Reviewers Note: Words/phrases in blue will be links to specific diagnostic procedures when this document is published in Freshdesk.

# CNG Cylinder Product Description and Operation Manual

# PDO.0033 Ver. 3.0 April 25, 2023

## Introduction

### About this Manual

This manual contains specific information pertaining to the characteristics and operation of Type 4 compressed natural gas (CNG) cylinders designed and manufactured by Hexagon® Agility®.* It should not be applied to cylinders made by other manufacturers.

It is the responsibility of the vehicle OEM or third party installer to provide this manual to the appropriate personnel and to ensure its accessibility. Appropriate personnel includes, but is not limited to, those who are responsible for the handling, installation, operation, maintenance, and inspection of the cylinders.

A thorough understanding of the information provided in this manual is required for the safe operation of the product. If further information is needed or questions arise, contact Hexagon Agility.

This document contains material from the Hexagon Agility ENP-558 Cylinder Inspection Manual which it supersedes.

*Hexagon Agility endeavors to maintain a comprehensive and accurate product and service information. We reserve the right to make changes at any time to manuals and other materials. Please contact Hexagon Agility FleetCare to ensure you have the latest version.*

*Applies to cylinders labeled under Agility Fuel Solutions, Hexagon Lincoln, and Lincoln Composites

## Safety

### In Case of Emergency

**WARNING**

**In the event of an emergency, call 9-1-1, and evacuate the area.**

Information for first responders may be found in Hexagon Agility publication ENP-084.

### General Safety Precautions

Always use proper personal protective equipment (PPE) when working on CNG cylinders, fuel systems, and vehicles.

Required PPE includes but is not limited to the following items:

1. safety glasses
2. hard hat
3. work gloves
4. *When specified:* nitrile or latex gloves
5. steel-toed shoes
6. high-visibility vest
7. fall arrestment harness

### Warning Messages and Symbols Used in this Document

**WARNING**

**WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.**

**CAUTION**

**CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**

***NOTICE***

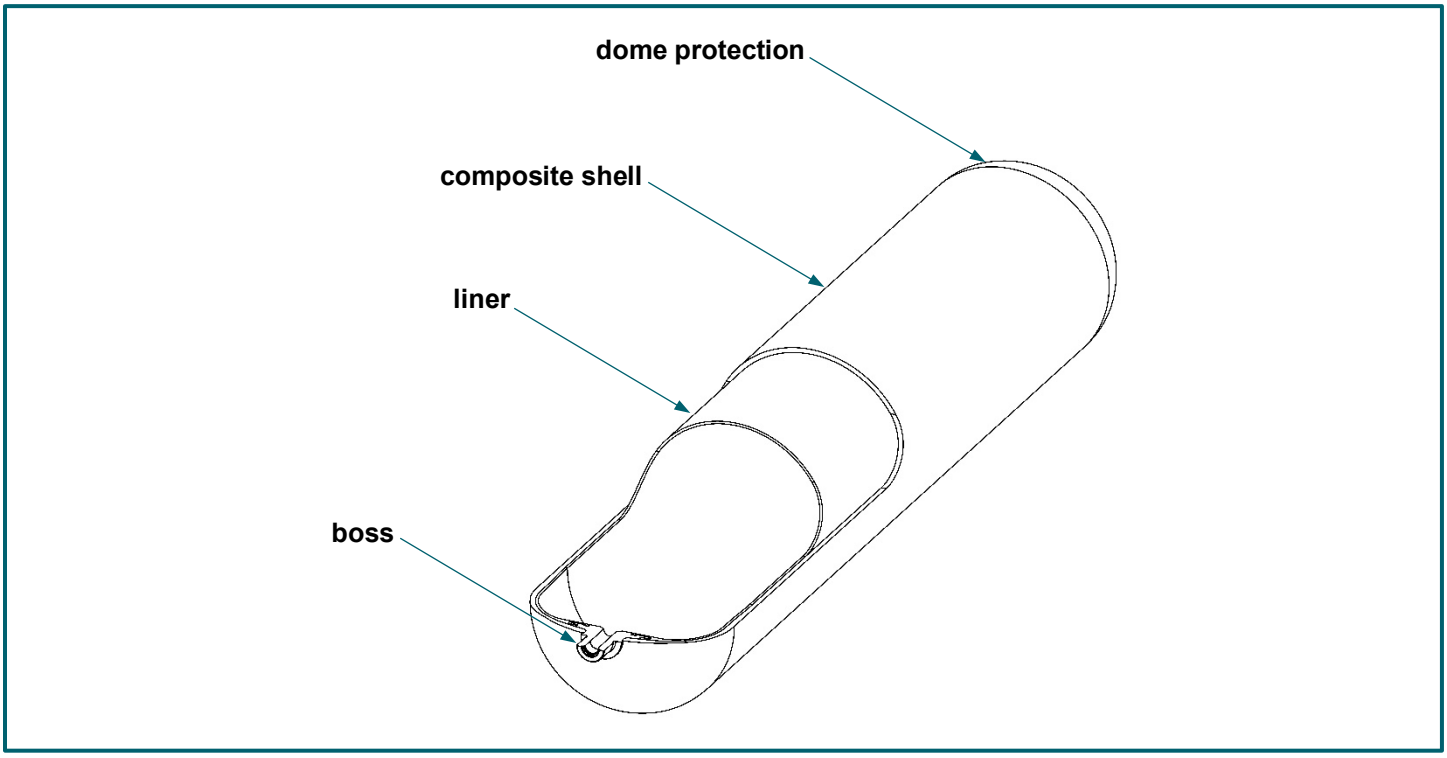
***NOTICE* is used to address practices not related to physical injury, such as best practices or tips to help an operation or procedure go smoothly and prevent equipment damage.**

