

ISHM 2019

Class# 8300.1

Measuring Natural Gas at Natural Gas Vehicle (NGV) Refueling Stations

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CNG DISPENSER CITY OF NORMAN OK



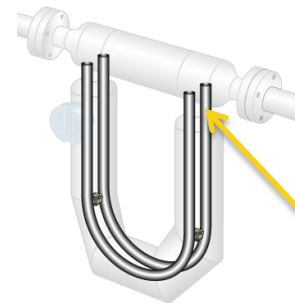
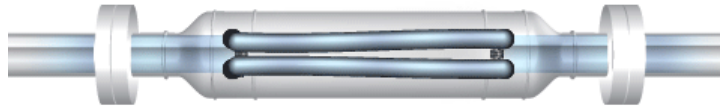
CNG Dispenser Metering

- CNG at 3600 PSIG is measured using a mass flow meter.
- Mass flow is measured by coils and magnets which measure tube twist which is proportional to mass flow (the Coriolis effect)
- The meter will send a 485 Modbus or a pulse to the dispenser electronics.
- This dispenser uses 1000 pulses per pound from the meter.
- We take the pounds per gallon (5.66) then display that as a Gasoline Gallon Equivalent (GGE)
- The point of sale (POS) either takes data from the dispenser or pulse, Handbook 44 requires 1000 pulses per unit. The dispenser requires hand shaking from the POS to reset and start/stop the sale.

No Flow



Flow



*Temperature from
embedded RTD*

Graphics compliments of Micro Motion

FLOW CONTROL OF A CNG DISPENSER

- Flow is controlled by the dispenser electronics and sequencing valves using the flow rate from the meter.
- The dispenser will flow from bank one until target pressure is met or flow rate is too low.
- The dispenser will flow from bank two until target pressure is met or flow rate is too low.
- Bank three will stop flow at target pressure or when the low flow cut off is reached for the meter.
- Pressure is temperature compensated using the Boyle's Gas Law.

