

Compressor Efficiency Calculator

How to assess your compressor efficiency?



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Compressor efficiency calculator

Flow calculation from process flow element

4

Based on the suction and discharge conditions below and gas composition, this tool calculates the compressor efficiency. The flow will be necessary to understand where your compressor operates on its map. It is also used for calculation of the gas you want to recalculate the flow from the flow element dp, please refer to next tab.

Enter your inputs

Calculate head and efficiency

Unit:

☒ Metric ☐ US

Gas Composition

100

Flow

Molar weight

3

Input the compressor flow.
Alternatively, you can recalculate the flow from the dp on the process flow orifice

Inlet conditions

Pressure

Temperature

Acid gas ☐

Outlet conditions

Pressure

Temperature

1

Fill the compressor parameters :

- Suction pressure and temperature
- Discharge pressure and temperature

C1 Methane

C2 Ethane

C3 Propane

iC4

nC4

iC5 i-Pentane

nC5 n-Pentane

nC6 n-Hexane

nC7 n-Heptane

nC8 n-Octane

nC9 n-Nonane

2

Get the gas composition



1

Get the compressor operating parameter from the OEM PLC, the DCS or the local gages, you will need to input:

- Suction pressure and temperature
- Discharge pressure and temperature
- Record also the compressor speed if you have a variable speed machine

The pressure and temperature shall be taken as close as possible to the machine to be able to compare the result with the flange to flange OEM data.

Strive to record those value in steady operating condition when the machine is up to temperature and valve (throttle and anti-surge) are not operating.

2

You have to get the gas composition as accurate as possible. The accuracy of the result highly depend on this. The ways to find the gas composition are:

- The OEM data sheet, if the operation is as per design. Note that this is rarely the case.
- A process simulation. Ask the process engineer to extract the latest gas composition from the process simulation
- Metering/chromatography. Pay attention that this shall be installed directly on the compressor without other means of separation in between (it would modify the gas composition).



3

In some case, you may get a flow measurement directly from the OEM panel or the DCS. Before you use this flow, you have to ensure that it is corrected for pressure and temperature and if the gas molar weight assumed for the calculation is still valid. If you are confident that this value is correct, populate it in the first tab flow section.

4

The most accurate method is the recalculation from the flow element dp. The tool proposes a flow calculation based on ISO 5267.

- Click on the tab
- Populate the details of the flow element.
- Enter the actual dp across the element
- Go back to the main tab to run the calculation

Compressor efficiency calculator
Flow calculation from process flow element
Results

Validate the check box if you want to calculate the flow from the flow element dp. The code used is:

☒ Calculate the flow from the dp read on flow orifice. You will need to provide the details of your fl

