SERVICE PROFILE

General Nitrogen Services

Overview

Nitrogen gas is one of the primary products in the Oil & Gas industry, from the initial drilling of the well to the delivery of the finished product via pipeline, truck, and train to the end user. As a naturally occurring inert gas, nitrogen can safely be used for a multitude of services in the energy industry. It has properties that make it an ideal tool for use in the energy industry; it is inert, nonreactive, nontoxic, and noncorrosive.

Nitrogen services can be in a variety of methods: shipped as a cryogenic liquid, compressed as a dry gas, or filtered from the atmosphere on site using a nitrogen membrane unit. It can be delivered at temperatures ranging from -196 to +400˚C and pressures starting at atmospheric and up to 10,000 psi. Recent developments also allow for the use of nitrogen filtering membranes to become an accepted method of gas delivery.

Sample Nitrogen Purge Calculations

The following equation demonstrates how hydrocarbon concentration can be reduced to less than 2.0% by volume in three pressurizing cycles:

$$\text{Final Concentration (\%)} = \frac{\text{Initial Concentration (\%)}}{CP^N}$$

Where:
Initial Concentration = 100%
CP (Cycle Pressure) = 3 bar (gauge) or 4 bar (absolute)
N (# of Cycles) = 3

$$\textbf{Final Concentration (\%)} = \frac{100}{4\ \text{bara}^{N\ (\text{number of cycles} = 3)}}$$

$$\textbf{Final Concentration (\%)} = \frac{100}{4 \times 4 \times 4}$$

$$\textbf{Final Concentration (\%)} = \frac{100}{64} = \textbf{1.56\%}$$

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Nitrogen Purging & Displacement (LEL & Oxygen Freeing)

Nitrogen purging services are essential when the required nitrogen supply exceeds a plant's ability to maintain the high flow rate often required during shutdowns and various other maintenance activities. Nitrogen purging is highly effective for pipeline purges, product displacement, and process pipeline inerting. Our engineers can develop the most effective and efficient purging techniques for any plant or pipeline environment.

Theoretical Concentrations for Pressure Cycle Purging to Reduce Oxygen Content

Pressure (barg)	1 cycle	2 cycle	3 cycle	4 cycle
20	4.70%	0.20%	— —	
15	6.25%	0.39%	—	
10	9.09%	0.82%	0.07%	
5	16.67%	2.78%	0.46%	
4	20.00%	4.00%	0.08%	
3	25.00%	6.25%	1.56%	0.39%
2	33.30%	11.10%	3.70%	1.20%
1	50.00%	25.00%	12.50%	6.25%

FourQuest Energy can design custom procedures for the removal of unwanted atmospheres by nitrogen purging, including the removal of hydrocarbons, oxygen, and other types of toxic or reactive gases. Our engineers will determine the optimum rate, temperature, and volume required to remove unwanted products in the safest and most efficient way possible. Because nitrogen is inert, it will not support combustion. Therefore, once a system has been purged using nitrogen, there is no risk of ignition within that system or pipeline. The nitrogen atmosphere reduces the corrosion caused by oxidation, making it ideal for preserving piping for prolonged periods without use.

Nitrogen Helium Leak & Ultrasonic Leak Detection

Helium leak detection involves pressurizing a system with a mixture of nitrogen and ~1% helium. Our qualified technicians then probe each potential leak with highly sensitive helium detection equipment. This process is extremely effective for identifying and quantifying leak rates prior to the introduction of volatile products to the system.

An alternative to helium leak detection is the use of ultrasonic leak detection equipment. In this procedure, the system is pressurized and inspected with extremely sensitive ultrasonic equipment that detects the sound created by a leak on a flange. While it is very effective for identifying leaks, this process cannot be used for quantifying the leak rate.

Nitrogen Drying and Preservation

Nitrogen gas provided by FourQuest Energy nitrogen pumping equipment provides 99.99% pure nitrogen with a dew point of -70˚C. This clean, extremely dry gas is effective for drying out any pipeline or process system. When combined with high temperatures, the drying time to achieve the required dew point is significantly reduced compared with conventional drying methods.

EDMONTON, AB
9304 39 Avenue Northwest
Edmonton, AB T6E 5T9
Office: +1 780-485-0690

CALGARY, AB
Suncor Energy Centre, West Tower
#5100, 150 6th Avenue, S.W.
Calgary, AB T2P 3Y7
Office: +1 403-538-2140

FORT MCMURRAY, AB
136 Macmillan Road
Fort McMurray, AB T9H 5L4
Office: +1 780-750-2829

FORT ST. JOHN, BC
Graywest Office Centre Ltd.
10704 97 Avenue
Fort St. John, BC V1J 6L7
Phone: +1 250-785-1706

Connect with us:

fourquest.com