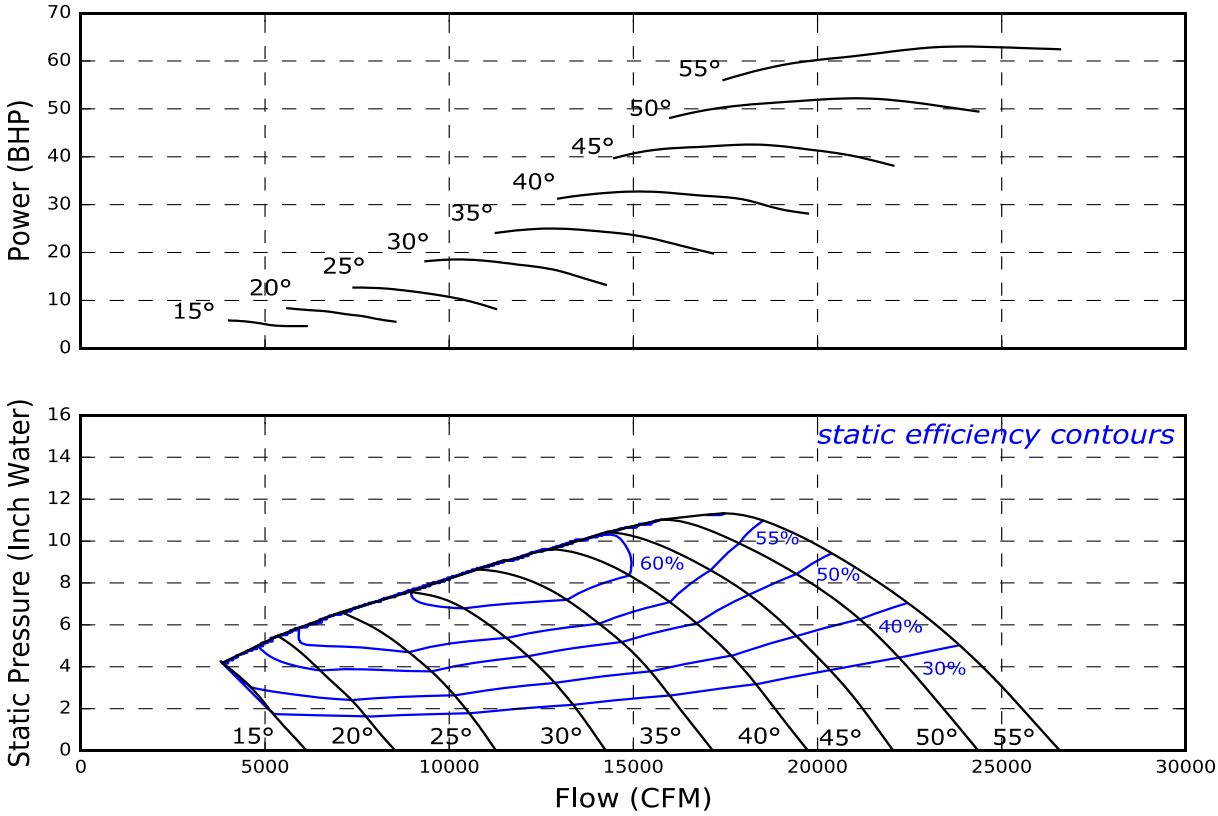
Size 21 3600 RPM



Size 21 3000 RPM



Size 24 3600 RPM



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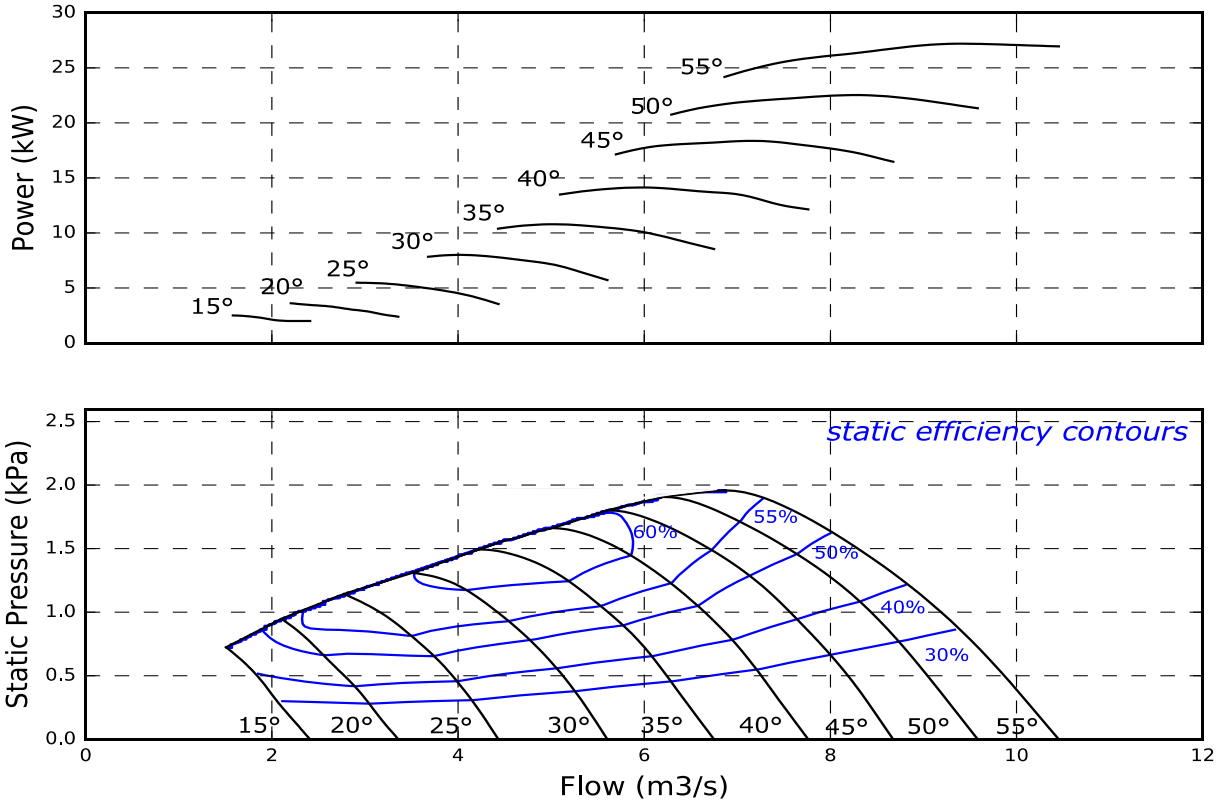
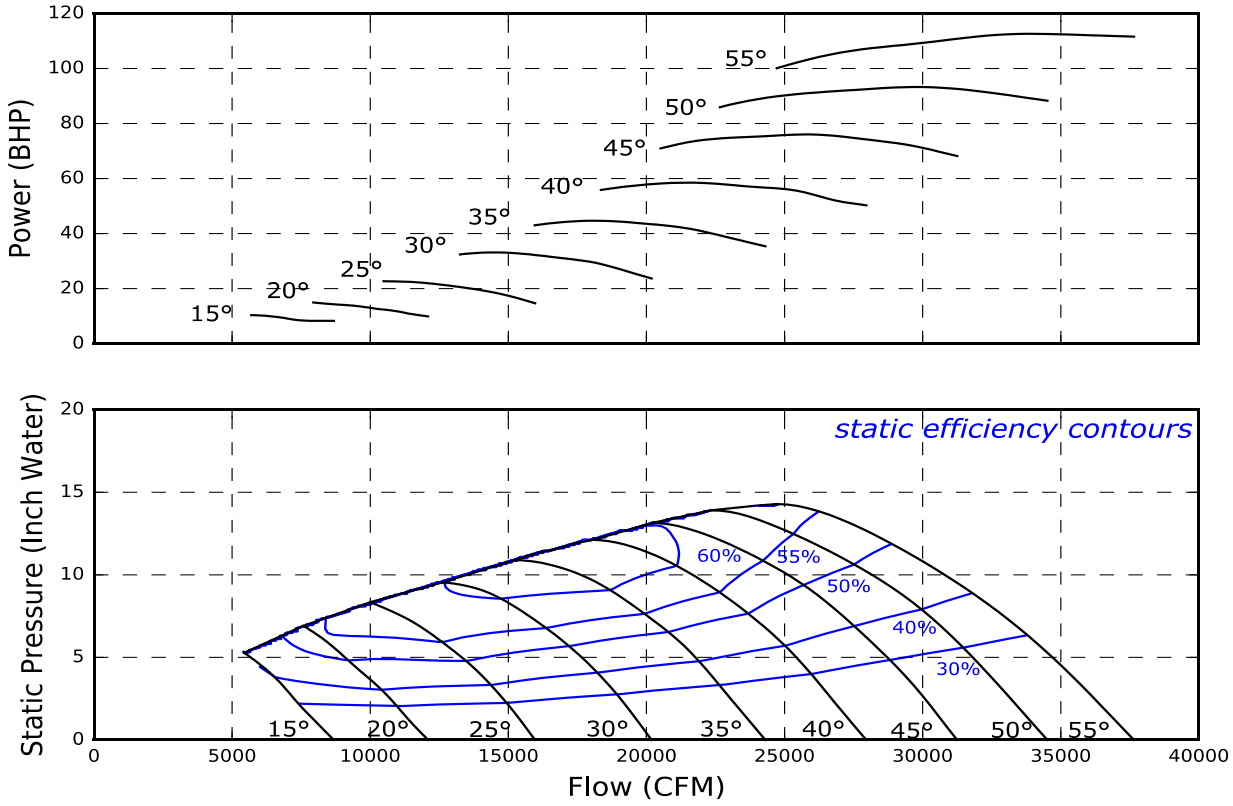


