CASE STUDY

From 84% to 91.5% Utilization: Optimizing Fleet Efficiency for Higher Throughput

Continuously Optimizing Total Fleet Performance

The Mission:

Continuous optimization of the client's compressor fleet for maximum throughput and equipment utilization.

Background:

Maximizing the throughput of a compressor simply means maximizing the capacity of the compressor. In a competitive natural gas gathering application, maintaining the lowest suction pressure can provide a significant production advantage to any gas producer.

To maximize the throughput of a reciprocating compressor there are two concepts in play:

1. The gas must go through the first stage of a compressor to go through the rest of the unit; hence the importance of maximizing the capacity of the first stage cylinder(s). The capacity can be impacted by clearance devices such as Variable Volume Clearance Pockets (VVCP) or Fixed Volume Clearance Pockets (FVCP) that add clearance to the head end of a cylinder. Clearance can be added to the crank end of a cylinder by adding valve spacers under the valves. The running speed of the compressor and single acting the crank end or head end of a cylinder will also influence the capacity of the machine.

2. To increase the capacity of a compressor by increasing the suction pressure, which means that the suction pressure is dictated by the flow of the compressor, or vice versa. The loading curve shown in the figure below shows the optimized performance of a two-stage unit at a discharge pressure of 6000 kPag. The curve can be divided in three segments: the cylinder capacity, the knee and the power section.

Cylinder Capacity Section

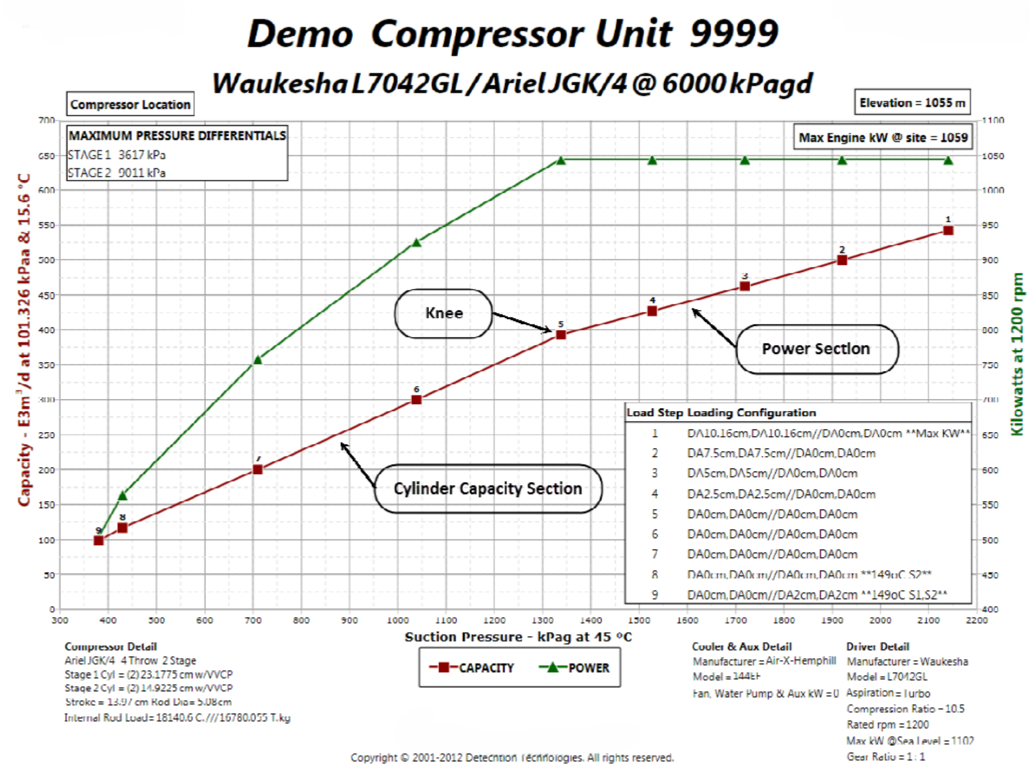
- Implies a cylinder capacity utilization of 100%, which means no clearance is added to the first stage cylinder(s) and the driver is running at maximum speed.
- Can be translated on to having the first stage cylinders double acted with no spacers, the VVCP or FVP fully closed and the driver speed set to the maximum.

