CAGI Data Sheets

An apples to apples performance comparison

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Comparing compressor performances across different manufacturers 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 compressors. 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.

MEMBER OF CAGI™ Compressed Air & Gas Institute

Performance Verification and 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 Rotary Compressor Performance Verification Program, rotary compressors are tested according to ISO 1217 (Annex C for fixed speed compressors and Annex E for variable speed compressors). There is a standard form for participating members to publish their compressor performance information and the values published on the form are then subject to third party testing and verification.

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 are a huge help in selecting the most energy efficient compressor. By standardizing the values recorded and how the measurements are taken, it is possible to make clear "apples to apples" 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 or "shows" how efficiently a compressor package produces compressed air. The lower the value, the more efficient the package is. This is a quick and easy way to see which compressor performs better at the stated conditions.

System Considerations

Finally, it is important to understand that while the efficiencies of individual compressors in a system are important, the overall efficiency of a compressed air system is usually more dependent on the sizing of the compressors and how they are controlled. Using the CAGI data sheets, you will find some compressors 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 compressor, 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 compressors 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**

Line 2: **General description of compressor type**

Model Number

Date

Air-cooled: Data should include power required by cooling fan.

Water-cooled: No cooling fan power required, but may require cabinet fan. Cooling water costs are not included.

Oil-injected

Oil-free

Type: Selectable from a drop-down list (Screw, Vane, Liquid Ring, or Other)

# of Stages: Single or multi-stage

Line 3: **Rated Capacity at Full Load 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 (ISO standard conditions) with the compressor operating at the rated pressure (again, measured at the terminal point of the package) stated on line 4. This takes into account all package air losses and pressure drops.

Line 4: **Full Load Operating Pressure:** The pressure at the terminal point of the package where the flow and power were measured.

Line 5: **Maximum Full Flow Operating Pressure:** The maximum pressure at which full flow can be maintained. It is usually the unload pressure set point for load/unload controls or the pressure at which modulation or other capacity control begins for other control schemes.

Line 6: **Drive Motor Nominal 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: **Drive Motor Nominal Efficiency:** The efficiency of the motor at the nameplate rating.

Line 8: **Fan Motor Nominal Rating (if applicable):** A nominal horsepower rating applied by the motor manufacturer. Applies to air-cooled machines and to vent fans on water-cooled machines if used.

Line 9: **Fan Motor Nominal Efficiency (if applicable):** The efficiency of the motor at the nameplate rating.

KAESER COMPRESSORS

KAESER COMPRESSORS

COMPRESSOR DATA SHEET
Rotary Compressor: Fixed Speed

MODEL DATA - FOR COMPRESSED AIR			
1	Manufacturer: **Kaeser Compressors, Inc.**		
2	Model Number: **CSD 60 - 125 psig / 460V/3ph/60Hz**	Date:	**12/3/2012**
	[X] Air-cooled [ ] Water-cooled	Type:	**Screw**
	[X] Oil-injected [ ] Oil-free	# of Stages:	**1**
3*	Rated Capacity at Full Load Operating Pressure [a, e]	**290**	acfm [a,e]
4	Full Load Operating Pressure [b]	**115**	psig [b]
5	Maximum Full Flow Operating Pressure [c]	**125**	psig [c]
6	Drive Motor Nominal Rating	**60**	hp
7	Drive Motor Nominal Efficiency	**93.6**	percent
8	Fan Motor Nominal Rating (if applicable)	**1.5**	hp
9	Fan Motor Nominal Efficiency	**85.5**	percent
10*	Total Package Input Power at Zero Flow [e]	**13.8**	kW [e]
11	Total Package Input Power at Rated Capacity and Full Load Operating Pressure [d]	**52.1**	kW [d]
12*	Specific Package Input Power at Rated Capacity and Full Load Operating Pressure [e]	**18.0**	kW/100 cfm [e]

*For models that are tested in the CAGI Performance Verification Program, these items are verified by the third party administrator.
Consult CAGI websitefor a list of participants in the third party verification program: www.cagi.org

NOTES:
a. Measured at the discharge terminal point of the compressor package in accordance with ISO 1217, Annex C; ACFM is actual cubic feet per minute at inlet conditions.
b. The operating pressure at which the Capacity (Item 3) and Electrical Consumption (Item 11) were measured for this data sheet.
c. Maximum pressure attainable at full flow, usually the unload pressure setting for load/no load control or the maximum pressure attainable before capacity control begins. May require additional power.
d. Total package input power at other than reported operating points will vary with control strategy.
e. Tolerance is specified in ISO 1217, Annex C, as shown in table below:

