

Compressor Screening Tool Overview

The compressor screening tool is based on the “Compressor Selection Chart” from the GPSA Engineering Data Book, Twelfth Edition, 2004. The chart shown in Figure 1 has been simplified so that it only includes screw, reciprocating, and centrifugal compressors. The actual screening tool can simultaneously evaluate eleven types of compressor designs.

To illustrate how compressors can be analyzed using the GPSA method, we have placed a star in Figure 1 at 250 acfm and 1050 psig to indicate where you would like your compressor to operate. For this example, it appears that either a single stage centrifugal or a multistage reciprocating compressor design could possibly work. After the calculated acfm flow and discharge pressure are evaluated, the screening tool then determines if the various compressor designs can also handle the required compression ratio. Those compressor designs making the final cut are listed as “possible fits.”

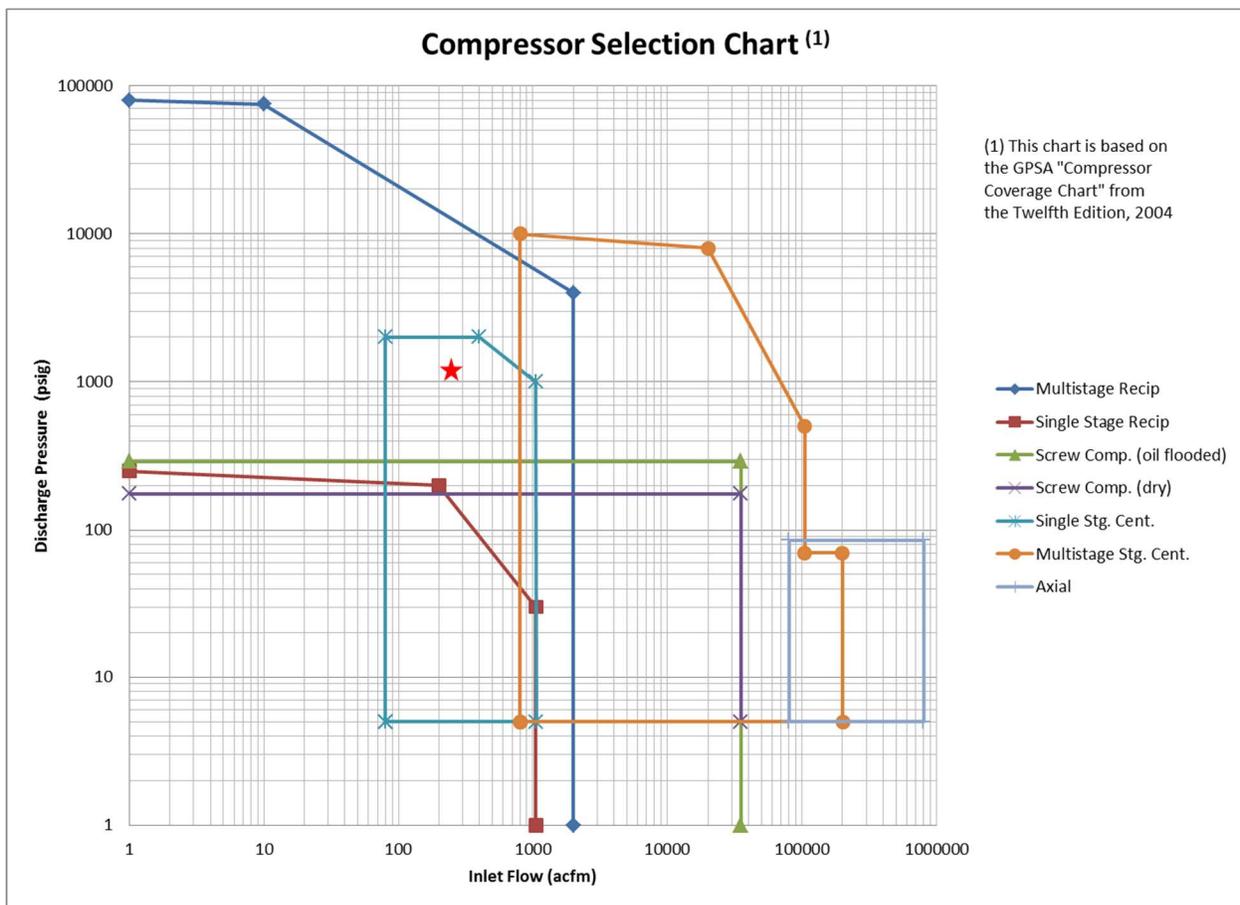


Figure 1: Compressor Selection Chart with an example application: 250 acfm with a discharge pressure of 1050 psig. Note: (1) Based on GPSA “Compressor Coverage Chart, Twelfth edition, 2004