Power Section

- Indicates horsepower utilization of 100%.
- In this portion of the curve, clearance devices are generally used to unload the driver and this is translated as an increased capacity while maintaining the horsepower usage to the maximum.

Knee

- The only point on an optimized loading curve where the cylinder capacity utilization and horsepower used is at 100%.

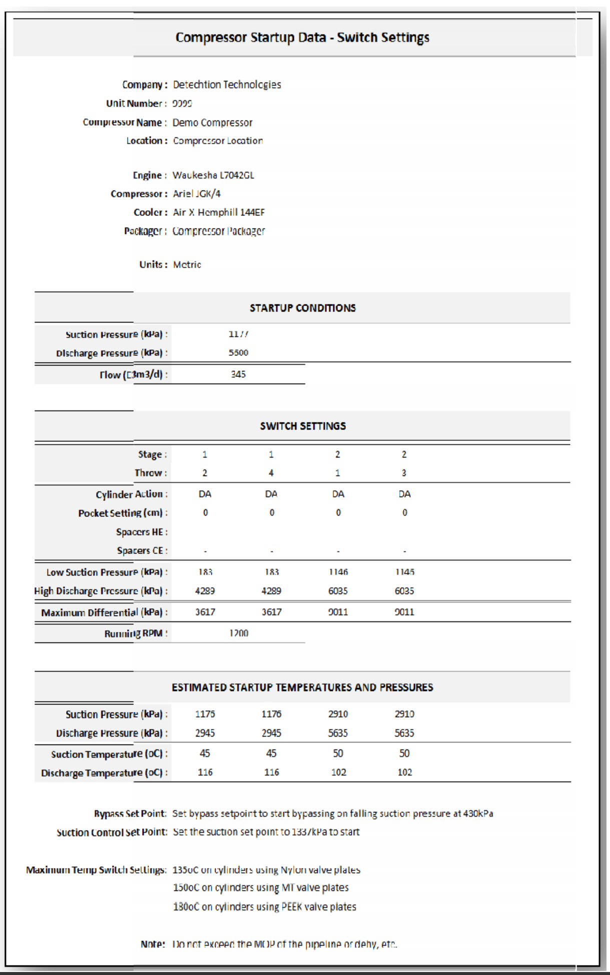


For a reciprocating compressor to be fully optimized for maximum throughput, either or both the cylinder capacity utilization and the horsepower utilization should be at 100%.

By using compressor performance curves, such as the one above, and a Detechtion Technologies Start-up Package of high- and low-pressure trip-points, shown on the right, compressor units can be evaluated for opportunities to:

- Increase running speed
- Reduce added cylinder clearance
- Optimize suction pressure
- Decrease recycle set point

Thus, resulting in increased utilization and maximizing throughput.



Compressor Startup Data - Switch Settings

Company : Detechtion Technologies
Unit Number : 9999
Compressor Name : Demo Compressor
Location : Compressor Location

Engine : Waukesha L7042GL
Compressor : Ariel JGK/4
Cooler : Air X Hemphill 144EF
Packager : Compressor Packager

Units : Metric

STARTUP CONDITIONS

Suction Pressure (kPa) :	1177
Discharge Pressure (kPa) :	5500
Flow (E3m3/d) :	345

SWITCH SETTINGS

Stage :	1	1	2	2
Throw :	2	4	1	3
Cylinder Action :	DA	DA	DA	DA
Pocket Setting (cm) :	0	0	0	0
Spacers HE :				
Spacers CE :	-	-	-	-
Low Suction Pressure (kPa) :	183	183	1146	1145
High Discharge Pressure (kPa) :	4289	4289	6035	6035
Maximum Differential (kPa) :	3617	3617	9011	9011
Running RPM :	1200			

ESTIMATED STARTUP TEMPERATURES AND PRESSURES

Suction Pressure (kPa) :	1175	1176	2910	2910
Discharge Pressure (kPa) :	2945	2945	5635	5635
Suction Temperature (oC) :	45	45	50	50
Discharge Temperature (oC) :	116	116	102	102