B&H CONSTRUCTION GOLDSBY OK



CITY OF NORMAN CNG STATION



CNG COMPRESSOR AND STORAGE



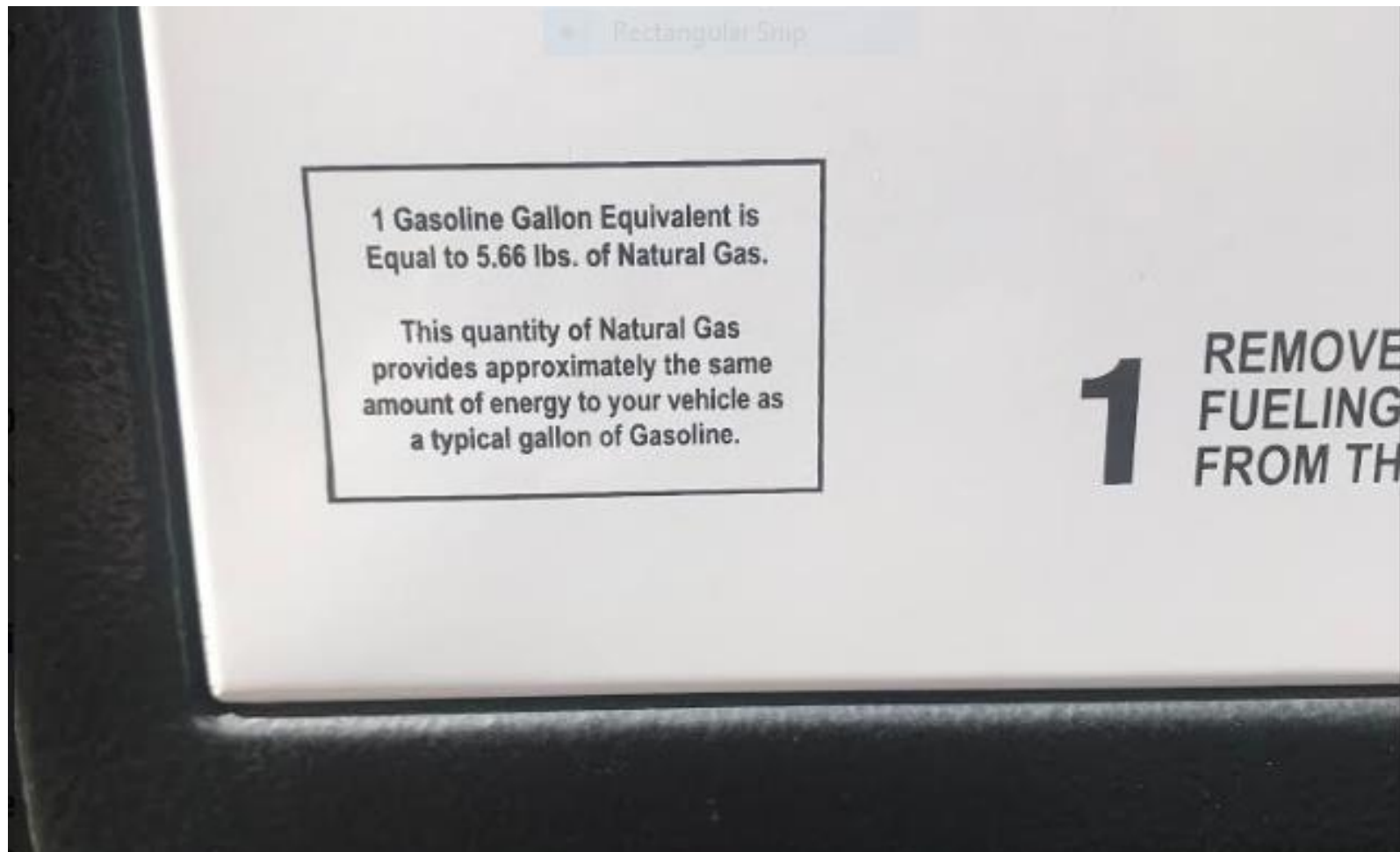
METERING FROM THE LDC METER TO THE VEHICLE

- Gas is purchased from a marketer in BTUs
- Delivered to the Local Distribution Company (LDC) in Dekatherm
- LDC delivers gas to the consumer in 1 Dekatherm (Dth), 1,000,000 Btus, units in the Oklahoma area but meters the gas in 1000 scf units or MFC.
- In a perfect world $1 \text{ Dth} = 1000 \text{ scf}$. With adjustments made to your bill + or – (Error #1)
- From the LDC they meter in gas with a PD, turbine or a sonic meter. (Error #2)
- Then the gas flows through the dryer to remove any moisture in the gas. Pipeline standard is less than 7 lbs of water per Dth. (Error #3)

- From the dryer the gas travel to the compressor that squeezes the gas to 3600 psig. (Change in composition)
- From the compressor the gas passes through coalescing filters removing any oil that may be in the system from the compression process. (Error #4)
- Now when a vehicle comes to a retail dispenser the NIST recognizes a unit calls Gasoline Gallon Equivalent. (GGE)
- Back 25 years ago when the NIST was trying to establish how CNG would be sold at a retail CNG station it was decided that gasoline had a Btu heating value of 118,000 Btus + or -.

- So how do we get from 118,000 Btus to a term that NIST recognizes to sell to a retail customer.
- MASS weight. NIST decided that 118,000 Btus has a average mass weight of 5.66 lbs per one Gasoline Gallon Equivalent. (Error #5)
- The big issue happens when you try to reconcile back to the gas bill from the gas marketer and or the LDC. The gas we bought is not the same as the gas we sold and the different meter technologies will have an in balance between them and both calibrate right.