Size 27 3600 RPM



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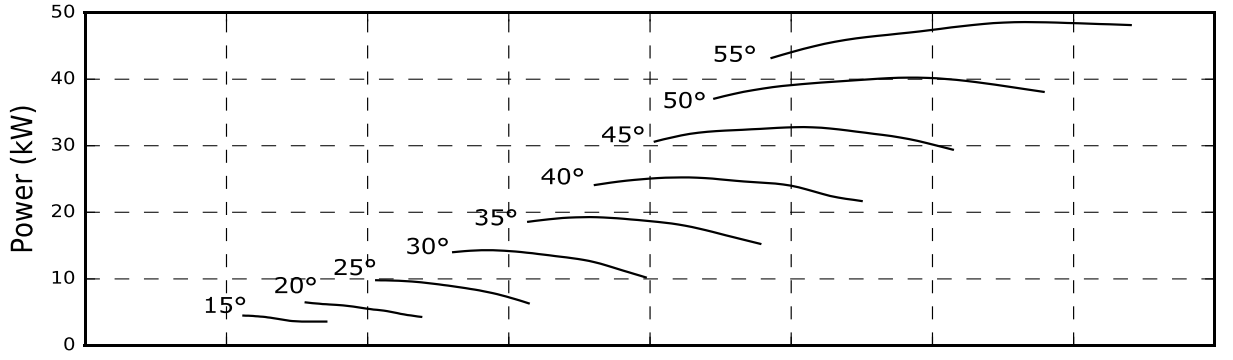

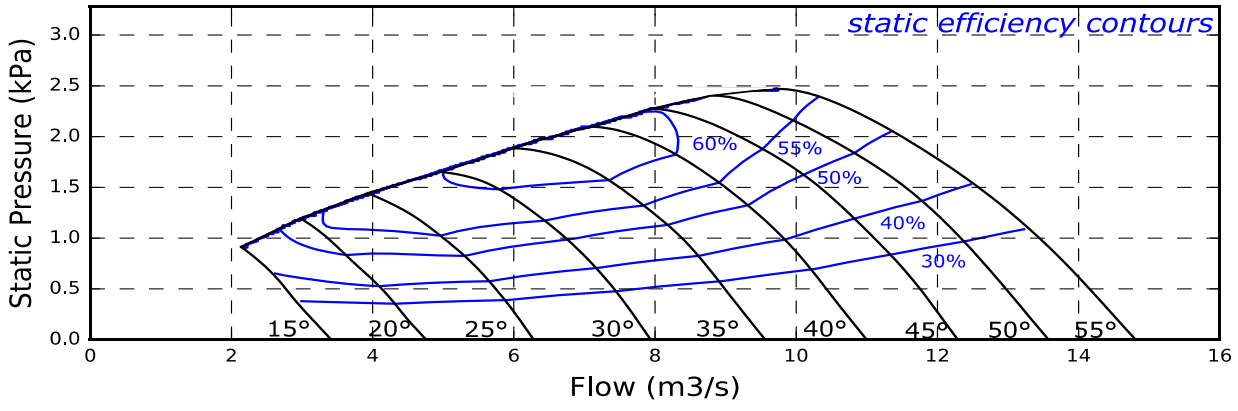

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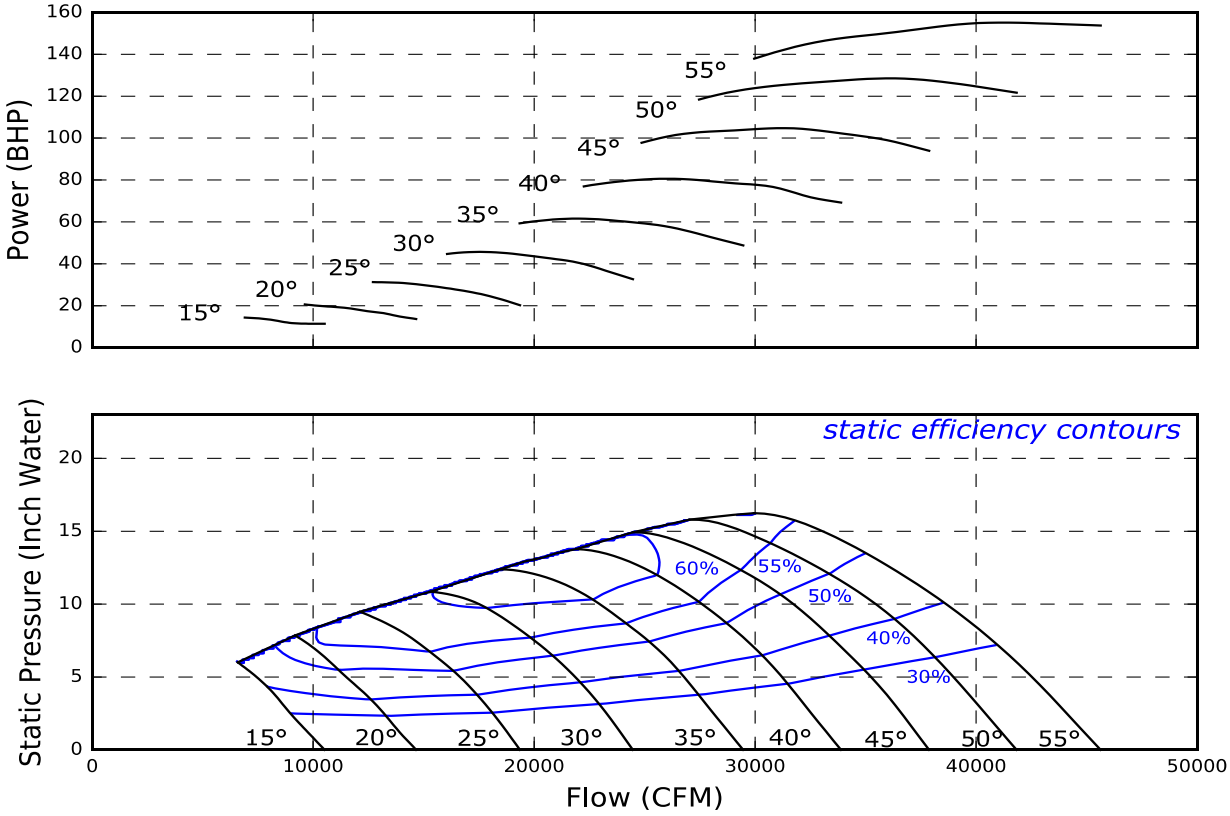

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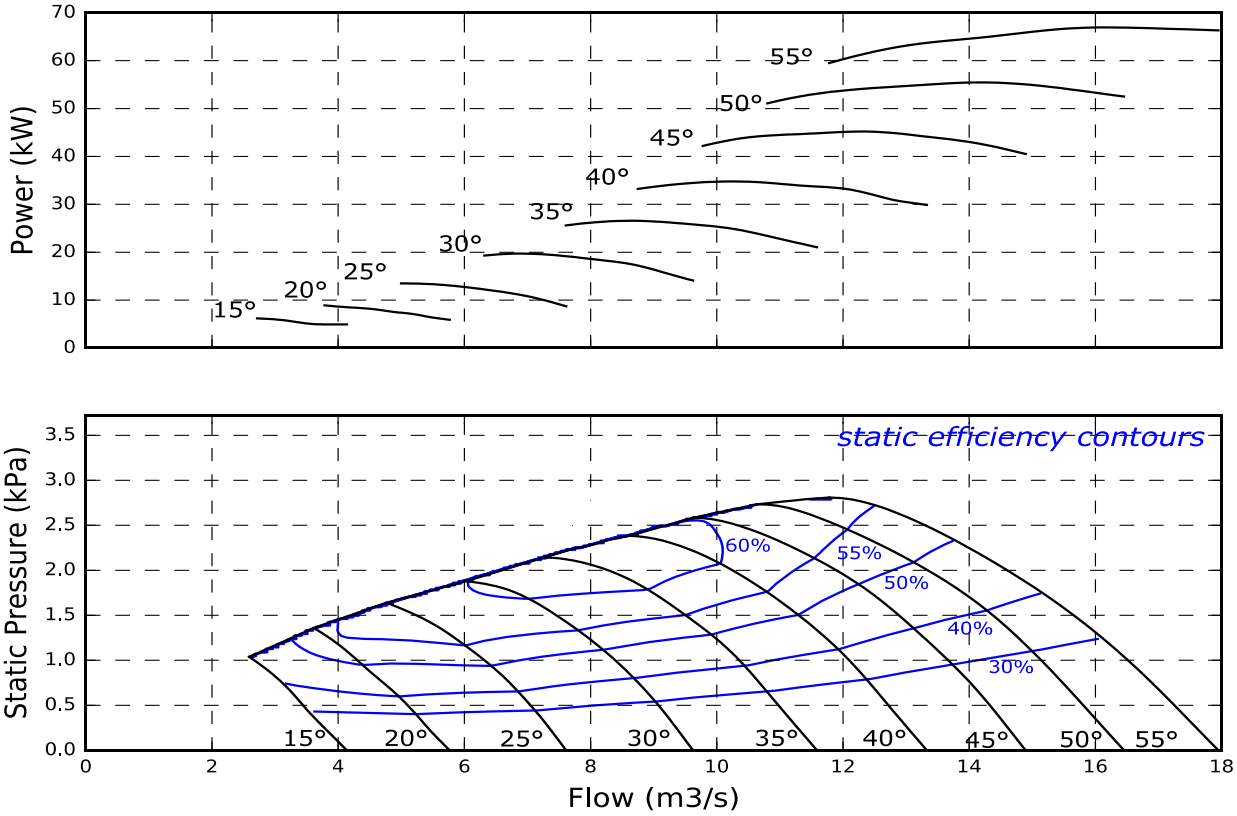