Bypass Set Point: Set bypass setpoint to start bypassing on falling suction pressure at 430kPa
Suction Control Set Point: Set the suction set point to 1337kPa to start

Maximum Temp Switch Settings: 135oC on cylinders using Nylon valve plates
150oC on cylinders using MT valve plates
180oC on cylinders using PEEK valve plates

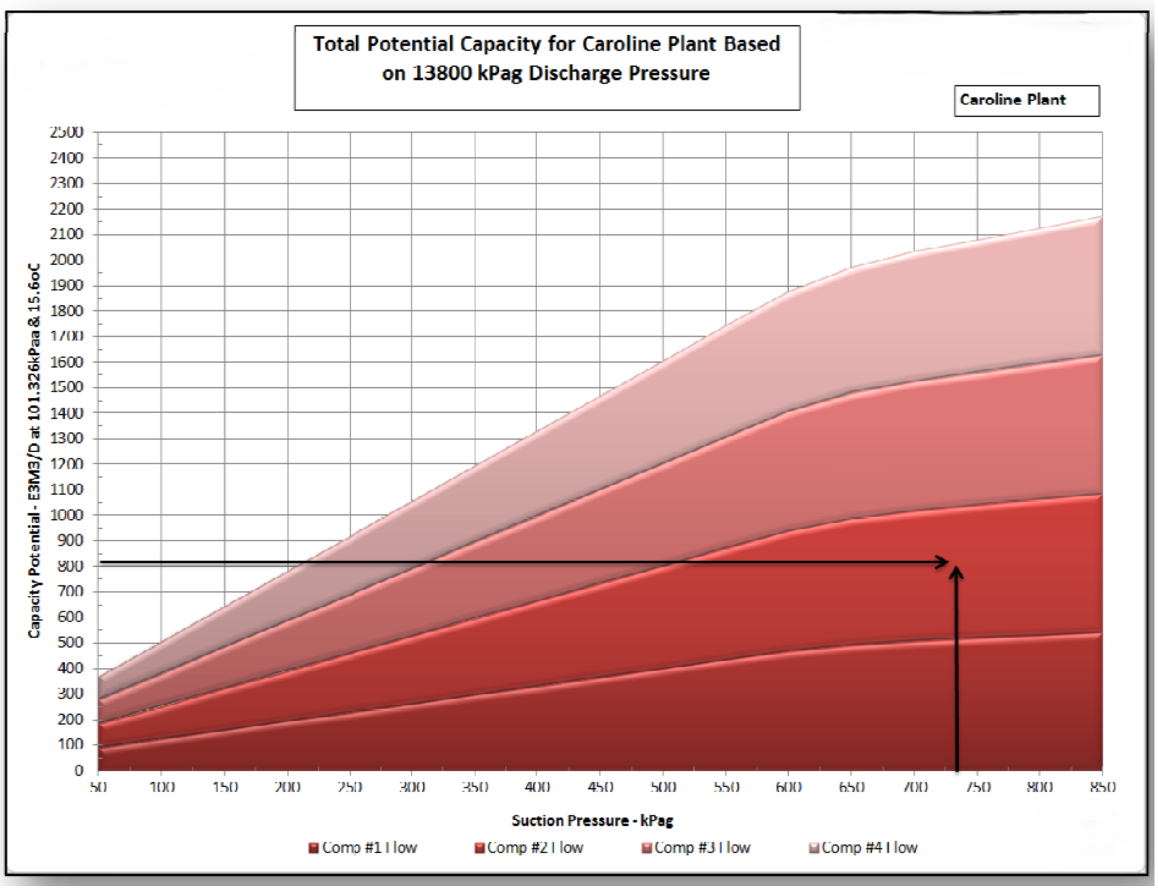
Note: Do not exceed the MOP of the pipeline or dehy, etc.

Essential to total fleet optimization is the ability to look at the capacity and throughput requirements of an entire compressor station.

Detechtion Technologies' Plant Capacity Curves provide an easy way to identify:

- Expected compressor station suction pressures
- Excess capacity for incremental production
- Required number of operating units

The Plant Capacity Curve below shows an example where the client requires the ability to flow 815e3m3/d at a suction pressure no less than 730kPag. The curve shows that only two units are required when configured correctly.



