KAESER COMPRESSORS

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CAGI Data Sheets

Blower Performance Comparison

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Comparing blower performances across different manufacturers and technologies has long been a difficult task. For many years, it was all too easy to present data that, although accurate, was potentially misleading. Manufacturers were selective about what information they published as well as what conditions they chose to specify performance. The result was a numbers game that the buyer frequently lost.

Fortunately, the Compressed Air and Gas Institute (CAGI), in cooperation with its members, has developed a tool for a fair comparison between blowers. CAGI is a non-profit organization of competitive companies that manufacture air and gas compressors and related equipment. CAGI seeks to educate end-users to promote effective, safe, and energy efficient uses of compressed air and gases.

Performance Data Sheets

CAGI members have worked closely with several standards development bodies such as PNEUROP (CAGI's European counterpart) and the International Organization for Standardization (ISO) to develop key standards for compressed air and gas systems equipment.

Under the *Performance Test Code for Electric Driven Low Pressure Air Compressor Packages* (BL 300), there is a standard form for participating members to publish their blower performance information.

Kaeser publishes its performance data sheets on dedicated webpages, as do other participating manufacturers. In addition, CAGI publishes the links to the manufacturers' data sheets on its website at www.cagi.org/performance-verification/data-sheets.aspx

CAGI data sheets will be very helpful in selecting the most energy efficient blower. By standardizing how these values are reported, it is possible to make clear comparisons between two or more models. The bottom line on the data sheet is the "Specific Package Input Power at Rated Capacity and Full Load Operating Pressure". This value (expressed in kW/100 cfm) is the measure of blower package efficiency. The lower the value, the more efficient the package is. This is a quick and easy way to see which blower uses less power at the stated conditions.

System Considerations

While the efficiencies of individual blowers in a system are important, the overall efficiency of a blower system is usually more dependent on the sizing of the blowers and how they are controlled. Using the CAGI data sheets, you will find some blowers are a few (or even several) percentage points more efficient than others of the same size. This can generate worthwhile savings and should be a strong consideration in choosing a blower, especially in larger sizes. But don't overlook the opportunity for even greater electrical power savings (typically 5 – 35% or more) by doing the analysis to choose the right size blowers and control them efficiently.

CAGI Performance Data Sheets

Below are line-by-line explanations for the fixed speed and variable speed CAGI data sheets.

Fixed Speed Units:

Line 1: **Name of the manufacturer and date**

Line 2: **Manufacturer's model number**

Line 3: **Indicates components included in the tested model.**

- Main drive motor: Electric drive motor
- Drive Cooling System: System used to cool drive motor, coupling, or bearings. May require external connections or water feed
- Lubrication System

AIR BLOWER PACKAGE DATA SHEET

Positive Displacement Fixed Speed Blower

MODEL DATA - Standard Conditions (US Units)				
1	Manufacturer:	**Kaeser Compressors, Inc.**	Date:	**8/1/2016**
2	Model Number:	**FBS 660 L STC**		
3	☑ Main Drive Motor ☐ Drive Cooling System ☐ Lubrication ☑ Starters ☑ Inlet Air Filter ☑ Gearbox / Belt Drive ☑ Control Cubicle ☑ Check Valve			
			VALUE	UNITS
4	Rated Capacity (FAD) at Rated Operating Pressure		**2048**	cfm
5	Rated Operating Pressure - p_2		**9.40**	psig
6	Drive Motor Nameplate Rating		**100.0**	hp
7	Blower Rated Speed		**5505**	rpm
8	Performance Table [a]			
	Discharge Pressure[c]		VALUE	UNITS
	9.4 psig	Delivered Air Flow - FAD[d]	**2049**	cfm
		Specific Power[b]	**3.54**	kW / 100 cfm
		Blower Speed	**5505**	rpm
	8.0 psig	Delivered Air Flow - FAD[d]	**2056**	cfm
		Specific Power[b]	**3.11**	kW / 100 cfm
		Blower Speed	**5505**	rpm
	6.0 psig	Delivered Air Flow - FAD[d]	**2067**	cfm
		Specific Power[b]	**2.60**	kW / 100 cfm
		Blower Speed	**5505**	rpm

Notes:

a. Based on reference inlet conditions of pamb= 14.7 psia, Tamb = 68°F, RH=36%.

b. Specific power (kW / 100cfm.) tolerance given BL 300 table below.

c. An 8 psig data point is required. Tolerance for discharge pressure given below

d. Delivered air flow tolerance given by BL 300 table below.