## Description

Hexagon Agility cylinders are designed to be robust and reliable for the entirety of their service life. As such, they require relatively low maintenance.

### Cylinder Construction

Hexagon Agility Type 4 cylinders are made by winding composite over a polymer liner with metallic end bosses.




Hexagon Agility Type 4 cylinder cutaway showing components

### Cylinder Envelope

Each cylinder requires a certain amount of space for production variation and expansion due to pressurization. The envelope requirement for a particular cylinder may be found in the Hexagon Agility Design Parameters (DP) document.

### Application

For storage of compressed natural gas (CNG) in vehicular applications.

## Cylinder Design Codes

Hexagon Agility designs and manufactures cylinders to the requirements of 49 CFR §571.304 (FMVSS 304), CSA/ANSI NGV 2, ECE R110, and ISO 11439. Every cylinder is marked with the code for which it is certified.

## Valves and T-PRDs

Hexagon Agility performs a thorough evaluation of valves and thermally-activated pressure relief devices (T-PRDs) to determine which devices are best suited for cylinders it manufactures. Only approved valves and T-PRDs are to be used. Hexagon Agility Statement of Service document defines the approved list of T-PRDs and valves for each cylinder, along with their acceptable positioning.

## Mounting Hardware

Hexagon Agility cylinders are designed to be secured using straps, or—for cylinders with end mounting features—fixed and sliding end mount blocks.**