Analysis Steps:

To use the screening tool, first enter:

1. Suction pressure (gauge)
2. Discharge pressure gauge
3. Design Flow (at Standard Conditions)
4. Suction Temperature
5. Z_{suction} (Compressibility Factor)

Compressor Screening Tool		
Step 1: Compressor Screening Tool		
1.1	Suction Pressure (gauge)	<input type="text" value="40"/> pound force/square inch ▾
1.2	Discharge Pressure (gauge)	<input type="text" value="100"/> pound force/square inch ▾
1.3	Design Flow (Standard)	<input type="text" value="36000"/> standard cubic feet/minute ▾
1.4	Suction Temperature	<input type="text" value="100"/> fahrenheit ▾
1.5	Zsuction (Compressability Factor)	<input type="text" value=".95"/>
Step 2: Solve		
2.1	Proof steps	<input checked="" type="checkbox"/> Show proof steps
2.2	Solve for Compressor	<input type="button" value="Compressor Screening Tool"/>

Next, press the “Compressor Screening Tool” button to get to the output screen.

Steps 1.1 through 1.6 determine 1) the design flow in actual cubic feet per minute and 2) the compression ratio.

Steps 1.8 through 1.17 list the various compressor types and if they are suitable for your service. In this example, a Multistage Compressor or Rotary Screw Compressor might work for your application.

Notice, that on the input screen (Step 1 page) you can choose from a number of unit types. This capability allows users to evaluate sets of English and Metric of data.

Here's the screen shot of the design flow in acfm and compression ratio calculations:

Step 1: Compressor Screening	
1.1	Determine Design Flow
$\text{Design Flow in ACFM} = \text{Design Flow SCFM} \times \frac{14.7}{520} \times \frac{(\text{Suction Temperature} + 460) \times Z_{\text{suction}}}{(\text{Suction Pressure} + 14.7)}$	
1.2	Determine Values
$\text{Design Flow in ACFM} = 36000 \times \frac{14.7}{520} \times \frac{(100 + 460) \times .95}{(40 + 14.7)}$	
1.3	Solve
$\text{Design Flow} = 9897.8484$	
1.4	Determine Compression Ratio
$\text{Compression Ratio} = \frac{Pd + 14.7}{Ps + 14.7}$	
1.5	Determine Values
$\text{Compression Ratio} = \frac{100 + 14.7}{40 + 14.7}$	
1.6	Solve
$\text{Compression Ratio} = 2.0969$	

Here's the compressor suitability screen shot:

1.7	Determine Single Stage Reciprocating Compressor
<i>Single Stage Reciprocating Compressor = Unsuitable</i>	
1.8	Determine Two Stage Reciprocating Compressor
<i>Two Stage Reciprocating Compressor = Unsuitable</i>	
1.9	Determine Three Stage Reciprocating Compressor
<i>Three Stage Reciprocating Compressor = Unsuitable</i>	
1.10	Determine Single Stage Centrifugal Compressor
<i>Single Stage Centrifugal Compressor = Unsuitable</i>	
1.11	Determine Multi Stage Centrifugal Compressor
<i>Multi Stage Centrifugal Compressor = Possible Fit</i>	
1.12	Determine Axial Compressor
<i>Axial Compressor = Unsuitable</i>	
1.13	Determine Rotary Screw Compressor
<i>Rotary Screw Compressor = Possible Fit</i>	
1.14	Determine Rotary Liquid Ring Compressor
<i>Rotary Liquid Ring Compressor = Unsuitable</i>	
1.15	Determine Diaphragm Compressor
<i>Diaphragm Compressor = Unsuitable</i>	
1.16	Determine Rotary Straight Lobe Compressor
<i>Rotary Straight Lobe Compressor = Unsuitable</i>	
1.17	Determine Rotary Sliding Vane Compressor
<i>Rotary Sliding Vane Compressor = Unsuitable</i>	