Member

CAGI Compressed Air & Gas Institute

Table 2 from BL 300:

Delivered Air Flow at specifed conditions		Delivered Air Flow Rate	Specific Power Consumption	Discharge Pressure
m³/min	ft³/min	%	%	%
Below 0.5	Below 15	+/- 7	+/- 8	-0 / +1
0.5 to 1.5	15 to 50	+/- 6	+/- 7	-0 / +1
1.5 to 15	50 to 500	+/- 5	+/- 6	-0 / +1
Above 15	Above 500	+/- 4	+/- 5	-0 / +1

BL 062 (US Units)
07/16 R5

This form was developed by the Compressed Air and Gas Institute for the use of its members. CAGI has not independently verified the reported data.

Fixed speed CAGI data sheet

- Starters: Package includes a starter array
- Inlet Air Filter
- Gearbox / Belt Drive
- Control Cubicle: Electrical cabinet which includes starters, control transformers, and unit controller
- Check Valve

Line 4: **Rated Capacity (FAD) at Rated Operating Pressure:** The volume of air (in cfm) measured at the terminal point of the package at an agreed upon set of standard inlet conditions (BL 300) with the blower operating at the rated pressure stated in line 5. This takes into account all package air losses and pressure drops. FAD (Free Air Delivery) is the actual quantity of air at the discharge of the compressor/blower with reference back to inlet conditions.

Line 5: **Rated Operating Pressure:** The pressure at the terminal point of the package where the flow and power were measured.

Line 6: **Drive Motor Nameplate Rating:** A nominal horsepower rating applied by the motor manufacturer. This number is not the maximum design capability for the motor. To determine the maximum power output that can be continuously sustained for a motor, multiply the nominal horsepower rating by the service factor. Sustained loads below this maximum will not shorten the design life of the motor.

Line 7: **Blower Rated Speed:** The blower speed (rpm) at which the rated capacity is achieved.

Line 8: **Performance Table:** Chart which displays machine performance at various stated pressures. Each chart must include an 8.0 psig data point.

Discharge Pressure: The pressure at the terminal point of the package where the flow and power were measured.

Delivered Air Flow - FAD: The volume of air consumed at the machine inlet, which is calculated by taking a measurement of flow at the discharge of the machine at the stated discharge pressure. FAD is calculated by converting this measured discharge flow back to an agreed upon set of inlet conditions (BL 300). By measuring the discharge flow at the stated pressure, all of the package air losses are accounted for. This takes into account all package air losses and pressure drops. FAD (Free Air Delivery) is the actual quantity of compressed air at the discharge of the compressor/blower with reference back to inlet conditions.

Specific Power: The measure of how efficiently the blower package produces low pressure air. It is the power input divided by the flow in units of 100 cfm. A 563 cfm machine that requires 19.2 kW at the input power leads to the machine for the rated pressure would have a specific power of 3.41 kW/100 cfm (19.2 ÷ 5.63 = 3.41). Comparing specific power ratings allows users to determine which blower delivers air at the lowest cost per cfm.

Blower Rated Speed: The blower speed (rpm) at which the rated capacity is achieved.

Table 2: The acceptable tolerances by flow range for the supplied data.

The drive motor is one of the blower components included on a blower CAGI data sheet.

CAGI data sheets are a useful tool to help select blowers for a complete system.

Variable Speed Units:

Line 1: **Name of the manufacturer and date**

Line 2: **Manufacturer's model number**

Line 3: **Indicates components included in the tested model.**

- Main drive motor: Electric drive motor
- Driver Cooling System: System used to cool drive motor, coupling, or bearings. May require external connections or water feed
- Harmonic Filter: A passive or active filter utilized to mitigate Total Harmonic Distortion Levels produced by VFD. Filters can be small and contained within the machine cabinet or large and in separate cabinets which need to be connected to the power supply. Compliance to IEEE519 should be checked with the manufacturer.
- No Negative Tolerance Data: If box is checked, values stated are at -0% and only the "+" part of the tolerances in Table 2 apply.
- Control Cubicle: Electrical cabinet which includes starters, control transformers, and unit controller
- Lubricant System: Is there an oil circuit (pumps, filters, cooler)?
- Discharge Check Valve
- VFD: Variable frequency drive used to alter the speed of the drive motor and blower
- Gearbox / Belt Drive
- Inlet Air Filter

Line 4: **Rated Capacity (FAD) at Rated Operating Pressure:** The volume of air (in cfm) measured at the terminal point of the package at an agreed upon set of standard inlet conditions (BL 300) with the blower operating at the rated pressure stated in line 5. This takes into account all package air losses and pressure drops. FAD (Free Air Delivery) is the actual quantity of air at the discharge of the compressor/ blower with reference back to inlet conditions.