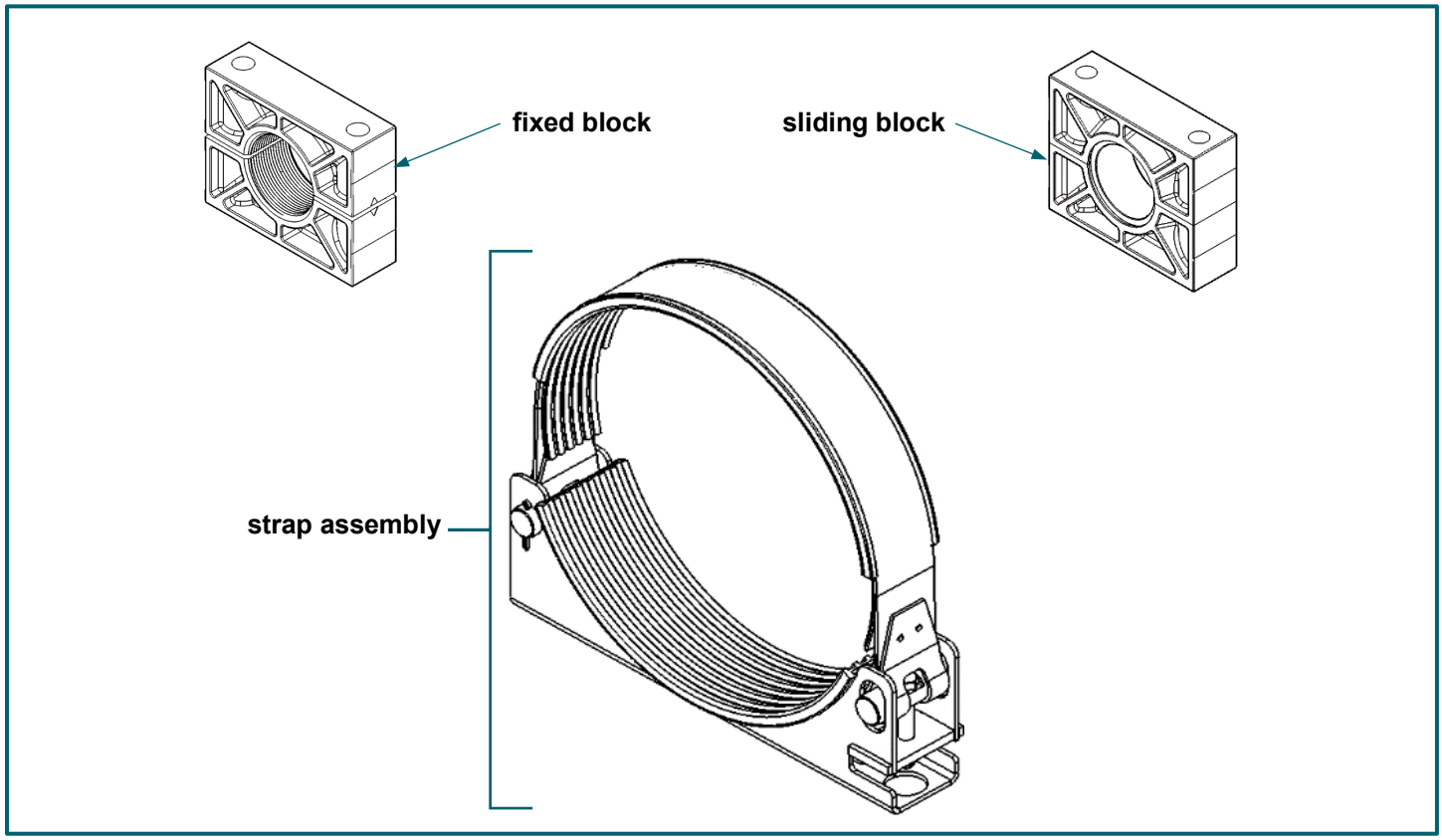



**Figure 2.** Hexagon Agility cylinder mounting types

Hexagon Agility does not prohibit the use of customer sourced mounting hardware; however, the customer assumes full responsibility and liability for design selection. Customer designed or purchased hardware must account for assembly tolerances, compliance of the supporting structure under the full range of vehicle motion, temperature effects and weathering, and cylinder expansion with pressure.

***NOTICE***

**Clearance must be maintained between cylinders and vehicle components and accessories and fuel system components. Hexagon Agility recommends that any customer sourced mounting hardware be able to withstand a 20*g* load in any direction.**

**Contact Hexagon Agility for approved hardware.

# Operation

## Service Conditions

The rated pressure, temperature, and service life of the cylinder varies based upon the design code used and intended application. This information is provided on the cylinder DP.

## Gas Composition

CNG composition requirements are specified by the applicable cylinder code.

## Filling

**CAUTION**

**Exercise care not to fill cylinders with liquid methane which can form from a high-pressure cascade system in cold conditions.**

Hexagon Agility cylinders may be filled without flow restrictions when the ambient temperature is above 10°F (-12°C), or the cylinder is at a pressure greater than 100 psi (7 bar).

***NOTICE***

**If a cylinder is below 100 psi (7 bar) and the ambient temperature is less than 10°F (-12°C), condition the cylinder by filling it directly with a compressor to 450 psi ± 50 psi (31 bar ± 3 bar), wait 1 hour, and then refuel normally. Alternatively, the cylinder may be conditioned by placing it in an environment with a temperature above 60°F (16°C) for 8 hours.**

## Depressurization (Venting) and Defueling

Removal and replacement of cylinder valves, fittings, and/or PRDs requires removal of all CNG through depressurization or defueling.

**WARNING**

**Never attempt to repair a cylinder or remove a pressurized fitting (e.g., valve or T-PRD) without verifying the cylinder is empty.**

Hexagon Agility cylinders may be vented without flow restrictions; however, it is recommended that cylinders be vented slowly. Rapid venting causes a significant drop in temperature, which may lead to ice buildup and damage to surrounding components.

***NOTICE***

**After rapid venting, leave cylinder valve open while residual gas in the cylinder expands as it warms to its surrounding temperature. Allow cylinder to warm for 4 hours before refilling.**

Cylinders in systems equipped with an excess flow device (EFD) must be defueled at a slow rate to avoid triggering the EFD. If the EFD closes during defueling, follow valve OEM instructions to reset the device. Most devices can be reset by closing the valve and slowly reopening it.

Cylinders equipped with electric solenoid valves should be defueled at a slow enough rate as to not close the solenoid. If the solenoid closes, close the manual shutoff, re-energize the solenoid, and slightly crack open the manual shutoff to resume flow. *Refer to electric solenoid cylinder valve OEM instructions.*

**WARNING**

***A faulty cylinder solenoid valve may give the impression a cylinder is empty when it is not. If there is any question whether the solenoid is working, follow electric solenoid cylinder valve OEM instructions.**