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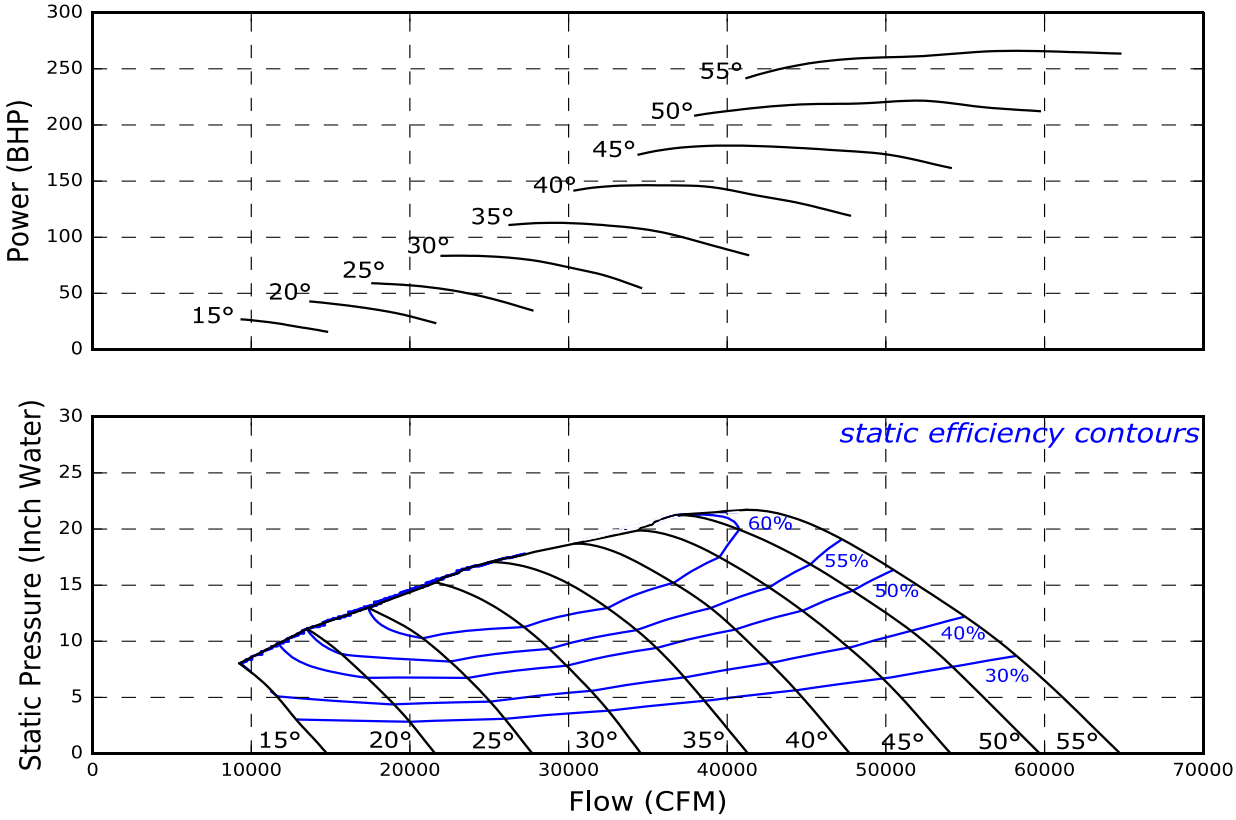

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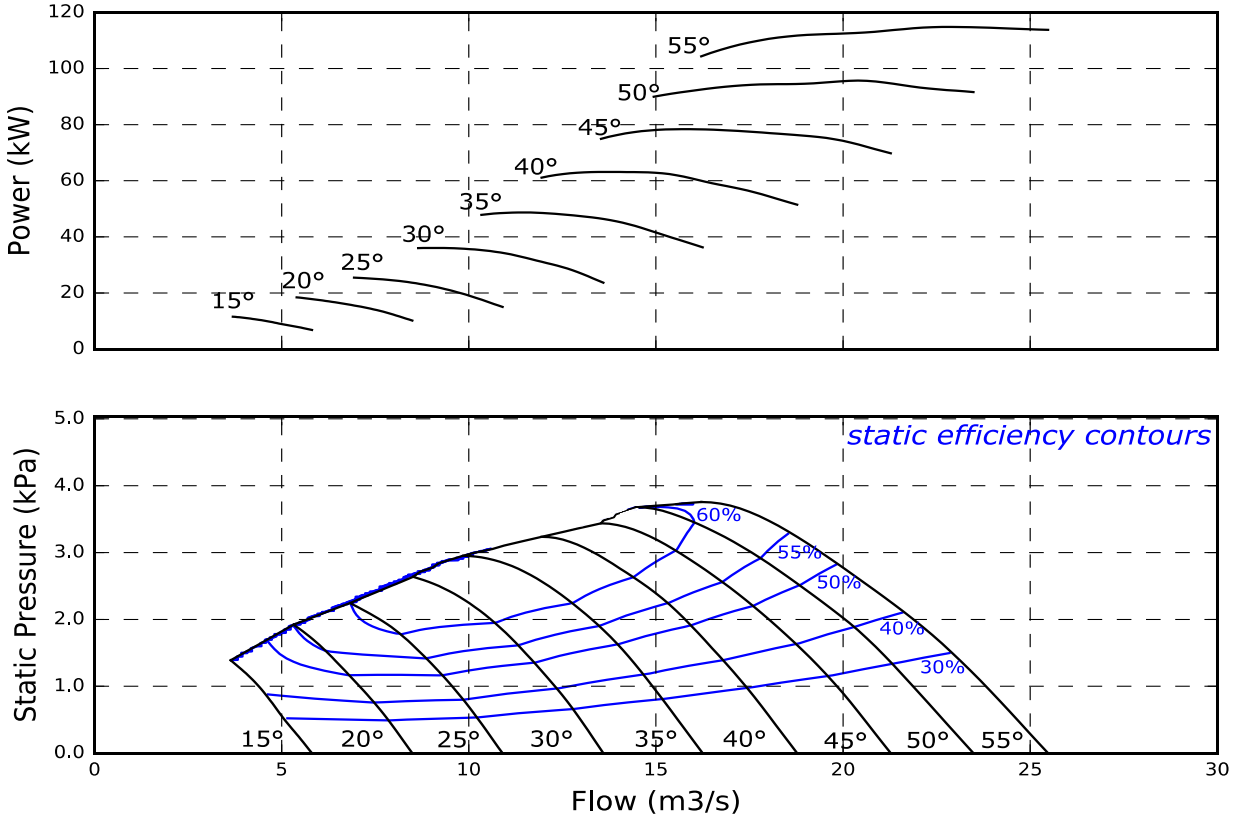
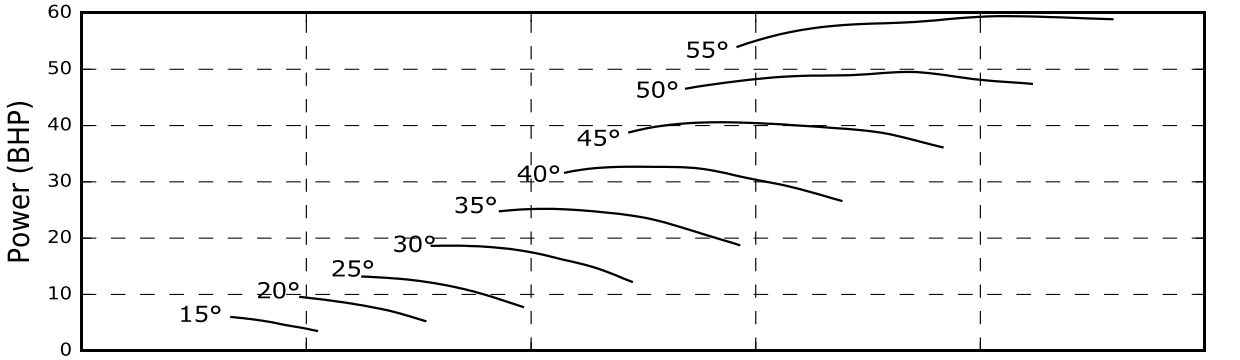
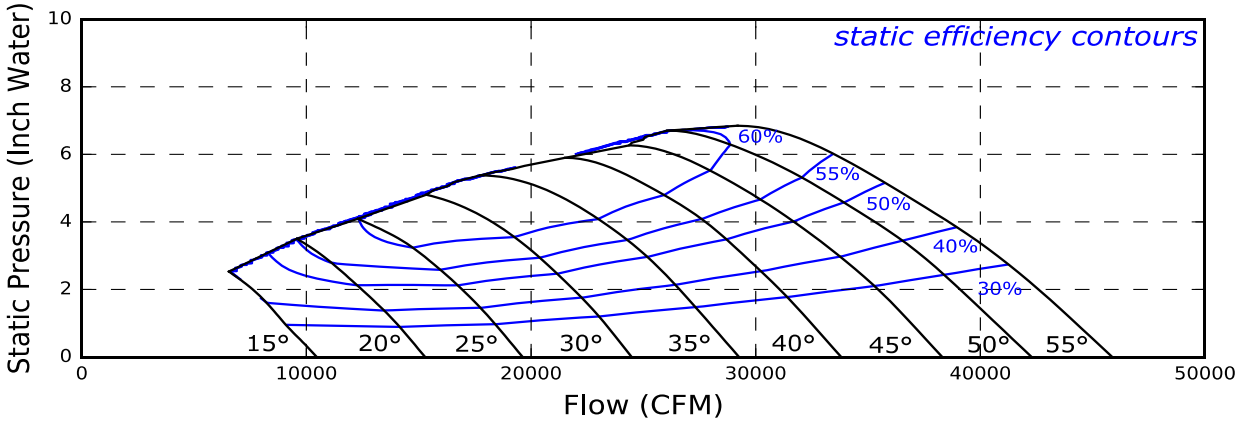


Size 36 1800 RPM





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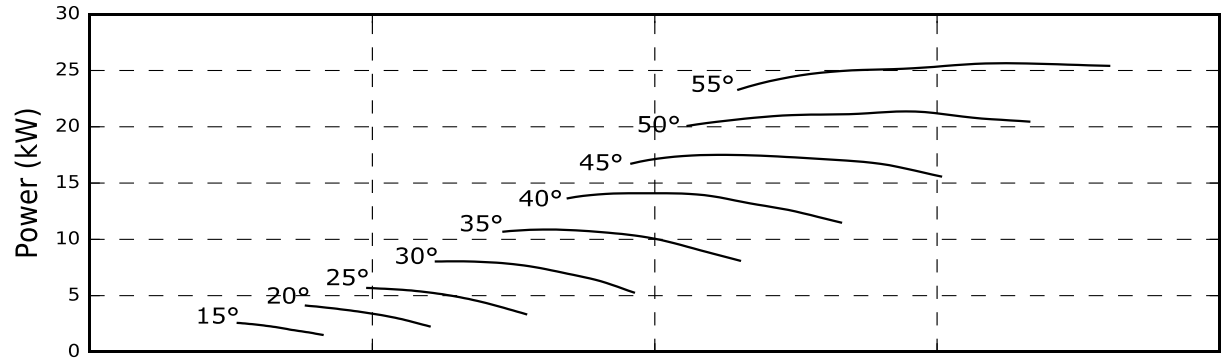