Line 5: **Rated Operating Pressure:** The pressure

at the terminal point of the package where the flow and power were measured.

Line 6: **Drive Motor Nameplate Rating:** A nominal horsepower rating applied by the motor manufacturer. This number is not the maximum design capability for the motor. To determine the maximum power output that can be continuously sustained for a motor, multiply the nominal horsepower rating by the service factor. Sustained loads below this maximum will not shorten the design life of the motor.

Line 7: **Blower Rated Speed:** The blower speed (rpm) at which the rated capacity is achieved.

Line 8: **Performance Table:** Chart which displays machine performance at various stated conditions. Each chart must include an 8.0 psig data point.

Discharge Pressure: The pressure at the terminal point of the package where the flow and power were measured.

Delivered Air Flow - FAD: The volume of air consumed at the machine inlet, which is calculated by taking a measurement of flow at the discharge of the machine at the stated discharge pressure. FAD is calculated by converting this measured discharge flow back to an agreed upon set of inlet conditions (BL 300). By measuring the discharge flow at the stated pressure, all of the package air losses are accounted for. This takes into account all package air losses and pressure drops. Given for minimum speed, maximum speed, and three evenly spaced speeds between, FAD (Free Air Delivery) is the actual quantity of compressed air at the discharge of the compressor/blower with reference back to inlet conditions.

Specific Power: The measure of how efficiently the blower package produces low pressure air. It is the power input divided by the flow in units of 100 cfm. A 563 cfm machine that requires 19.2 kW at the input power leads to the machine for the rated pressure would have a specific power of 3.41 kW/100 cfm (19.2 ÷ 5.63 = 3.41). Comparing specific power ratings allows users to determine which blower delivers air at the lowest cost per cfm. Given for minimum speed, maximum speed, and three evenly spaced speeds between.

Blower Rated Speed: The blower speeds at which the rated capacity is achieved. Given for minimum speed, maximum speed, and three evenly spaced speeds between.

Line 10: **Performance Graph:** Graphical representation of the Specific Power and Capacity (line 8). The Y-Axis (specific power) has a typical scale of 0 - 5.00 with increments of 0.5 kW/100 cfm. The X-Axis (capacity) displays machine capacity for the given blower.

The graph gives the performance curve which is useful in comparing overall performance and efficiency at a glance.

Table 2: Acceptable deviations at stated conditions from published values.

About the Author

***Stephen Horne** is the US Product Manager for Kaeser's blower product line, and has over 10 years of experience with the design and function of blower systems in wastewater aeration applications. Stephen has also served as Kaeser's in-house engineer for machine modifications and system design. He is a primary blower product and application instructor in Kaeser's Factory Certified Training program. Stephen holds a Bachelor's degree in Mechanical Engineering from Virginia Polytechnical Institute and State University.*

AIR BLOWER PACKAGE DATA SHEET

Positive Displacement Variable Speed Blower

MODEL DATA - Standard Conditions (US Units)

1	Manufacturer:	**Kaeser Compressors**	Date:	**08/01/16**
2	Model Number:	**FBS 660 L SFC**		

3

☑ Main Drive Motor	☑ Control Cubicle	☑ VFD
☐ Driver Cooling System	☐ Lubrication System	☑ Gearbox / Belt Drive
☐ Harmonic Filter	☑ Discharge Check Valve	☑ Inlet Air Filter
☐ No Negative Tolerance Data		

		VALUE	UNITS
4	Rated Capacity (FAD) at Rated Operating Pressure	**2324**	cfm
5	Rated Operating Pressure - p_2	**9.40**	psig
6	Drive Motor Nameplate Rating	**100.0**	hp
7	Blower Rated Speed	**6200**	rpm

8 — Performance Table[a]

