# Optimizing Gas Compressor Performance in Natural Gas Gathering Systems

**Gas Compression Article | Brahma Compression**

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# Optimizing Gas Compressor Performance in Natural Gas Gathering Systems

## Overview

This article provides the key factors affecting the performance of rotary screw gas compressor packages in natural gas gathering systems.

## The Challenge in Natural Gas Gathering Systems

If there is one thing that is common in operating a gas well for natural gas gathering, it is that the conditions are likely to change. In time, the suction pressures to the gas gathering compressor are likely to decrease as the well pressure drops, while the line pressures might increase as other wells are brought online and produce into the same system.

The result of these changes in operating conditions can have a significant impact on the performance of your compressor. The compressor could experience a number of operational issues, like reduced flow rates, or lack of available horsepower to overcome the higher compression ratio required. If these changes in operating conditions take place in your natural gas gathering system over an extended period of time, your gas production could be declining unnecessarily.

## The Solution to Increase Your Natural Gas Production

When your operating conditions change, there are a few simple things you can do to ensure your compressor maintains the best performance and production possible. The following will help provide an explanation of the key factors affecting the flow rate of your screw compressor package within your gas gathering system.

**1. Speed is the critical factor in rotary screw compressor performance.**

A rotary screw compressor is a positive displacement compressor. Which is another way of saying that the more often you "displace" the volume of gas within the compression chamber (speed) the greater the volume of gas that is produced (flow rate). In the case of a screw compressor, the speed of the screw determines the volume of gas it displaces and its resulting flow.

**Effect of screw compressor speed on flow rate (example only)**

| | Screw Compressor Speed: 1800 rpm | Screw Compressor Speed: 3600 rpm |
|---|---|---|
| **Suction Pressure** | 10 psig | 10 psig |
| **Discharge Pressure** | 100 psig | 100 psig |
| **Flow Rate** | 10 $e^3m^3/d$ | 20 $e^3m^3/d$ |

The faster the speed of the screw compressor, the more gas is displaced and produced. The limiting factors being, (a) the maximum design speed for the compressor, and (b) the available horsepower in which to produce the gas. Since more gas production requires more horsepower, the available horsepower from the driver (engine or electric motor) can limit the speed in which to operate the compressor.

**2. The speed of your compressor needs to change with your operating conditions.**

Let's use the example below to illustrate the importance of screw compressor speed on the performance of a gas compressor package for natural gas gathering.

| **Design Conditions** | |
|---|---|
| Suction Pressure | 10 psig |
| Discharge Pressure | 100 psig |
| Available Engine HP | 90 bhp |
| Screw Compressor Diameter | 177 mm |
| Screw Compressor Speed | 1800 rpm |
| Flow Rate at 1800 rpm | 10 $e^3m^3/d$ |
| Actual BHP requirements at 1800 rpm | 70 bhp |

In this example, the screw compressor is operating at 1800 rpm (the same speed as the engine), with a suction pressure of 10 psig, and a discharge pressure of 100 psig. The screw compressor is coupled to an engine with 90 bhp available. With this screw compressor rotating at 1800 rpm, at these operating conditions, it is "displacing" 10e3m3/d of gas. The amount of energy required to displace this volume of gas is 70 bhp. However, there is 90 bhp available at the engine. Which means, an additional 20 bhp of energy is available in which to produce even more natural gas into your gathering system. The question is, how do you optimize your natural gas production and take advantage of the additional 20 bhp of un-utilized energy and production?

The additional 20 bhp can be utilized to increase your natural gas production by increasing the speed of the screw compressor, thereby increasing the volume of gas it is displacing. We said earlier in this paper that, "the more often you 'displace' the volume of gas within the compression chamber (speed) the greater the volume of gas that is produced (flow rate)". In this example, by increasing the screw compressor speed from 1800 rpm to 2100 rpm, the screw compressor is displacing a greater volume of gas (and consuming additional horsepower). The gas production is increased from 10 e3m3/d to 13 e3m3/d (a 30% increase in flow). The chart below illustrates this.

| **Design Conditions** | |
|---|---|
| Suction Pressure | 10 psig |
| Discharge Pressure | 100 psig |
| Available Engine HP | 90 bhp |
| Screw Compressor Diameter | 177 mm |
| Screw Compressor Speed | 2100 rpm |
| Flow Rate at 1800 rpm | 13 $e^3m^3/d$ |
| Actual BHP requirements at 1800 rpm | 87 bhp |

By increasing the speed of the screw compressor from 1800 rpm to 2100 rpm the installed gas compressor increased is flow rate by 30%, and optimized the available bhp available.

**3. The speed of the screw compressor is adapted by internal gears.**

Since the speed of the screw compressor plays an import role in optimizing the production of gas in your natural gas gathering system, it is important to ensure you purchase or rent a gas screw compressor package with internal gears that can be easily changed. The internal gears in a screw compressor make it possible to adapt the speed of the screw compressor to virtually any range of operating conditions.

In conclusion, when operating a gas screw compressor package in a natural gas gathering system, you can improve your natural gas production by developing a close relationship with a supplier who is knowledgeable and able to help you optimize the performance of your gas compressor package, including performing gas screw compressor optimization services.