Flow element details

Location of the flow element At compressor suction

Type of flow element Flow orifice, dp taken at flange

Pipe diameter 300 mm

Flow element diameter 250 mm

Orifice dp readings 150 mbar

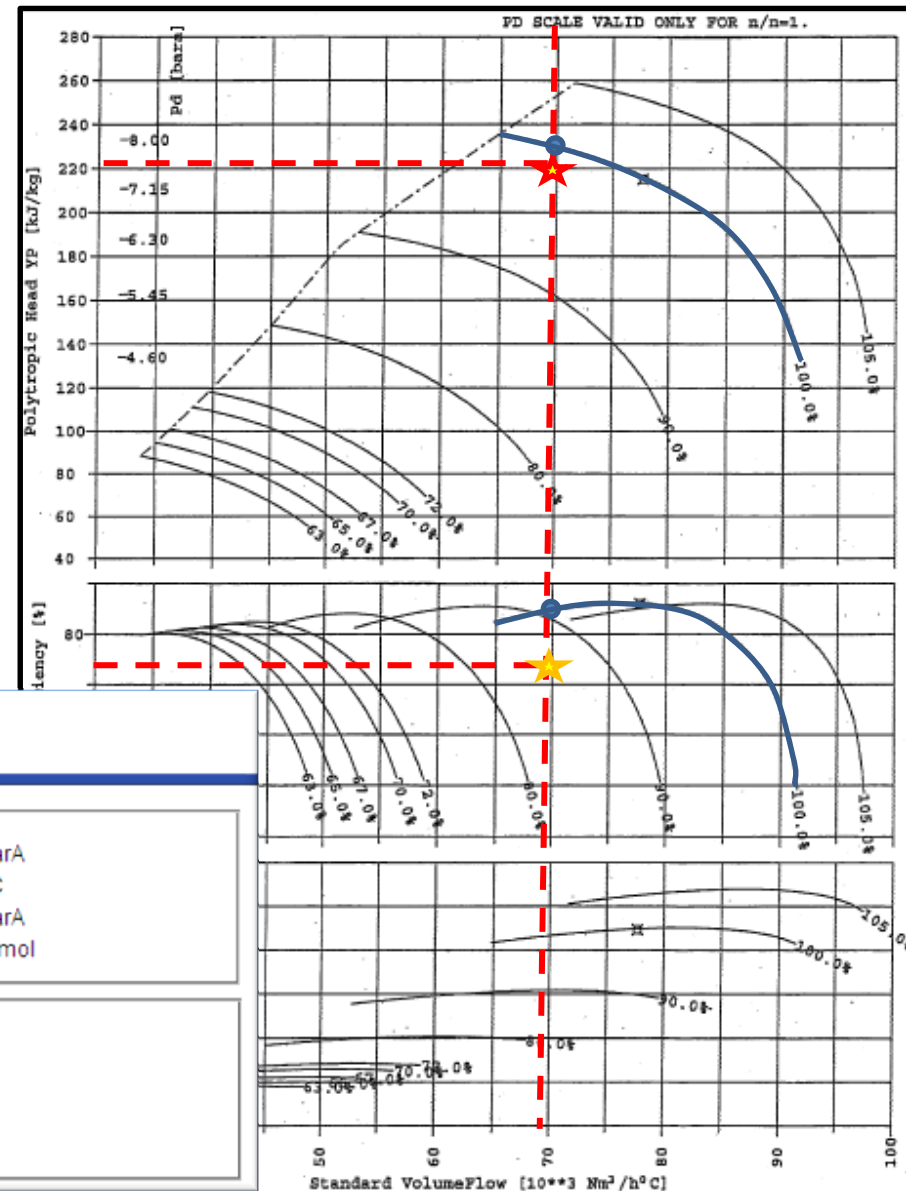
This is the differential pressure across the flow element.

Check the results with the OEM curves



- Run the calculation.
- Plot the head and efficiency against volume flow on your compressor curve.
- Compare these values with the expected values for the given running speed.

In this example, the compressor was running at 100% speed when the sample was taken so the efficiency is 6% below expected and head is 10 kJ/kg below expected.



Compressor efficiency calculator		Flow calculation from process flow element		Results	
Inputs					
Mass flow**:	97 050 kg/h	Suction pressure:	2 barA		
Normal flow**:	123 609 Nm³/h	Suction temperature:	30 °C		
Suction flow**:	69 413 m³/h	Discharge pressure:	7.34 barA		
		Molar weight:	17.6 g/mol		
Results					
Hp:	222 kJ/kg	★			
Efficiency:	76.7 %	★			
Gas Power:	7 793 kW **from the flow you have given				



- Don't use the compressor power from your compressor curves. It is likely to be irrelevant the gas specific gravity will be different from the one on the curve (your gas composition and operating parameters are different).
- You can however use the gas power to calculate the shaft end power and compare it with the actual mechanical power to confirm the consistency of the calculation.
- For the same reason, don't use the mass flow curves. Always compare volume flows.
- Compressor OEM may use equations that result in slightly different figure of efficiency and head. Run the calculation with the design figure first to see if you meet the OEM figures or if you need to offset them.

Help, questions, feedback, suggestion for improvement:

www.setMach.com

Email us at: selection@setmach.com

Or join our linked in group: http://www.linkedin.com/groups/Do-you-find-Compressor-Performance-4488172.S.5804618695896481794?trk=groups%2Finclude%2Fitem_snippet-0-b-ttl