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Volume Flow Rate at specified conditions		Volume Flow Rate	Specific Energy Consumption	No Load / Zero Flow Power
m^3 / min	ft3 / min	%	%	
Below 0.5	Below 15	+/- 7	+/- 8	
0.5 to 1.5	15 to 50	+/- 6	+/- 7	+/- 10%
1.5 to 15	50 to 500	+/- 5	+/- 6	
Above 15	Above 500	+/- 4	+/- 5	

ROT 030

10/11 R8 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 data sheet

Line 10: **Total Package Input Power at Zero Flow:** This is commonly referred to as *unloaded* power. It is the power consumed by the compressor with the inlet valve closed and the sump pressure relieved to its lowest pressure required.

Line 11: **Total Package Input Power at Rated Capacity and Full Load Operating Pressure:** The complete input power requirement, in kW, of the compressor package when the compressor is running at the Rated Capacity listed in line 3 and the Full Load Operating Pressure listed in line 4.

This is the power the customer will have to provide to operate the compressor package at these conditions. It includes all efficiency, power factor, and accessory losses. When comparing these numbers between manufacturers, it is important to make certain that power consumption of remote cooler packages is included. Some manufacturers may not count remote cooling packages in this number. This may include remote-mounted air-cooled coolers and closed-loop water-cooling systems. Also, power should be measured on the supply side of remote-mounted variable frequency drive controls.

Line 12: **Specific Package Input Power at Rated Capacity and Full Load Operating Pressure:** The measure of how efficiently the compressor package produces compressed air. It is the power input divided by the flow in units of 100 cfm. A 563 cfm machine that requires 91.58 kW at the rated pressure would have a specific power of 16.3 kW/100 cfm (91.58 ÷ 5.63 = 16.3). Comparing specific power ratings allows users to determine which compressor delivers air at the lowest cost per cfm.

Variable Speed Units:

Line 1: **Name of the manufacturer**

Line 2: **General description of compressor type**

Model Number

Date

Air-cooled: Data should include power required by cooling fan.

Water-cooled: No cooling fan power required, but may require cabinet fan. Cooling water costs are not included.

Oil-injected

Oil-free

Type: Selectable from a drop-down list (Screw, Vane, Liquid Ring, or Other)

# of Stages: Single or multi-stage

Line 3: **Rated Operating Pressure:** The pressure at the terminal point of the package where the flow and power were measured.

Line 4: **Drive Motor Nominal 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 5: **Drive Motor Nominal Efficiency:** The efficiency of the motor at the nameplate rating.

Line 6: **Fan Motor Nominal Rating (If applicable):** A nominal horsepower rating applied by the motor manufacturer. Applies to air-cooled machines and to vent fans on water-cooled machines if used.

Line 7: **Fan Motor Nominal Efficiency:** The efficiency of the motor at the nameplate rating.

Line 8: **Input Power:** The complete input power requirement, in kW, of the compressor package when the compressor is running at the Capacity listed in line 8 and the Rated Operating Pressure listed in line 3. This is the power the customer will have to provide to operate the compressor package at these conditions. It includes all efficiency, power factor, drive, and accessory losses. When comparing these numbers between models, it is important to make certain that power consumption of remote cooler packages is included. Some manufacturers may not count remote cooling packages in this number. This may include remote-mounted air-cooled coolers and closed-loop water-cooling systems. Also, power should be measured on the supply side of remote-mounted variable frequency drive controls.

The data points are listed from maximum to minimum. A minimum of five points must be listed.