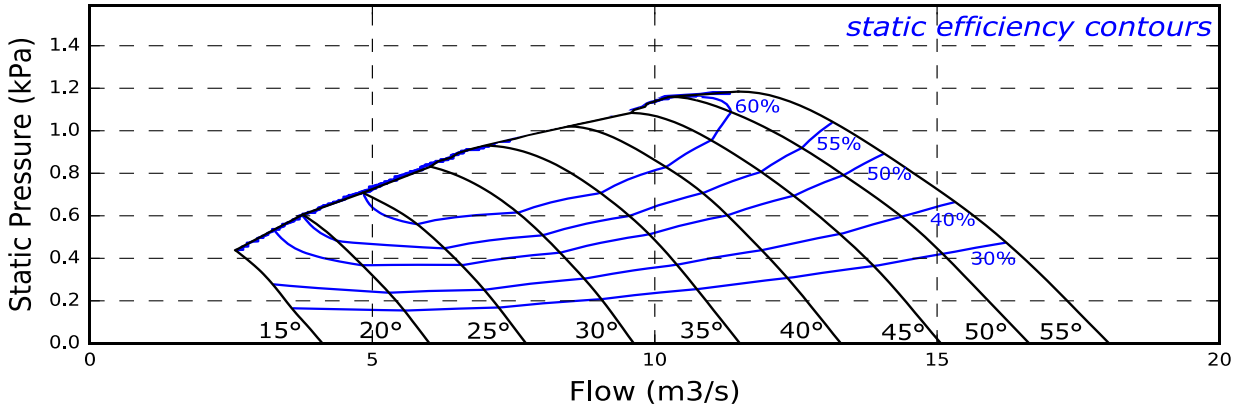

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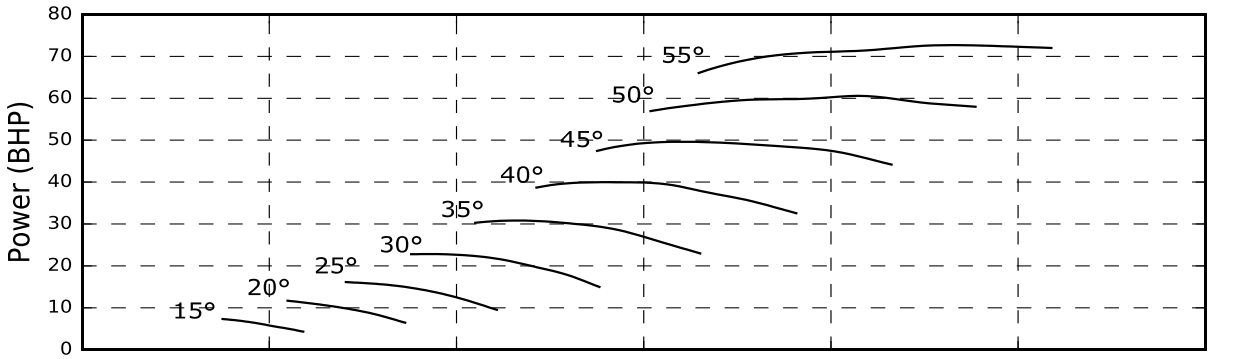

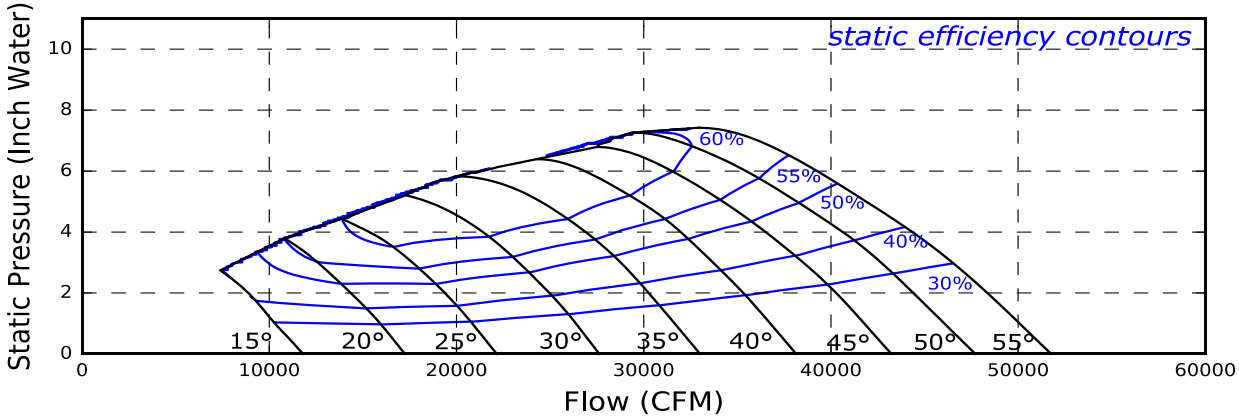

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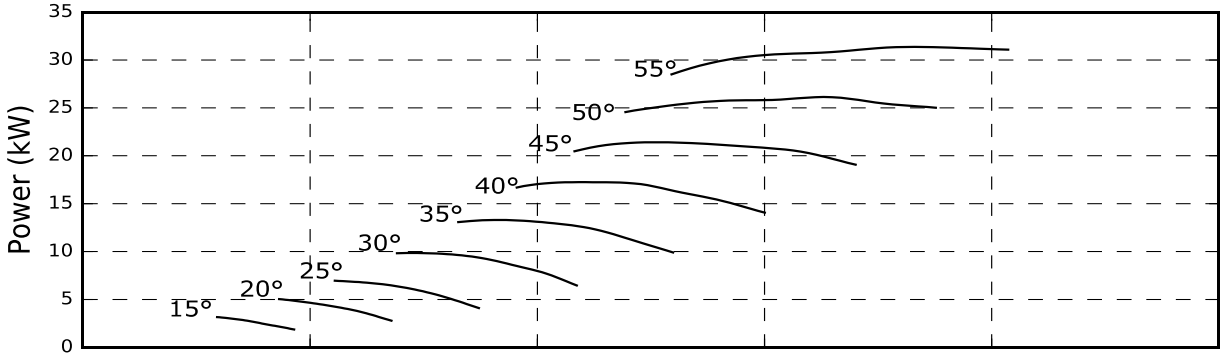

