Proof Positive

Simplifying the painstaking process of calibrating a natural gas dispenser

By Tom Sewell

Recently I traveled to the Institute for Metrology and Technology (NMI) in the Netherlands to take part in testing of a compressed natural gas (CNG) accuracy prover assembled by my company, Tulsa Gas Technologies Inc.

I didn't know what to expect. What I did know was that the prover we developed in our shop using a super-calibrated Coriolis flow meter had successfully verified the calibration of dispensers that we manufacture.

The testing we were to undertake at NMI involved both the traditional method of dispenser proving using a scale and a more advanced method using the Coriolis meter.

Before field demonstration, the prover is tested at Micro Motion's laboratory.

The goal was to demonstrate to CNG fueling equipment owners that the Coriolis prover could provide a faster, safer, more accurate and less labor-intensive way to calibrate a CNG dispenser. By succeeding, we could show dispenser operators in Europe and the United States that there is a viable alternative to scale proving.

Among those on hand during testing were officials from Electrabel and Ruhrgas, two European energy companies that operate CNG stations. They wanted to see the new prover work before deciding whether to use it for their natural gas fuel dispensers.

When testing began, I watched in amazement as the new CNG50 meter used in our prover went through a 30-point calibration and the zero was absolutely stable, despite being shipped halfway around the world. This gave me great confidence in the procedure that we would soon undertake.

I couldn't speak the native language and a lot of the time during the testing process I didn't understand what people were saying. However, I could tell from their body language that we were succeeding in our test.

The NMI representative on hand for the tests was familiar with the meter we were using in the new prover and the manufacturer of the meter supplied a knowledgeable staff to perform the testing.

Struggles with the scale

First, however, we would try the scale proving method, an approach used for most (if not all) CNG dispensers in the United States. During testing we verified the scales using weights, checking the scale up and down the calibration window that we were using. We verified that it repeated and returned to zero each time.

The time spent checking the scale was complicated by wind. A gust of wind would create an error in the scale and make the test unreliable.

Before we could finish we had to build a wind block around the scale and start the verification process again.

After this was completed and we were sure of the scale's accuracy under the conditions, we had to weigh the vessel and establish a zero with no gas into the tank. Again the wind played havoc with the process and a shield had to be constructed around the scale.

Finally we were ready to run a batch of gas. We began with a typical fill to 3,000 psi at flow rates normally seen during an average fill. The prover was simply zeroed then purged so the prover lines were at the same pressure as the dispenser and the fill began. After the fill was complete we recorded the values in mass. The mass volumes can be extracted back to cubic feet later when we know what the gas is.

A CNG tank involved in testing is weighed, with the prover in the foreground.

In the U.S., NCWM Publication 14 Code reference S.1.3.1.1. states that one gasoline gallon equivalent (GGE) means 5.66 lb. of natural gas. This is what normally shows on the volume display. A mechanism on a weights-and-measures dispenser will allow you to toggle between mass and GGE showing an inspector both values.

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After the gas was vented to atmosphere we then started to make fills throughout the flow rate stated by the manufacturer of the meter. We stuck with the same procedure throughout the testing to prevent procedural errors.

During testing we were constantly bothered by wind, which had no effect on the prover but was a constant disruption to the scale. The wind would change and our wind blocks would all have to be moved. Then we would need to verify that the scale was stable again.

The scale required an outside power source and a cord had to be run from the control room. This made testing close to the dispenser a problem because of the hazardous location. The specifications of 1998 NFPA 52 Table 4-12 state that dispensing equipment outdoors is Class 1 Division 2 from zero to five feet from the dispenser. Keeping the scale that far away meant that we would have had to move the bottle every time we ran a batch or we would have to stretch the hose to its limits.

A better way

Having finished the complicated and sometimes frustrating scale proving method, we now began what we believed would be a much simpler process with the Coriolis prover.

With this test we used the prover in series with the dispenser and the test vessel. The prover was constructed to be acceptable for the location and the dispenser hose could reach the prover easily. Also, the hose from the prover could easily reach the vessel on the scale that was out of the classified area.

After we finished testing, the prover was purged with air, making it safe to transport by any means of shipment. The vessel was vented down to atmosphere again and placed back in the van.

There was no means of purging the vessel at our testing location. In the U.S. this van would be hauling hazardous material and the driver would need to be certified for transporting it. This reinforced the mounting argument that using the Coriolis prover inline with the dispenser to a vessel or a vehicle, without a scale, is by far the safest method and a reliable way to check for calibration of a CNG station.

Distinct differences

Following is a comparison of the Coriolis prover versus scale proving:

Safety. You now can check the calibration of a CNG dispenser using a prover without ever handling the vessel and without having to discharge the gas back to a safe place or having to arrange to put the gas back into the compressor.

A CNG cylinder of the size required to do calibration with scales can weigh up to 100 lb. It is difficult to make a brace that can hold the vessel safely and yet be under the weight requirements of the high accuracy scales. Some scales require a remote power source and are not designed for use in a Class 1, Division 2, environment. A prover easily can be manufactured for that environment.

Grounding is another safety concern. The CNG prover connected to a vehicle discharges back to ground any static that could be built up. The vessel on a scale can store this static energy and discharge unexpectedly when it is being emptied or just sitting on the scale that is isolated from ground. Several fires have been documented from static discharges during the emptying of a CNG vessel to atmosphere.

Environment. Most CNG stations do not have a remote place to put gas back into the compressor suction. This creates the problem of having to discharge this gas back into the atmosphere. Sometimes three vessel-loads of gas are required to make an accurate adjustment in a CNG dispenser, which would be a sizable amount of gas to release in a populated area.

Time. When using a CNG Coriolis prover you can save time by simply bringing an empty vehicle to fill into. Or you can have a fill port built into the CNG compressor station that can directly send gas back to the compressor suction from controls onboard the compressor.

Accuracy. With testing, the Coriolis prover has shown accuracy that would qualify it as a stand-alone field proving unit. Testing by NMI on CNG dispensers has resulted in their certifying this method of proving CNG dispensers in the Netherlands.

Documentation. With Coriolis meters and a prover you can use electronics to map the fills and monitor the zero of the meter at all times. This can then be recorded into a database for records or a print can be generated.

A Coriolis meter can be tracked by the manufacturer and checked for operation on a periodic basis and these records can also be tracked into a database. Any shift in zero then can be adjusted.

The prover package

The CNG meter we use in the prover is a Micro Motion CNG50 with a 2700 transmitter that includes a local display option. The prover features a complete self-powered unit that closes up in a case, ready for shipment.

The case comes with a retractable pull handle and wheels similar to luggage. The battery charger that is supplied can handle almost any voltage around the world, so with a cord change the unit can be used virtually anywhere and keep working. A purging adapter is included with the prover that will allow a complete purge of any gas that would be left in the unit after it is vented down. Just connect an air or inert gas to the Schrader valve and purge until all gas is removed. TGT's Prov 50 is small enough to ship via UPS or to take on a flight as luggage.

The meter is sealed at the factory. As long as the documentation is current the meter should be good for continuous use. The prover can be verified by sending it back to TGT and recertifying it to the standards for a prover. One of the added benefits from a unit packaged like this is its portability.

TGT has a rental program that will allow a user to verify his dispenser once a year. This should result in more compliance to weights and measure standards for verification of a retail motor fuel device.

Training is available on the requirements of testing CNG dispensers to the current proposed test procedures for field testing a CNG retail dispenser.

With greater training and awareness, my hope is that the proving process using a Coriolis meter will emerge as a viable option for CNG station operators in the U.S., Europe and elsewhere.

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