



Replace Gas Starters with Air or Nitrogen



Technology/Practice Overview

Description

In the natural gas industry, internal combustion engines for compressors, generators, and pumps are often started using small gas expansion turbine motor starters. High-pressure natural gas is stored in a volume tank while a compressor is running. The pressurized gas is expanded across the starter turbine, initiating startup of the engine, and then vented to the atmosphere. In addition to the vented emissions, natural gas leakage from the volume tank also leads to significant losses.

Partners have found that replacing the natural gas with compressed air or nitrogen for engine starting can reduce methane and volatile organic compounds (VOCs) emissions. This practice simply fills the startup volume tank with

compressed air or nitrogen as necessary to support the frequency of engine startups. No facility changes are necessary except a high-pressure air or nitrogen fill connection.

Operating Requirements

A stationary or mobile air compressor is required for this practice.

When using air/nitrogen as the startup gas, either the high-pressure startup gas system must be very tight (no leakage) or air/nitrogen re-supply made just prior to startups to ensure an adequate volume of high-pressure air/nitrogen. Re-supply of compressed air/nitrogen must be arranged on a schedule coinciding with engine startup frequency.

Applicability

This practice is applicable to all compressors with natural gas expansion

- Compressors/Engines
- Dehydrators
- Directed Inspection & Maintenance
- Pipelines
- Pneumatics/Controls
- Tanks
- Valves
- Wells
- Other

Applicable Sector(s)

- Production
- Processing
- Transmission
- Distribution

Other Related Documents:

Reduce Gas Venting with Fewer Compressor Engine Startups & Improved Engine Ignition, PRO No. 102

Install Electric Compressors, PRO No. 103

Install Electric Motor Starters, PRO No. 105

Economic and Environmental Benefits

Methane Savings

Estimated annual methane emission reductions *1,356 Mcf per compressor unit*
(Assumes 10 engine startups per year)

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost ¹	Payback (months)
\$7.00/Mcf	1,356 Mcf	\$10,100	\$500	\$500 \$250	1-2 Month
\$5.00/Mcf	1,356 Mcf	\$7,200	\$500	\$500 \$250	2 Months
\$3.00/Mcf	1,356 Mcf	\$4,300	\$500	\$500 \$250	3 Months

* Whole gas savings are calculated using a conversion factor of 94% methane in pipeline quality natural gas.

¹ Incremental operating cost is \$500 if using compressed air, and \$250 if using compressed nitrogen.

Additional Benefits

- Reducing methane emissions is a primary justification for the project
- Reducing VOC emissions
- Operations and maintenance cost savings
- For nitrogen, reduced gas starter corrosion and maintenance costs

Replace Gas Starters with Air or Nitrogen (Cont'd)

turbine motor starters. This opportunity is highly cost-effective when there is an existing compressed air system onsite or a pressurized nitrogen stream from an onsite nitrogen rejection unit (NRU).

Methane Emissions

The methane emissions savings are based on 10 compressor startup attempts using factors found in Perry's Chemical Engineers' Handbook, Sixth Edition, (p. 24-15) of 0.5 scf of gas per HP at 250 psig stored to operate the starting motor. The EPA/GRI Study, "Methane Emissions from The Natural Gas Industry" Volume 8, reported 1,341 Mcf per year leakage from compressor starter open-ended lines. Blowdown valves of a size and pressure differential similar to the gas shut-off valve on the volume tank leak up to 150 scf per hour or 1.3 MMcf per year.

Conversion to nitrogen or air completely eliminates the venting of methane to the atmosphere and the leakage of methane through the gas shut-off valve. Typical production site compressor engine startups vent 1 to 5 Mcf of gas with each attempt, while field engines often require multiple attempts. Using compressed air, one Partner reported methane savings of 500 Mcf per year for multiple applications.

Economic Analysis

Basis for Costs and Savings

Reported methane emissions savings of 1,356 Mcf per year apply to one 3,000-horsepower reciprocating compressor that requires 10 startups per year. The compressor starter open-ended line is assumed to have average leakage. The same volume of emissions are avoided using the existing compressed air system or a nitrogen stream from an onsite NRU.

Discussion

Replacing gas starters with air or nitrogen can result in quick payback and the primary benefit is to save methane emissions. The capital cost is the installation of piping between an existing air compressor or NRU and the starter is assumed to be incremental to the cost of the existing equipment (air compressor already used for pneumatic controls or existing NRU). Operating cost includes the electrical power needed to compress the air.

Associated benefits from these opportunities include reduced VOC emissions and reduced gas starter corrosion and maintenance costs when replacing the use of sour gas with nitrogen or compressed air.

Methane Content of Natural Gas

The average methane content of natural gas varies by natural gas industry sector. The Natural Gas STAR Program assumes the following methane content of natural gas when estimating methane savings for Partner Reported Opportunities.

Production	79 %
Processing	87 %
Transmission and Distribution	94 %