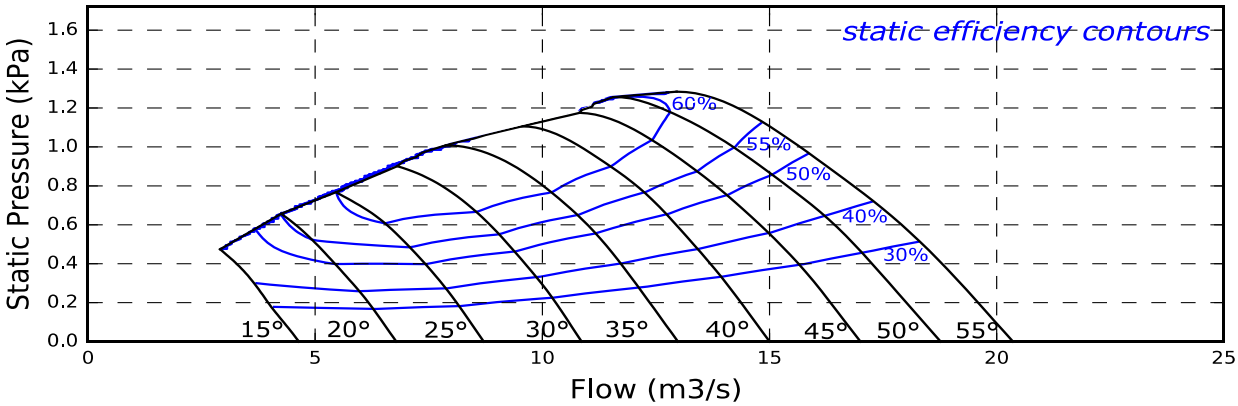

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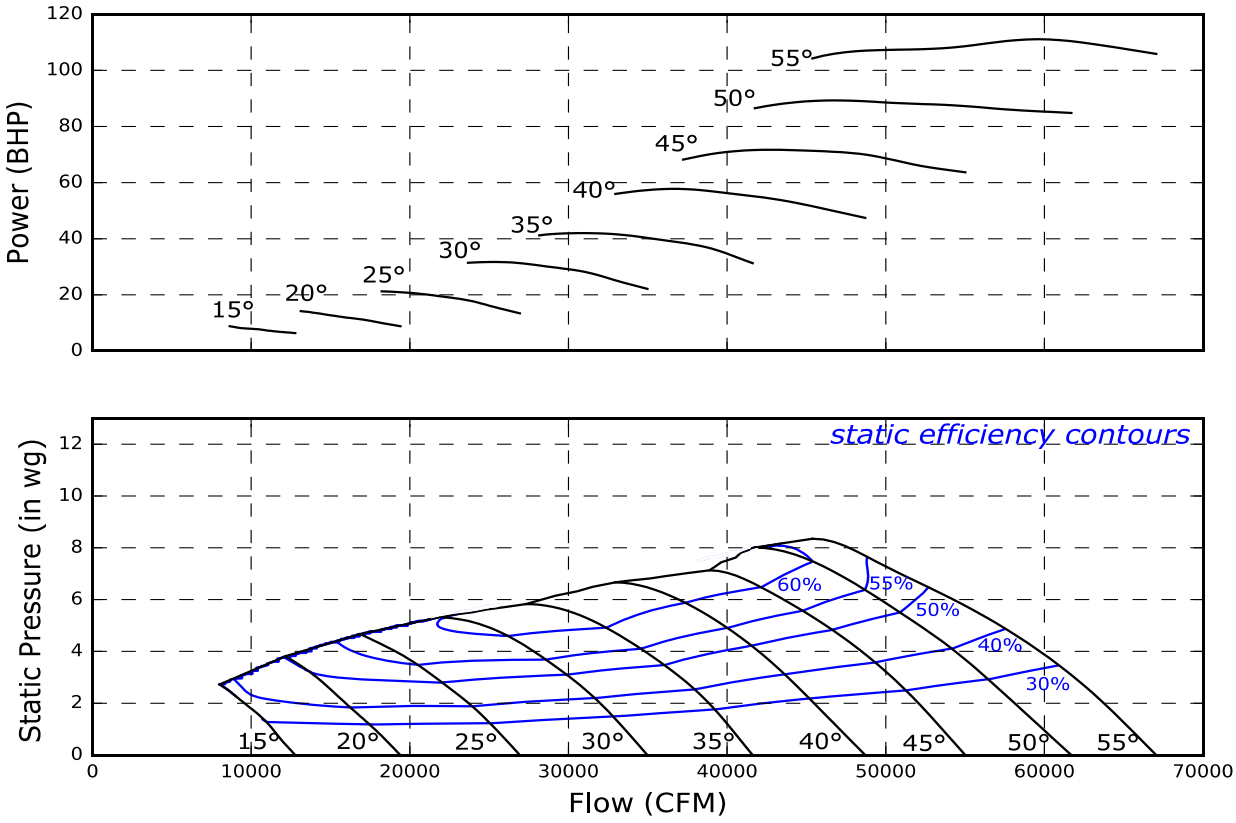

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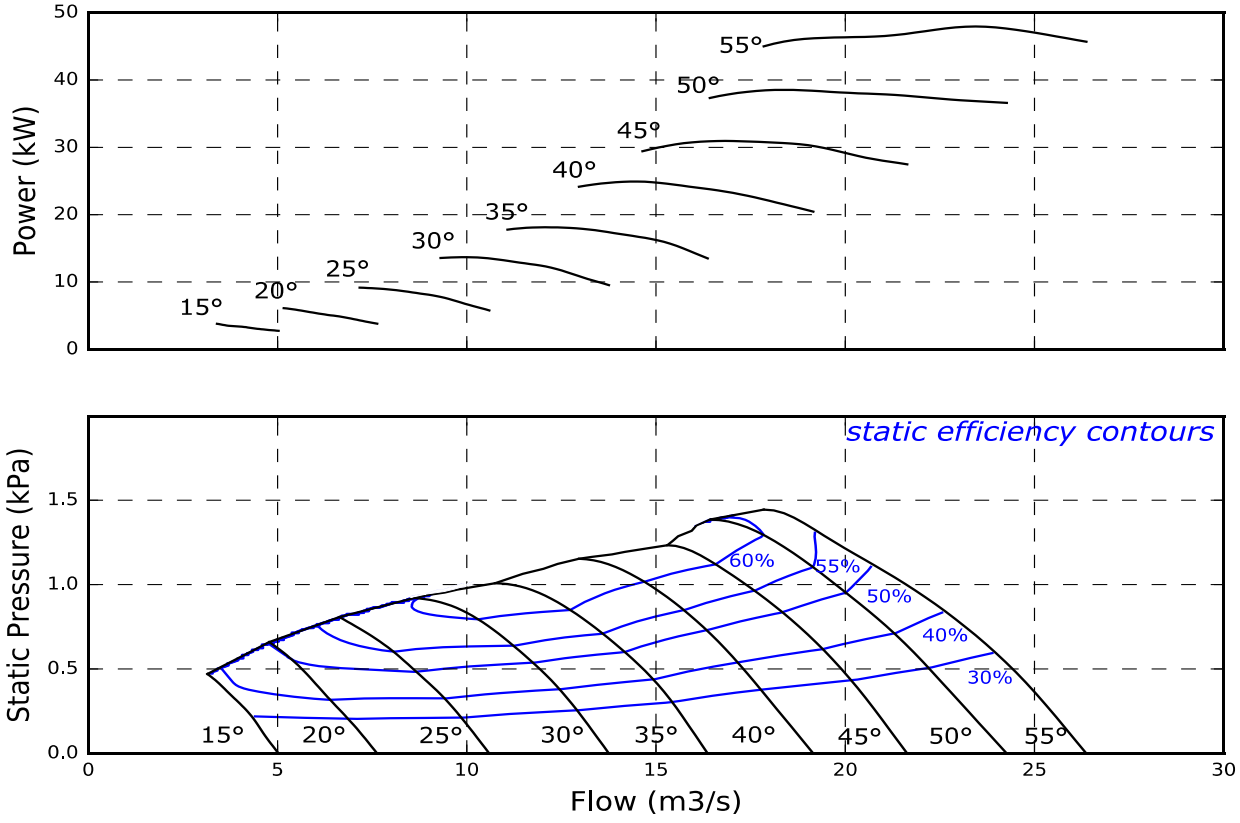

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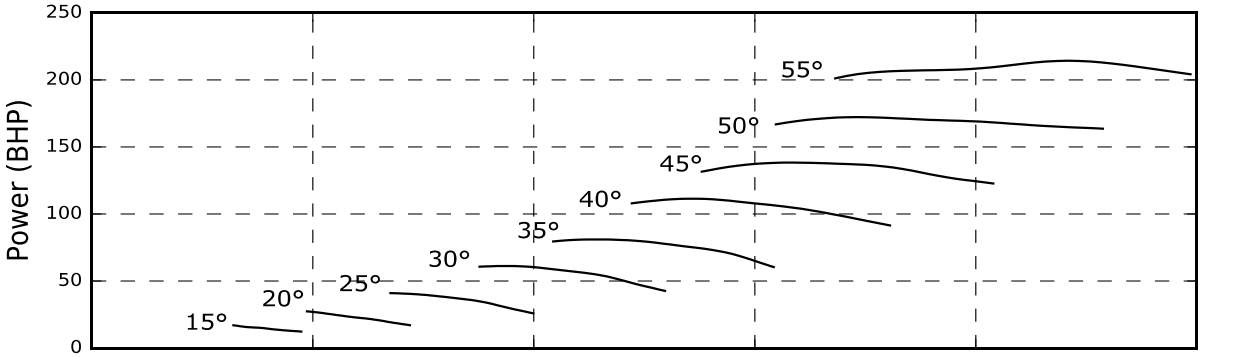

