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**An Ounce of Prevention:
The Nuts and Bolts of CNG Fuel
System Inspection**



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Introduction

Leo Thomason is the Executive Director of NGVi where he applies his more than 25 years of alternative fuels experience to developing and serving as the lead instructor for a variety of natural gas related training courses for fleets around the world. Leo developed and is the lead instructor for NGVi's natural gas vehicle fuel system and fuel storage cylinder inspection training course. In this Technical Paper, Leo answers the most commonly asked questions about compressed natural gas (CNG) fuel system inspections.

Q& A with Leo Thomason

Question: What is covered in NGVi's CNG Fuel System Inspector Training Course?

Answer: Any compressed natural gas (CNG) fuel system inspection training needs to be comprehensive and cover the entire fuel system, from the vehicle fueling receptacle to at least the outlet of the high-pressure regulator—not just the fuel storage cylinders. By the end of the training, I especially want the potential inspector to know how to assess CNG fuel system and cylinder damage and determine the necessary steps to either correct the problem or safely dispose of the damaged component, including any damaged cylinders.

Question: Are there any requirements in place for cylinder inspection or is it just an essential safety practice?

Answer: Of course, NGV safety is the key goal, but inspections are required by the National Highway Transportation Safety Administration (NHTSA) every three years or 36,000 miles, whichever comes first. Additionally, any NGV accident that occurs at speeds greater than five mph and/or an incident that involves a fire anywhere on the vehicle requires that at least the fuel storage cylinders be inspected. Inspections are designed to ensure driver safety. Unknown or undetected damage to cylinders could result in a life-threatening situation.

Question: Who is qualified to inspect CNG fuel storage cylinders?

Answer: While there is no requirement that cylinder inspectors be certified, they must be trained by a recognized CNG fuel system inspection training provider. Certified inspectors have passed a third-party examination administered by CSA America, Inc. that ensures they understand all of the key elements of the inspection process.

Question: What is involved in the inspection?

Answer: It is an external visual inspection only and the cylinder is not removed from the vehicle. Inspectors are looking for any physical damage, loose brackets, or deterioration to the external surface of the cylinder including scratches, nicks, dings, chips, abrasion, impact damage or chemical damage.

Question: How long does cylinder inspection take?

Answer: It depends on the number of cylinders onboard the vehicle and the location of the cylinders. For example, a transit bus with natural gas fuel storage cylinders located on the roof of the bus under an enclosure has cylinders that are relatively easy to inspect. Conversely, a pick-up truck with cylinders located underneath and possibly in the bed of the vehicle with shields covering them may take longer.

Question: What equipment is required to conduct a vehicle fuel system safety inspection?

Answer: There is specialized equipment required to measure the depth and length of any cylinder damage. The reason this is important is because the depth and length of the damage determines whether the cylinder can be repaired or must be replaced.

Question: When we hear about cylinder ruptures, what's happening?

Answer: If a cylinder has ruptured, it is most likely due to external damage that was possibly not observed during inspection and properly addressed or was caused by a cylinder being damaged and the damage going unnoticed either because it wasn't inspected or the inspector was not properly trained. To inspect cylinders properly, the shields have to be removed, allowing a visual inspection all the way around the cylinder. If the cylinders are located underneath the vehicle, the vehicle must be placed on a lift. The inspection includes examining each cylinder, cylinder valve, mounting brackets, pressure relief device (PRD) and the PRD vent line. The entire fuel system also must be inspected for external damage. That portion of the inspection includes the fuel lines, regulators, coalescing filters, receptacle and solenoid valves.

Question: What happens if a cylinder is so damaged it must be disposed?

Answer: The cylinder must be safely defueled and decommissioned according to manufacturers' specifications or Compressed Gas Association (CGA) guidance documents.

Question: Speaking of manufacturers, do they have any liability in case of cylinder failure?

Answer: Manufacturers provide a warranty for a portion of the useful life of the cylinder. These warranties generally cover manufacturing defects, but they do not cover road damage or other external damage.

Question: Do vehicle cylinders have a finite useful life?

Answer: Yes. For use in the United States vehicle fuel storage cylinders for CNG are manufactured to NHTSA Federal Motor Vehicle Safety Standard (FMVSS) 304 and American National Standard (ANSI) NGV 2. These cylinders have a useful life of 15, 20 or 25 years from the date of manufacture. Once the cylinder reaches the end of its useful life as stated on the cylinder label, it must be defueled and disposed of in accordance with the cylinder manufacturers' guidelines or CGA guidance documents.

Question: What is the most cost-effective way to provide for fuel system and cylinder inspection?

Answer: The best approach for a fleet owner, whenever possible, is to have in-house maintenance technicians trained to visually inspect the entire fuel system including the cylinders. General visual inspections, which are a cursory inspection of the visible portion of the fuel system and cylinder(s) not covered by shields, should be conducted regularly as part of the vehicle's routine maintenance schedule. Any damage observed to a cylinder shield or fuel system component during a general visual inspection should be reported to a trained fuel system inspector for proper evaluation and possible further inspection of the damaged component.

NGVi Options

NGVi offers a variety of products and services related to the use of natural gas as a transportation fuel.

Training courses that cover CNG fuel system inspection and NGV safety include the following. NGVi offers this training in-house for companies that have multiple technicians requiring training, as well as in open-enrollment format several times per year.

- **CNG Fuel System Inspection Training Course**
This two-day course focuses on teaching the proper techniques for inspecting on-board compressed natural gas fueling systems. NHTSA states that on-board vehicle CNG fuel storage cylinders, manufactured after March of 1995, should be visually inspected every three years or 36,000 miles, whichever comes first. You will learn the proper methods to use to insure vehicle fuel storage safety and integrity. The training includes hands-on inspection of vehicle fuel cylinders.

- **NGV Driver & Mechanic Safety Training**
This one-day course is devoted to training drivers and mechanics on safe driving, fueling and maintenance of today's natural gas vehicles. The training will deliver all the information necessary to insure that your NGV fleet is driven, fueled and maintained to meet or exceed current safety standards. Trainers are welcome and will go through the same training as Drivers and Mechanics and will also receive "Train the Trainer" instruction and all course materials and support software.

For more information about these and other consulting services, contact Leo Thomason at 702-254-4180 or via email at info@ngvi.com.

Helpful Links

CSA America www.csa-america.org

Cylinder manufacturers:

Luxfer www.luxfer.com

Dynetek www.dynetek.com

SCI www.scicomposites.com

Lincoln Composites www.lincolncomposites.com