

Low-Emission Fixed Maximum Liquid Level Gauges

Research Fact Sheet

Fixed maximum liquid level gauges (FMLLGs) used in propane containers accurately indicate a tank's fill level to ensure safe tank refilling and transfer operations. New FMLLGs with No. 72-drill (0.025-inch) orifice diameters have the potential to have lower emissions than standard No. 54-drill orifice (0.055-inch) gauges. However, there is concern that these smaller orifices may be more vulnerable to freezing and clogging, compromising the accuracy of the tank fill-level reading.

To evaluate the performance of these low-emission gauges, the propane industry conducted a study to assess the extent of decreased propane flow from FMLLGs with reduced orifice diameters. The study determined that these gauges pose no greater risk of clogging or freezing than FMLLGs with standard orifice sizes.



An alternative means of measuring the filling process could help reduce emissions.

– Patrick Hyland, "Fugitive on the Loose," LP Gas, June 2007

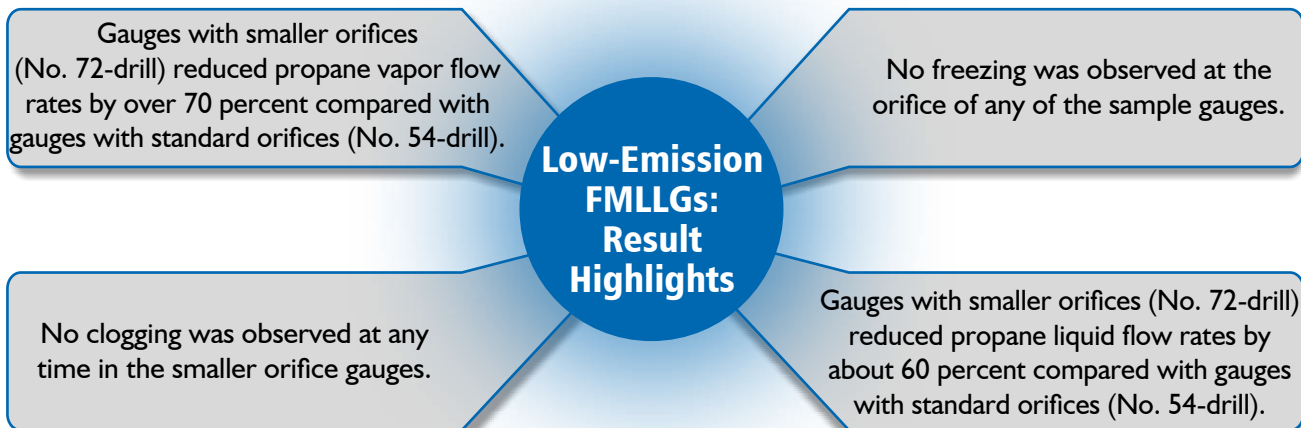


Research Status: Results Available

- Laboratory testing of the low-emission gauges is complete and their performance has been validated.
- The study's results provide encouraging support for industry adoption of FMLLGs with smaller orifices.
- The complete study report is available at www.propaneresearch.com.

Supporting Facts

- FMLLGs with smaller orifices can reduce propane flow.
- Reduced propane flow decreases the likelihood of fugitive or evaporative emissions.
- Clogged FMLLG orifices can make a tank more vulnerable to overfill.

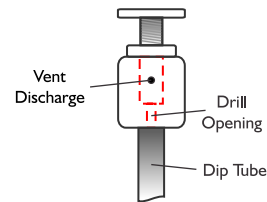


For more information on this and other research projects, go to www.propaneresearch.com.

A Closer Look

Fixed Maximum Liquid Level Gauge: How It Works

Fixed maximum liquid level gauges release propane vapor when the maximum fill level is achieved during tank filling. As a tank is filled, the propane level rises in the tank until it reaches the bottom of the gauge's dip tube. Propane liquid is then released through the gauge, signaling that the tank has reached its maximum filling capacity.



Line diagram (side view) of an FMLLG.

Project:

Research Investigation on the Testing and Evaluation of New Low-Emission Fixed Maximum Liquid Level Gauges for Use in LP-Gas Containers (**Docket 15198**)

Partners:

Battelle Memorial Institute
Underwriters Laboratories

Research Process

Sample Selection

- Selected nine FMLLGs to serve as representative samples of standard No. 54-drill (0.055-inch) gauges, small No. 72-drill (0.025-inch) gauges, and self-cleaning gauges with a small No. 72-drill orifice.

Comparative Testing and Evaluation

- Conducted an *air flow capacity test* of all samples at propane container pressures of 20 pounds per square inch gauge (psig), 80 psig, and 175 psig to determine the propane vapor release rate during container filling.
- Conducted a *liquid propane release and freeze susceptibility test* of all samples at temperatures of 0 degrees Fahrenheit, 50 degrees Fahrenheit, and 100 degrees Fahrenheit to measure liquid propane release and freezing potential as liquid propane flashes to vapor propane.
- Conducted a *susceptibility to clogging by particulates test* of all samples at inlet pressures of 20 psig and 175 psig to measure mass flow and liquid flow rates for water and polystyrene latex spheres solutions (to simulate particulate matter in propane).

Results

- Air flow capacity test*: Compared with the standard gauges, the No. 72-drill gauges reduced flow rates by over 70 percent, while the self-cleaning gauges reduced flow rates by just under 70 percent for the lower pressures.
- Susceptibility test*: No freezing at the orifice was observed in any of the samples. Compared with the standard gauges, the No. 72-drill samples reduced flow rates by approximately 60 percent and the self-cleaning gauges achieved a similar reduction in flow rates.
- Susceptibility to clogging by particulates test*: No clogging occurred in either of the two small orifice designs at either test pressure.

What's Next?

The complete study report is available at www.propaneresearch.com.

FOR MORE INFORMATION:

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