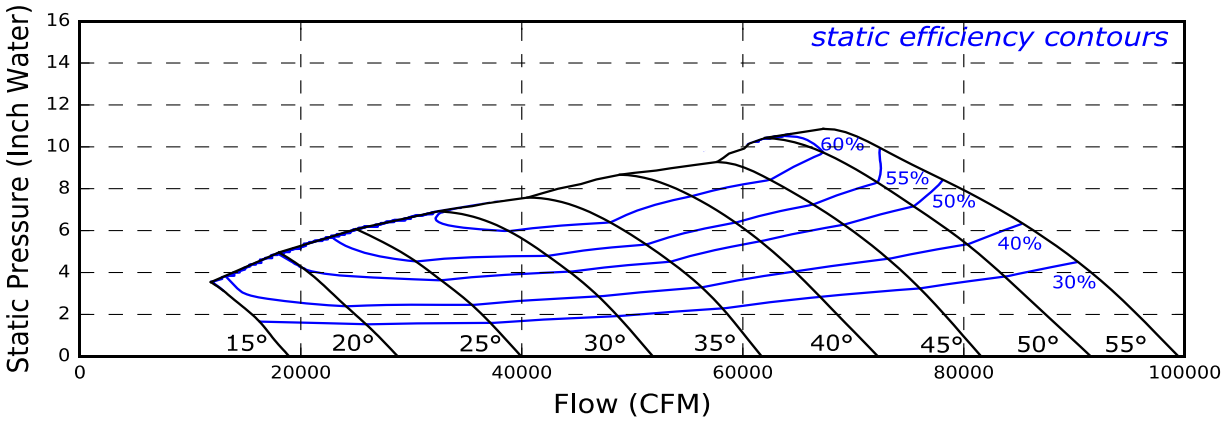

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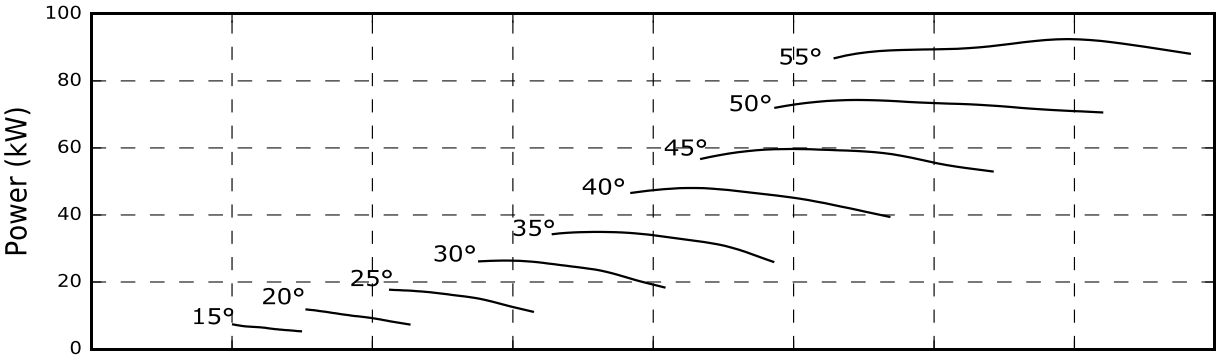
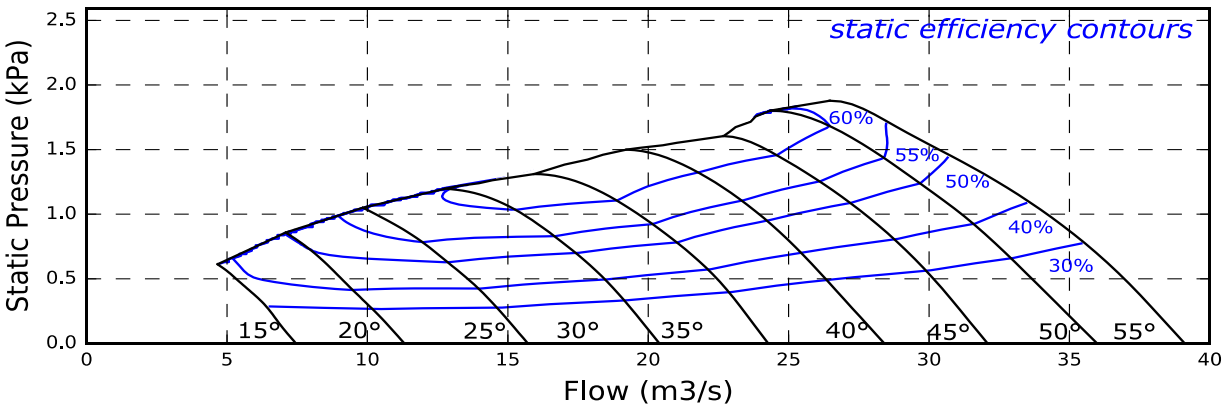
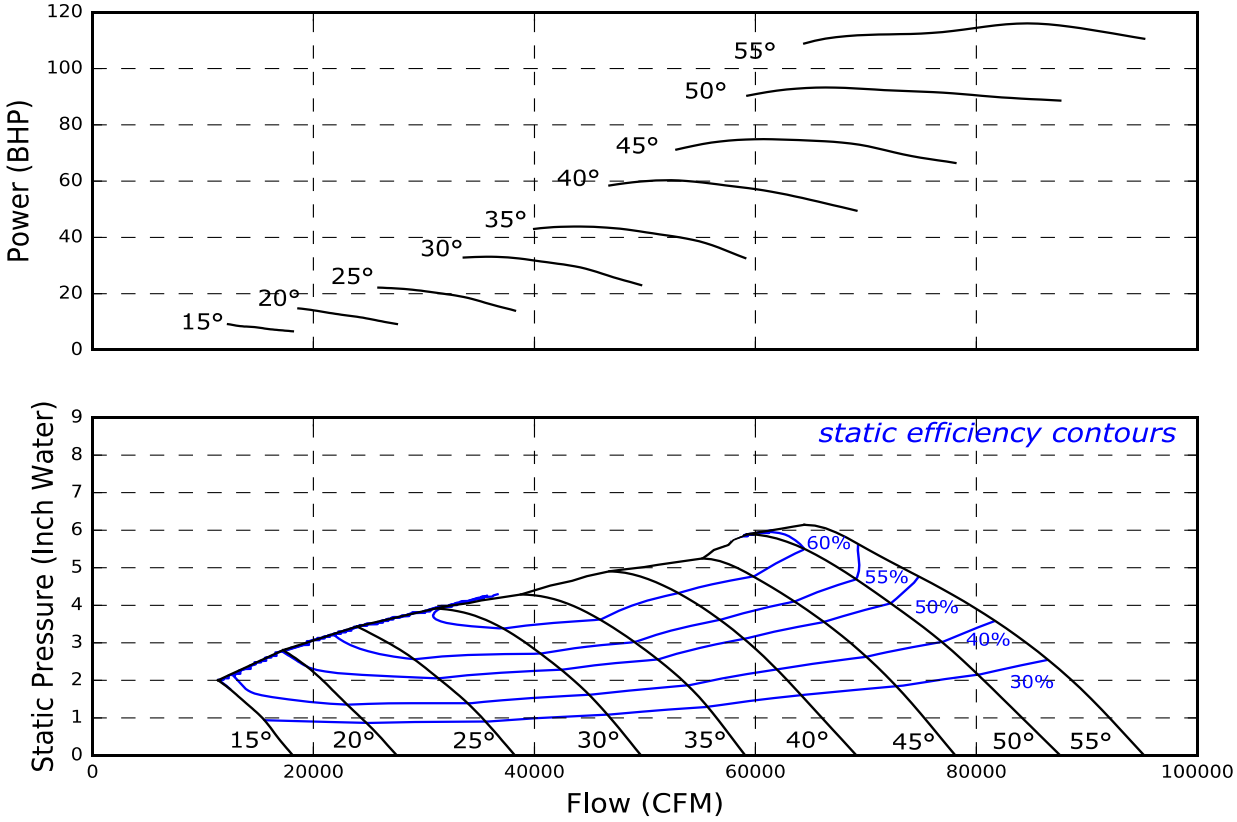




Size 54 1200 RPM



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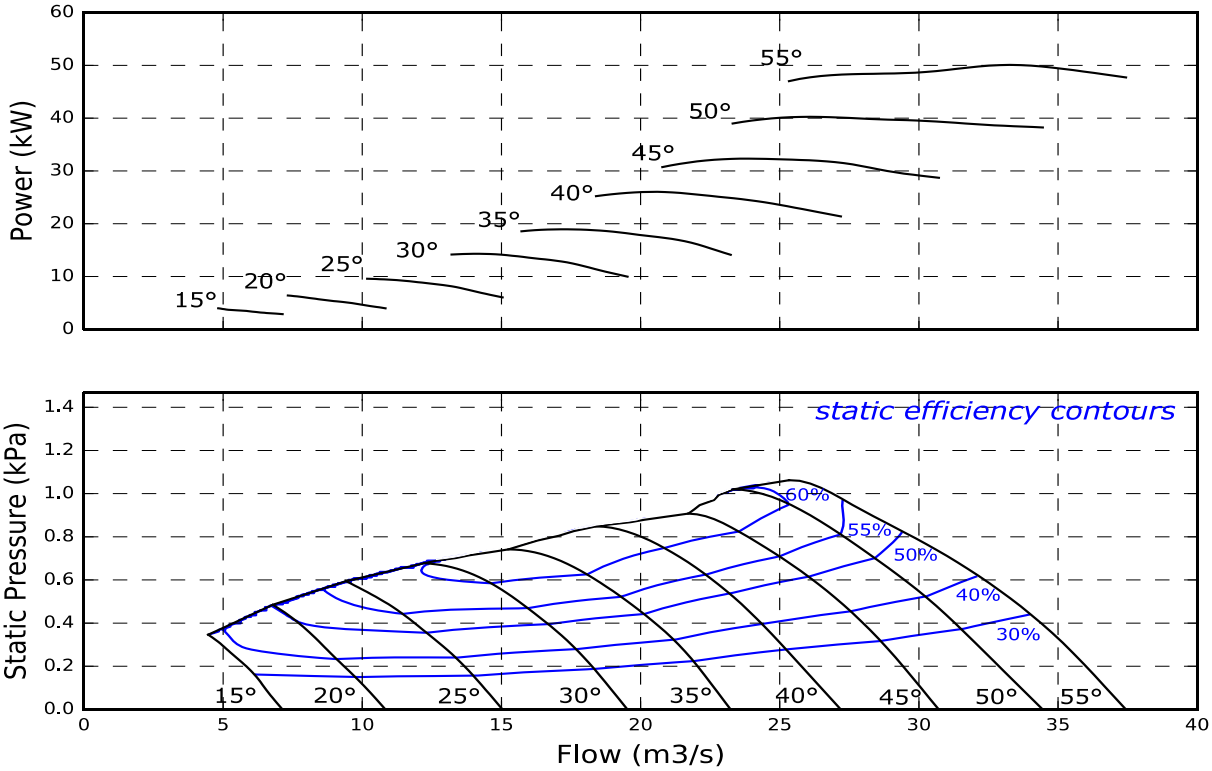

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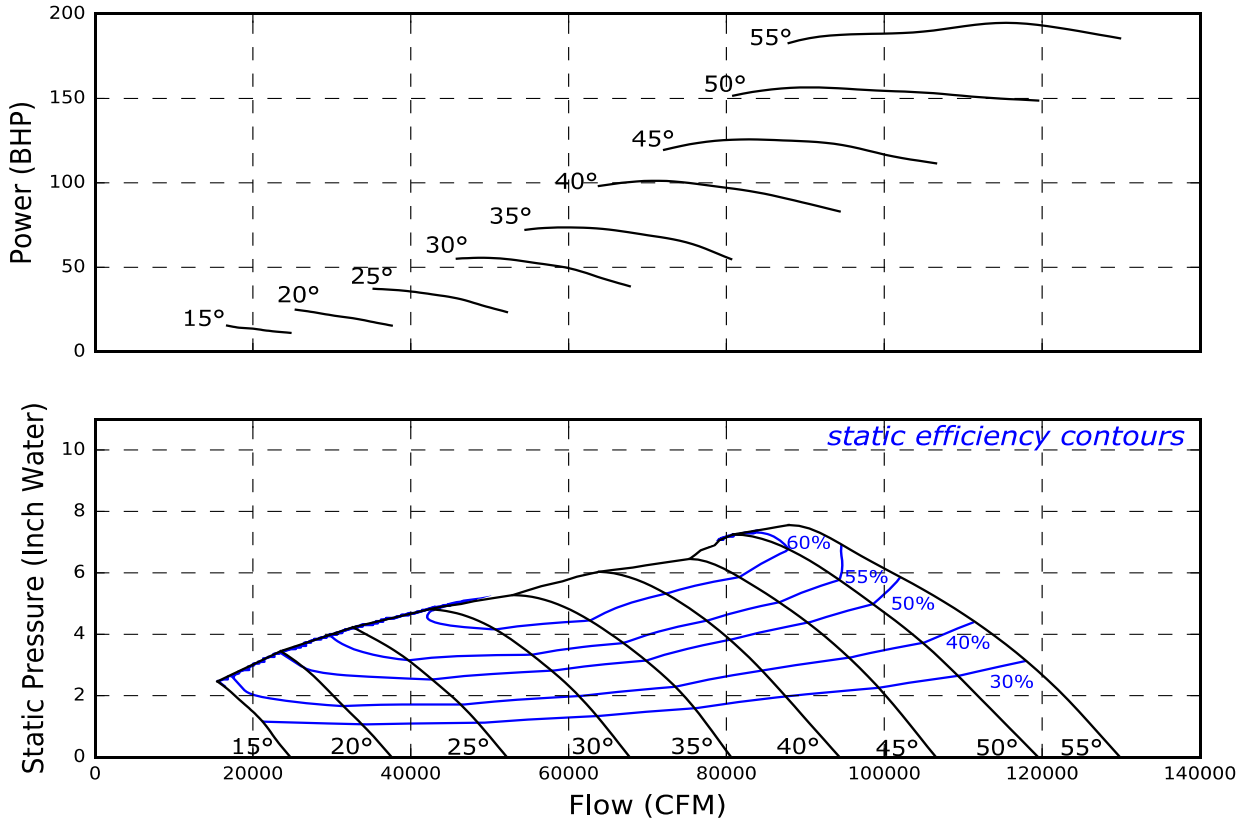