As fields fluctuate and, over time, decline, compressor optimization must be done on a regular basis in order to continue increasing overall fleet utilization and maximizing throughput.

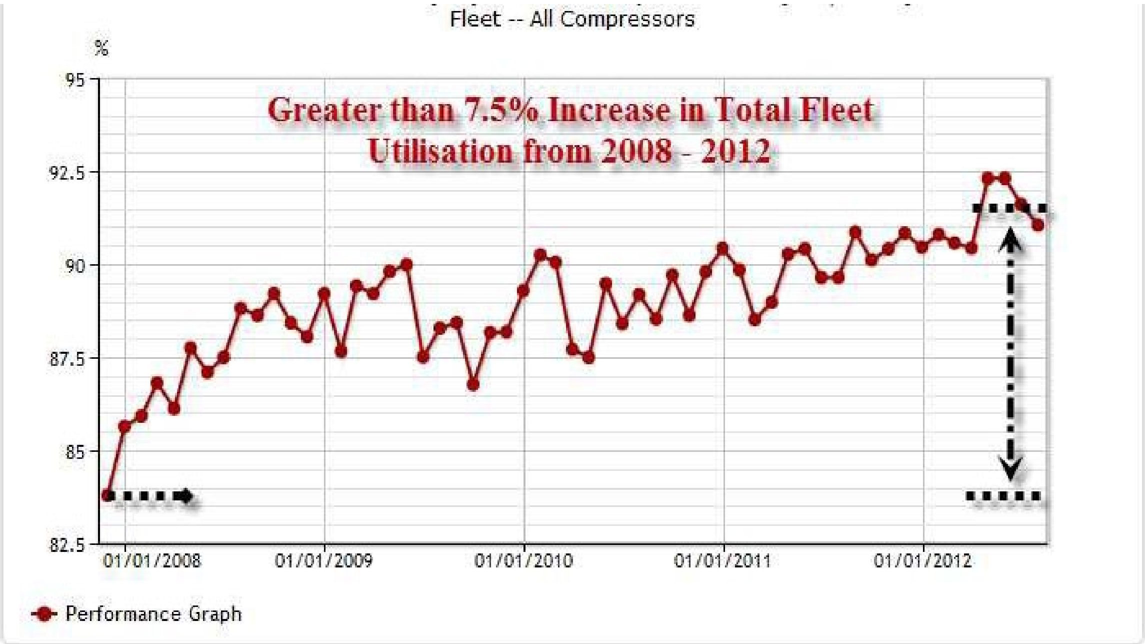
The Solution:

Compressor performance is tracked within Detechtion Technologies' Analysis system every time a compressor's operating data is entered to generate an Analysis performance report. Clients, therefore, can track and report compressor fleet performance and various other parameters via Fleet Management Reports and Tools within Analysis.

The Performance Graph in Analysis graphs the average performance (compressor flow divided by the total potential flow) of the compressor in a certain region over a period of time. This graph is, therefore, a direct indication of the utilization of the compressor, as determined by the greater of the power utilization and the cylinder capacity utilization and allows the client to identify the regions where production is not optimized.

The Impact:

The graph shown below represents the performance for the entire compressor fleet of a long term Detechtion client from the start over a period of 4 years. The graph shows a continuous improvement in compressor fleet performance over the last four years and a total, fleet-wide performance improvement of more than 7.5%.



What is the value of 7.5% increase in total fleet performance?

In the case of this client, with a compressor fleet of well over 100 operating units and more than 150,000KW, **7.5% could represent 11,250KW of power used more effectively.**

Alternatively, with a reported daily throughput of more than 30,000e3m3/d, **7.5% could represent 2,250e3m3/d of increased potential production.**

About Detechtion:

Detechtion Technologies is a leader in optimizing remote assets for the Oil and gas industry. Our purpose-built solution delivers asset performance management to help you increase production, reduce risk, improve sustainability and reduce operating expenses. Our cloud-based, asset-specific solutions, are built on digital twins and leverage data analytics to provide a complete IIoT solution with autonomous edge capabilities. Over 100 organizations have trusted Detechtion to help them reduce their operating expenses, make more informed decisions, better manager field activities and reduce risk all while maintaining compliance.