Discharge Pressure p2 (psig)[b]		Delivered Air Flow - FAD (cfm) 100% FAD	FAD[c]	FAD[c]	FAD[c]	MIN FAD[d]
8.7 psig	FAD[f]	**2328**	**2002**	**1627**	**1012**	**573**
	Spec. Power[e]	**3.45**	**3.45**	**3.49**	**3.64**	**4.04**
	Blower Speed (rpm)	**6200**	**5332**	**4464**	**2945**	**1860**
8 psig	FAD[f]	**2331**	**2005**	**1631**	**1017**	**577**
	Spec. Power[e]	**3.25**	**3.25**	**3.27**	**3.39**	**3.74**
	Blower Speed (rpm)	**6200**	**5332**	**4464**	**2945**	**1860**
6 psig	FAD[f]	**2341**	**2013**	**1642**	**1029**	**590**
	Spec. Power[e]	**2.71**	**2.71**	**2.67**	**2.71**	**2.94**
	Blower Speed (rpm)	**6200**	**5332**	**4464**	**2945**	**1860**
4.4 psig	FAD[f]	**2349**	**2020**	**1651**	**1039**	**601**
	Spec. Power[e]	**2.27**	**2.27**	**2.19**	**2.18**	**2.33**
	Blower Speed (rpm)	**6200**	**5332**	**4464**	**2945**	**1860**

Notes:

a. Based on reference inlet conditions of pamb=14.7 psia, Tamb=68°F, RH=36%

b. Discharge pressure in -2 psig increments starting at max, rated operating pressure. To include 8 psig

c. Intermediate points at equal spacing between 100% and Min. Flow (see note d.)

d. Lowest Turned Down FAD

e. Specific power (kW /100 cfm) tolerance of +/- tolerance given by Table 2 in BL 300 unless "No Negative Tolerance" box is checked

f. Delivered air flow +/- tolerance given by Table 2 in BL 300 unless "No Negative Tolerance" box is checked

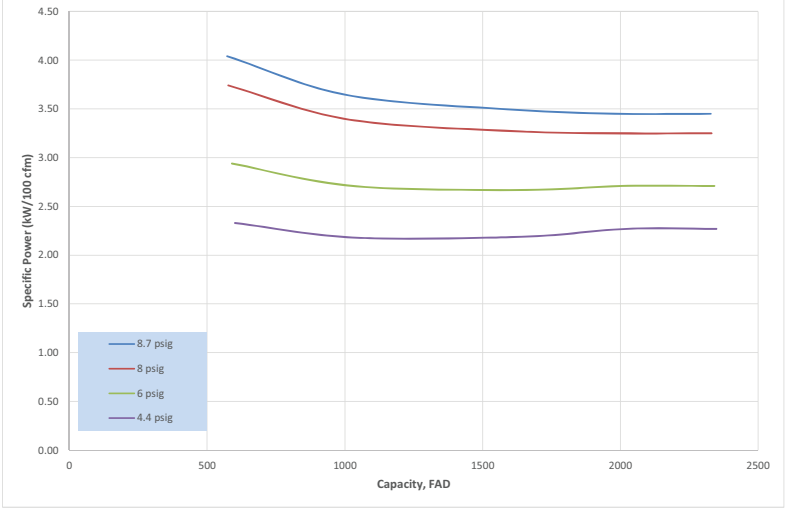

Table 2 from BL 300:	Delivered Air Flow at specifed conditions		Delivered Air Flow Rate	Specific Power Consumption	Discharge Pressure
	m³/min	ft³/min	%	%	%
	Below 0.5	Below 15	+/- 7	+/- 8	-0 / +1
	0.5 to 1.5	15 to 50	+/- 6	+/- 7	-0 / +1
	1.5 to 15	50 to 500	+/- 5	+/- 6	-0 / +1
	Above 15	Above 500	+/- 4	+/- 5	-0 / +1

Member CAGI Compressed Air & Gas Institute

BL 082 (US Units)
07/16 R5

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Variable speed CAGI data sheet

Technology Meets Tradition

Our compressed air heritage is built on a century of manufacturing experience. Generations of quality craftsmanship guide our engineering principles of efficiency, reliability, and serviceability.

This tradition of excellence also drives new technology development. Advances in airend design, controls, and system design ensure our customers can meet the daily challenges of their manufacturing operations.

Each Kaeser product is designed with the future in mind, but we never lose sight of our roots. Technology needs may change from year to year, but the need for quality and reliability will always remain.

KAESER COMPRESSORS

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