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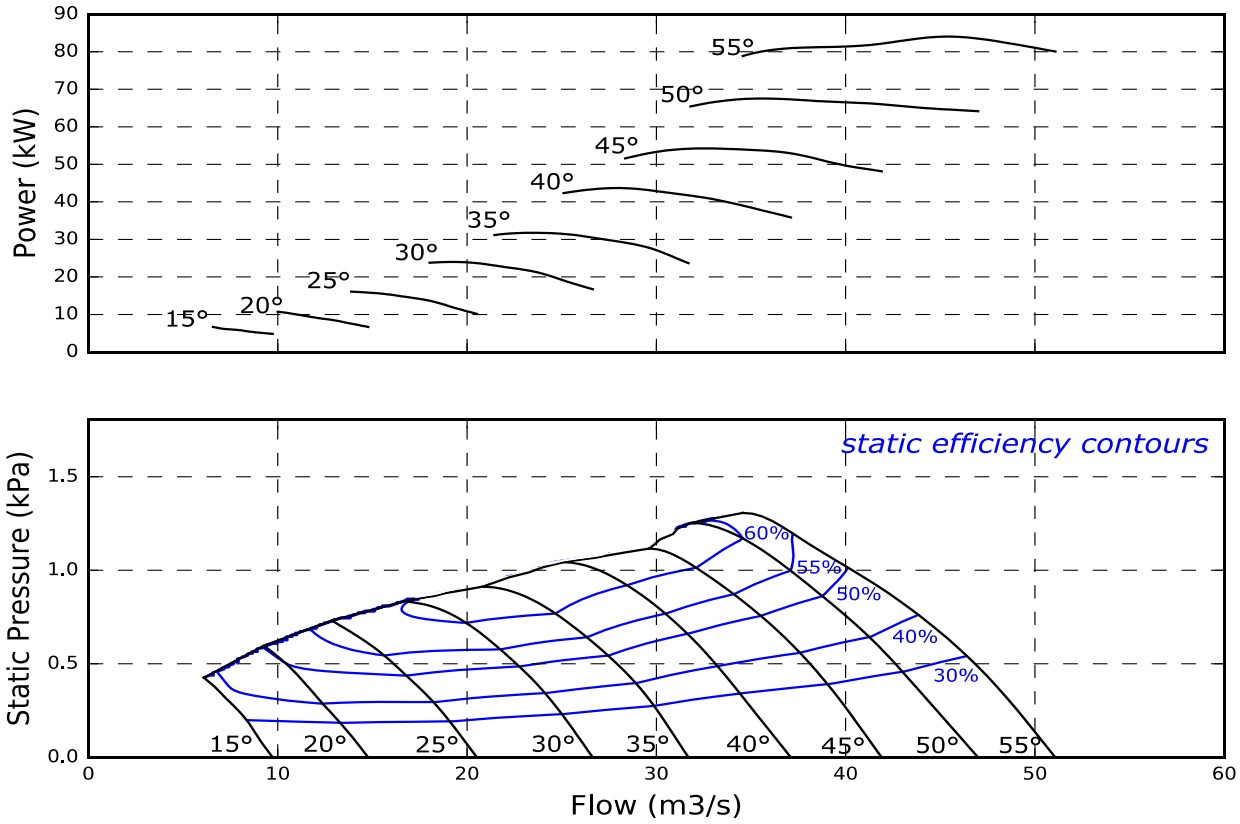

MATERIAL SPECIFICATIONS

CHART III

SIZE	MOTOR FRAME	NUMBER BLADES	†WHEEL WEIGHT (LBS)	†WHEEL WR² (LB-FT²)	BUSHING TYPE	MOTOR BORE SIZE	HOUSING GAUGE	BLADE O.D. (IN)	STRUCTURAL SAFE SPEED	ǂBARE FAN WEIGHT (APPROXIMATE) 4-D	ǂBARE FAN WEIGHT (APPROXIMATE) 4-M
21-12-12	182TC/184TC	12	33	6.6	B	1 1/8	7 GA	21	3600	235	295
	213TC/215TC					1 3/8				237	298
24-14-12	182TC/184TC	12	41	11.7	B	1 1/8	7 GA	24 3/16	3600	283	355
	213TC/215TC					1 3/8				284	357
	254TC/256TC				Q1	1 5/8				306	385
27-16-12	182TC/184TC	12	63	22.4	B	1 1/8	7 GA	27 3/16	3600	356	446
	213TC/215TC					1 3/8				354	444
	254TC/256TC			22.5	Q1	1 5/8				373	468
	284TSC/286TSC			22.4	B					379	478
29-17-12	213TC/215TC	12	83	33.4	B	1 3/8	7 GA	29	3600	424	525
	254TC/256TC		86		Q1	1 5/8				442	546
	284TSC/286TSC		83		B					449	556
	324TSC/326TSC		84	33.1	Q1	1 7/8				464	574
32-19-12	254TC/256TC	12	104	52.4	Q1	1 5/8	7 GA	32 1/4	3600	517	633
	284TC/286TC		105		Q2	1 7/8				529	648
	284TSC/286TSC		101		B	1 5/8				525	644
	324TC/326TC		106		Q2	2 1/8				544	666
	324TSC/326TSC		103		Q1	1 7/8				540	663
	364TSC/365TSC		103							549	673
36-21-12	213TC/215TC	12	127	86.4	B	1 3/8	7 GA	36 1/4	1800	640	778
	254TC/256TC		129		Q1	1 5/8				646	784
	284TC/286TC		131		Q2	1 7/8				651	790
	324TC/326TC					2 1/8				666	809
	364TC/365TC		132	86.5		2 3/8				671	816
38-22-12	213TC/215TC	12	146	108	B	1 3/8	1/4"	37 3/4	1800	894	1052
	254TC/256TC		148		Q1	1 5/8				894	1051
	284TC/286TC		150		Q2	1 7/8				890	1048
	324TC/326TC		151			2 1/8				896	1055
	364TC/365TC		159		R2	2 3/8				906	1068
42-25-12	*254TCZ/256TCZ	12	168	163	Q2	1 5/8	1/4"	42 3/8	1800	1080	1262
	284TC/286TC					1 7/8				1072	1255
	324TC/326TC					2 1/8				1069	1252
	364TC/365TC		175		R2	2 3/8				1064	1247
	404TC/405TC					2 7/8				1253	1453
	444TC/445TC					3 3/8				1314	1524
48-29-12	284TC/286TC	12	234	307	Q2	1 7/8	1/4"	48 3/8	1800	1377	1609
	324TC/326TC					2 1/8				1372	1604
	364TC/365TC					2 3/8				1356	1588
	404TC/405TC		241		R2	2 7/8				1535	1781
	444TC/445TC					3 3/8				1598	1854
	447TC/449TC									1811	2092
54-33-12	*254TCZ/256TCZ	12	301	522	Q2	1 5/8	1/4"	54 1/2	1200	1727	2015
	284TC/286TC					1 7/8				1714	2002
	324TC/326TC					2 1/8				1706	1994
	364TC/365TC		308		R2	2 3/8				1693	1980
	404TC/405TC					2 7/8				1842	2137
	444TC/445TC					3 3/8				1909	2215
60-36-12	284TC/286TC	12	458	964	Q2	1 7/8	1/4"	60 1/2	1200	2180	2541
	324TC/326TC					2 1/8				2169	2531
	364TC/365TC		464		R2	2 3/8				2150	2512
	404TC/405TC					2 7/8				2264	2626
	444TC/445TC					3 3/8				2324	2696
	447TC/449TC									2585	2990

*Requires Extended Shaft Motors (consult Sales)

†Wheel Weight and WR² Includes Wheel, Bushing and Nose Cone

ǂ Fan Weight Includes Wheel Assembly and Housing Assembly

MATERIAL SPECS. CONTINUED

Motor Requirements & Permissible Motor Thrust Loads (WEG): Sizes 21-36

CHART IV

SIZE	LOW SPEED	FRAME	Max Thrust Vertical Shaft Down (DE Angular Contact) (LBS)	Max Thrust Horizontal (Standard Bearing) (LBS)	Max Motor Diameter	†Min Motor Shaft Lengths	Vane Band Length
21	1800	182/4TC	300	167	11 1/2	2 5/8	6 5/8
	3600	182/4TC	300	167		2 5/8	6 5/8
		213/5TC	300	180		3 1/8	7 1/8
		ǂ254/6TC	400	268		3 3/4	9 3/8
24	1800	182/4TC	300	167	13 3/8	2 5/8	6 5/8
		213/5TC	300	220		3 1/8	7 1/8
	3600	213/5TC	300	180		3 1/8	7 1/8
		254/6TC	400	268		3 3/4	9 3/8
		ǂ284/6TSC	800	273		3	10 1/4
27	1800	182/4TC	300	167	15 3/16	2 5/8	6 5/8
		213/5TC	300	220		3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
	3600	254/6TC	400	268		3 3/4	9 3/8
		284/6TSC	800	273		3	10 1/4
		ǂ324/6TSC	900	407		3 1/2	11 3/8
29	1800	213/5TC	300	167	16	3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
	3600	254/6TC	400	268		3 3/4	9 3/8
		284/6TSC	800	273		3	10 1/4
		324/6TSC	900	407		3 1/2	11 3/8
		ǂ364/5TSC	1100	700		3 1/2	12
32	1800	254/6TC	400	350	18	3 3/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
	3600	284/6TSC	800	273		3	10 1/4
		324/6TSC	900	407		3 1/2	11 3/8
		364/6TSC	1100	700		3 1/2	12
36	1200	213/5TC	300	220	20 3/8	3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
	1800	213/5TC	300	220		3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	799		5 5/8	12