Capacity: The number of cfm measured at the

KAESER COMPRESSORS

COMPRESSOR DATA SHEET
Rotary Compressor: Variable Frequency Drive

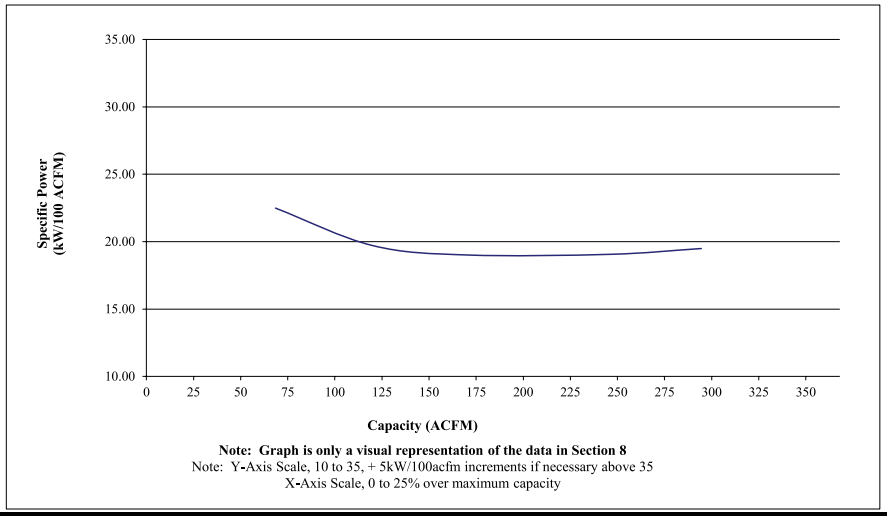
MODEL DATA - FOR COMPRESSED AIR

1	Manufacturer: **Kaeser Compressors, Inc.**		
2	Model Number: **SFC 45 - 125 psig / 460V/3ph/60Hz**	Date:	**12/3/2012**
	[X] Air-cooled [ ] Water-cooled	Type:	**Screw**
	[X] Oil-injected [ ] Oil-free	# of Stages:	**1**
3	Rated Operating Pressure	**125**	psig[b]
4	Drive Motor Nominal Rating	**60**	hp
5	Drive Motor Nominal Efficiency	**93.6**	percent
6	Fan Motor Nominal Rating (if applicable)	**1.5**	hp
7	Fan Motor Nominal Efficiency	**85.5**	percent

8*	Input Power (kW)		Capacity (acfm)[a,d]	Specific Power (kW/100 acfm)[d]
	57.4	Max	**295**	**19.49**
	46.8		**246**	**19.06**
	32.4		**171**	**19.01**
	23.7		**120**	**19.71**
	15.4	Min	**69**	**22.49**

9*	Total Package Input Power at Zero Flow[c, d]	**0.0**	kW

10



Note: Graph is only a visual representation of the data in Section 8
Note: Y-Axis Scale, 10 to 35, + 5kW/100acfm increments if necessary above 35
X-Axis Scale, 0 to 25% over maximum capacity

*For models that are tested in the CAGI Performance Verification Program, these items are verified by program administrator
Consult CAGI website for a list of participants in the third party verification program: www.cagi.org

NOTES:
a. Measured at the discharge terminal point of the compressor package in accordance with ISO 1217, Annex E; acfm is actual cubic feet per minute at inlet conditions.
b. The operating pressure at which the Capacity and Electrical Consumption were measured for this data sheet.
c. No Load Power. In accordance with ISO 1217, Annex E, if measurement of no load power equals less than 1%, manufacturer may state "not significant" or "0" on the test report.
d. Tolerance is specified in ISO 1217, Annex E, as shown in table below:
NOTE: The terms "power" and "energy" are synonymous for purposes of this document.

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Volume Flow Rate at specified conditions		Volume Flow Rate	Specific Energy Consumption	No Load / Zero Flow Power
m^3 / min	ft3 / min	%	%	
Below 0.5	Below 15	+/- 7	+/- 8	
0.5 to 1.5	15 to 50	+/- 6	+/- 7	+/- 10%
1.5 to 15	50 to 500	+/- 5	+/- 6	
Above 15	Above 500	+/- 4	+/- 5	

ROT 031

10/11 R7 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.

Variable speed data sheet

terminal point of the package, at an agreed upon set of standard inlet conditions (ISO standard conditions) with the compressor operating at the rated pressure (again, measured at the terminal point of the package) stated on line 3. This takes into account all package air losses and pressure drops.

The data points are listed from maximum to minimum. A minimum of five points must be listed.

Specific Power: This is the measure of how efficiently a compressor package produces compressed air. It is the power input divided by the flow in units of 100 cfm. A 563 cfm machine that requires 91.58 kW at the rated pressure would have a specific power of 16.3 kW/100 cfm (91.58 ÷ 5.63 = 16.3). Comparing specific power ratings allows users to determine which compressor delivers air at the lowest cost per cfm.

Line 9: **Total Package Input Power at Zero Flow:** This is commonly referred to as *unloaded* power. It is the power consumed by the compressor with the inlet valve closed and the sump pressure relieved to its lowest pressure required. A value of zero means that the compressor stopped the drive motor due to the unlimited starting capabilities of variable speed drives.

Line 10: **Performance Graph:** Graphical representation of the Specific Power and Capacity (line 8). The Y-Axis (specific power) has a scale of 10.00 - 35.00 with additional increments of +5 kW/100 cfm for values higher than 35.00. The X-Axis (capacity) has a scale of 0 to 25% over the maximum capacity.

The graph gives the performance curve which is useful in comparing overall performance and efficiency at a glance. The rules for scaling enable a fair comparison of graphs for similar sized compressors.