Motor Requirements & Permissible Motor Thrust Loads (WEG): Sizes 38-60

SIZE	LOW SPEED	FRAME	Max Thrust Vertical Shaft Down (DE Angular Contact)	Max Thrust Horizontal (Standard Bearing)	Max Motor Diameter	†Min Motor Shaft Lengths	Vane Band Length
38	1200	213/5TC	300	220	21 5/16	3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
	1800	213/5TC	300	220		3 1/8	7 1/8
		254/6TC	400	350		3 3/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	700		5 5/8	12
42	1200	*254/6TCZ	400	350	24 1/8	5 1/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
	1800	*254/6TCZ	400	350	24 1/8	5 1/4	9 3/8
		284/6TC	800	526		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	700		5 5/8	12
		404/5TC	1100	875	23 7/8	7	16 3/8
		444/5TC	1300	1000		8 1/4	18 1/2
48	1200	284/6TC	800	526	27 3/4	4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
	1800	284/6TC	800	620	27 3/4	4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	700		5 5/8	12
		404/5TC	1100	875	27 1/2	7	16 3/8
		444/5TC	1300	1000		8 1/4	18 1/2
		447/9TC	2000	1325		8 1/4	23 5/8
54	1200	*254/6TCZ	400	414	31 1/2	5 1/4	9 3/8
		284/6TC	800	560		4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	700		5 5/8	12
		404/5TC	1100	875	31 1/4	7	16 3/8
		444/5TC	1600	1000		8 1/4	18 1/2
60	1200	284/6TC	800	560	35 1/8	4 3/8	10 1/4
		324/6TC	900	620		5	11 3/8
		364/5TC	1100	700		5 5/8	12
		404/5TC	1100	875	34 7/8	7	16 3/8
		444/5TC	1600	1000		8 1/4	18 1/2
		447/9TC	2000	1325		8 1/4	24 1/8

***Requires Extended Shaft Motor. Consult Sales**

†Min Motor Shaft Lengths - from c-face to end of shaft

ǂMotor frame size on application

DIMENSIONS

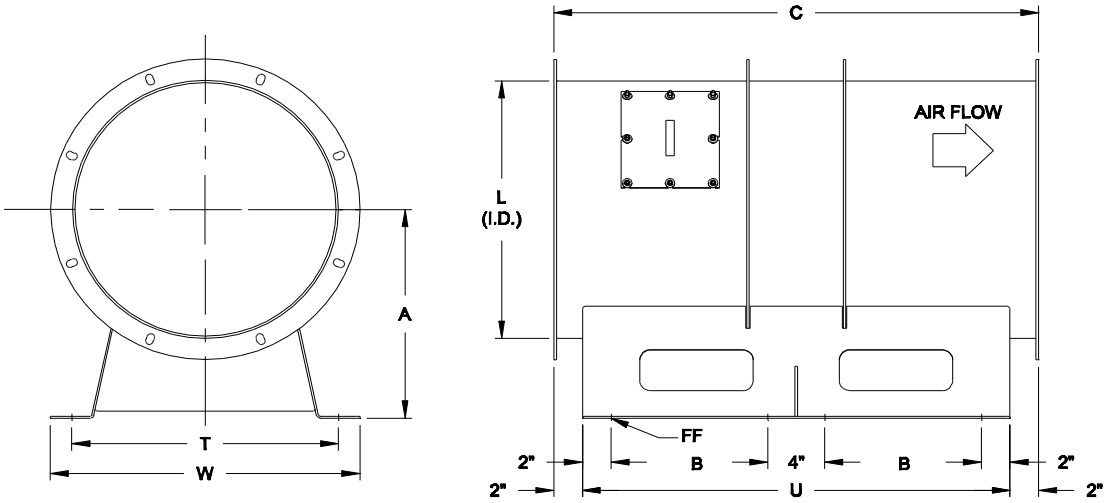

CHART V

DIMENSIONS									
SIZE	FRAME SIZE	A	C	B	FF	L	T	U	W
21-12-12	182TC/184TC	17 5/8	26 3/8	7 3/16	9/16	21 3/16	22	22 3/8	25
	213TC/215TC		27 3/8	7 11/16				23 3/8	
24-14-12	182TC/184TC	19 1/4	27 1/8	7 9/16	9/16	24 3/8	25	23 1/8	28
	213TC/215TC		27 7/8	7 15/16				23 7/8	
	254TC/256TC		32 1/4	10 1/8				28 1/4	
27-16-12	182TC/184TC	20 1/2	29 5/8	8 13/16	9/16	27 3/8	28	25 5/8	31
	213TC/215TC								
	254TC/256TC		33 1/8	10 9/16				29 1/8	
	284TSC/286TSC		35 1/8	11 9/16				31 1/8	
29-17-12	213TC/215TC	22	31 3/8	9 11/16	9/16	29 3/16	30	27 3/8	33
	254TC/256TC		33 5/8	10 13/16				29 5/8	
	284TSC/286TSC		35 1/2	11 3/4				31 1/2	
	324TSC/326TSC		37 5/8	12 13/16				33 5/8	
32-19-12	254TC/256TC	23 1/2	34 3/8	11 3/16	9/16	32 1/2	33	30 3/8	36
	284TC/286TC		36 1/4	12 1/8				32 1/4	
	284TSC/286TSC								
	324TC/326TC		38 3/8	13 3/16				34 3/8	
	324TSC/326TSC								
	364TSC/365TSC		39 5/8	13 13/16				35 5/8	
36-21-12	213TC/215TC	26	36 5/8	12 5/16	9/16	36 1/2	38	32 5/8	41
	254TC/256TC								
	284TC/286TC		37 1/4	12 5/8				33 1/4	
	324TC/326TC		39 3/8	13 11/16				35 3/8	
	364TC/365TC		40 5/8	14 5/16				36 5/8	
38-22-12	213TC/215TC	27 1/2	39	13 1/2	9/16	38	39 1/2	35	42 1/2
	254TC/256TC								
	284TC/286TC								
	324TC/326TC		39 3/4	13 7/8				35 3/4	
	364TC/365TC		41	14 1/2				37	
42-25-12	*254TCZ/256TCZ	30	42 1/2	15 1/4	9/16	42 3/4	44 1/2	38 1/2	47 1/2
	284TC/286TC								
	324TC/326TC								
	364TC/365TC								
	404TC/405TC		51 1/4	19 5/8				47 1/4	
	444TC/445TC		55 3/8	21 11/16				51 3/8	
48-29-12	284TC/286TC	33 1/2	47	17 1/2	9/16	48 3/4	50 1/2	43	53 1/2
	324TC/326TC								
	364TC/365TC								
	404TC/405TC		52 5/8	20 5/16				48 5/8	
	444TC/445TC		56 7/8	22 7/16				52 7/8	
	447TC/449TC		67 3/8	27 11/16				63 3/8	
54-33-12	*254TCZ/256TCZ	37 1/2	51 1/2	19 3/4	3/4	55	57	47 1/2	60
	284TC/286TC								
	324TC/326TC								
	364TC/365TC								
	404TC/405TC		54 1/4	21 1/8				50 1/4	
	444TC/445TC		58 3/8	23 3/16				54 3/8	
60-36-12	284TC/286TC	41 1/2	56 1/2	22 1/4	3/4	61	63	52 1/2	66
	324TC/326TC								
	364TC/365TC								
	404TC/405TC								
	444TC/445TC		59 7/8	23 15/16				55 7/8	
	447TC/449TC		70 1/2	29 1/4				66 1/2	

*Requires Extended Shaft Motors (consult Sales)

CONTINUED DIMENSIONS

CHART VI

FAN FLANGE / COMPANION FLANGE					
SIZE	FAN ID	BOLT CIRCLE	FLANGE OD	FLANGE SLOTS	
				NUMBER	SIZE
21	21 3/16	23	24 5/8	8	7/16 x 13/16
24	24 3/8	26 1/8	27 3/4		
27	27 3/8	29 1/8	30 3/4		
29	29 3/16	31	32 5/8	16	9/16 x 1
32	32 1/2	34 1/4	35 7/8		
36	36 1/2	38 5/16	41		
38	38	40 1/4	42 1/2		
42	42 3/4	45	47 1/4		
48	48 3/4	51	53 3/8		
54	55	57 7/16	59 5/8		
60	61	63 7/16	65 5/8		

INLET BELL DIMENSIONS

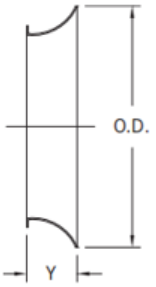

CHART VII

INLET BELL		
SIZE	Y	OD
21	3 11/16	28 1/4
24	4 1/16	32 1/8
27	4 11/16	36 3/8
29	5	38 7/8
32	5 3/4	43 1/2
36	6 1/4	48 1/2
38	6 5/8	50 7/8
42	7 1/4	56 3/4
48	8 1/4	64 3/4
54	9 1/8	73
60	10 1/8	81

INLET VANE DAMPER DIMENSIONS

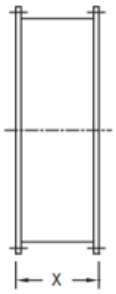

CHART VIII

INLET VANE DAMPER		
SIZE	LENGTH (X)	
	TYPE B	TYPE C
21	12	14
24		
27		
29		
32		
36		
38		
42		
48		
54		
60		

CHART IX

FAN ACCESS SECTION			
SIZE	LENGTH	CUTOUT SIZE	WEIGHT
21	11 1/2	7 1/2	76
24	12	8	89
27	12 5/8	8 5/8	103
29	13 1/2	9 1/2	116
32	14	10	132
36	14 3/4	10 3/4	166