5.66 LBS PER GGE



TYPICAL CNG DISPENSER DISPLAY



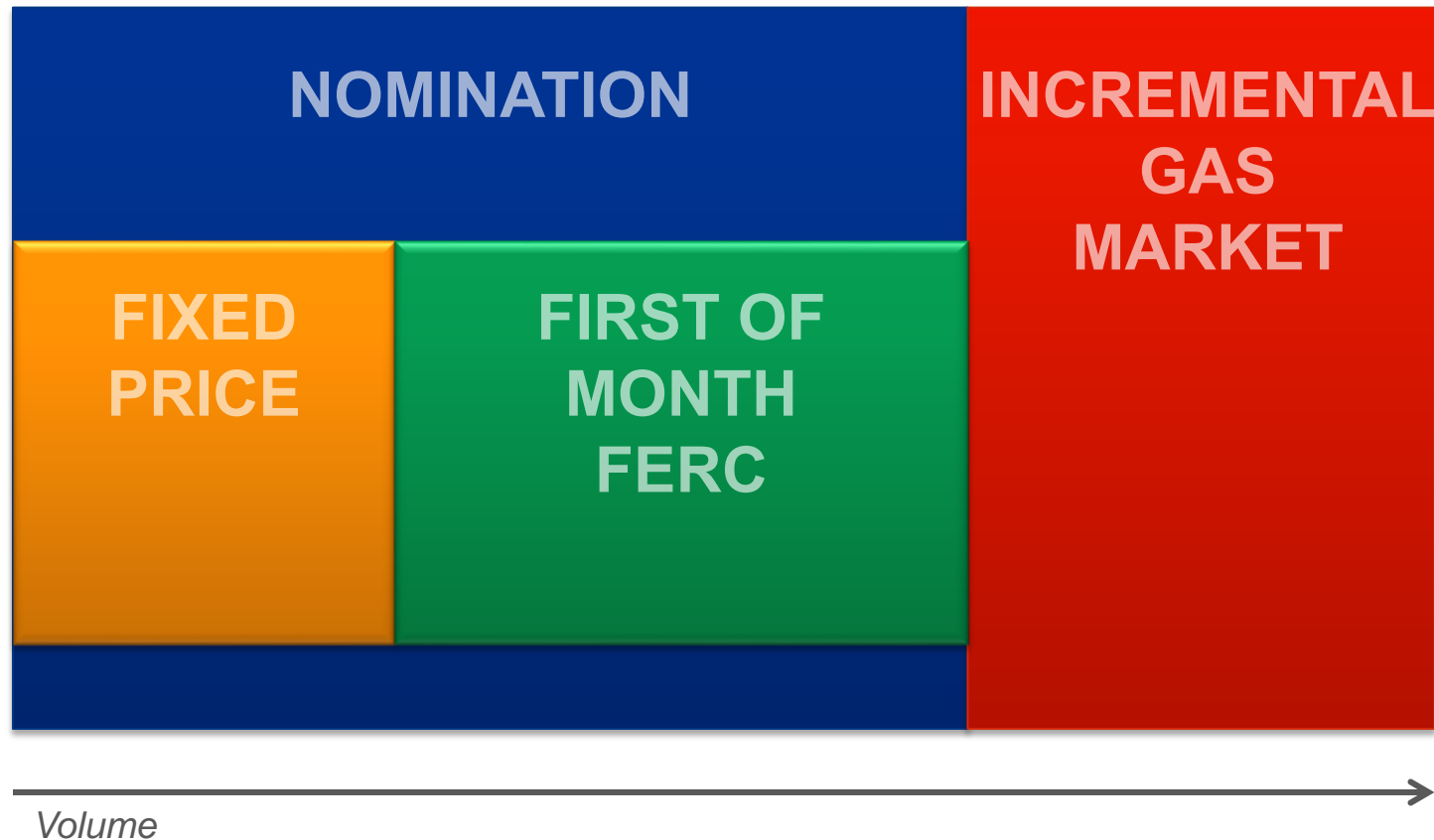
GAS DRYER



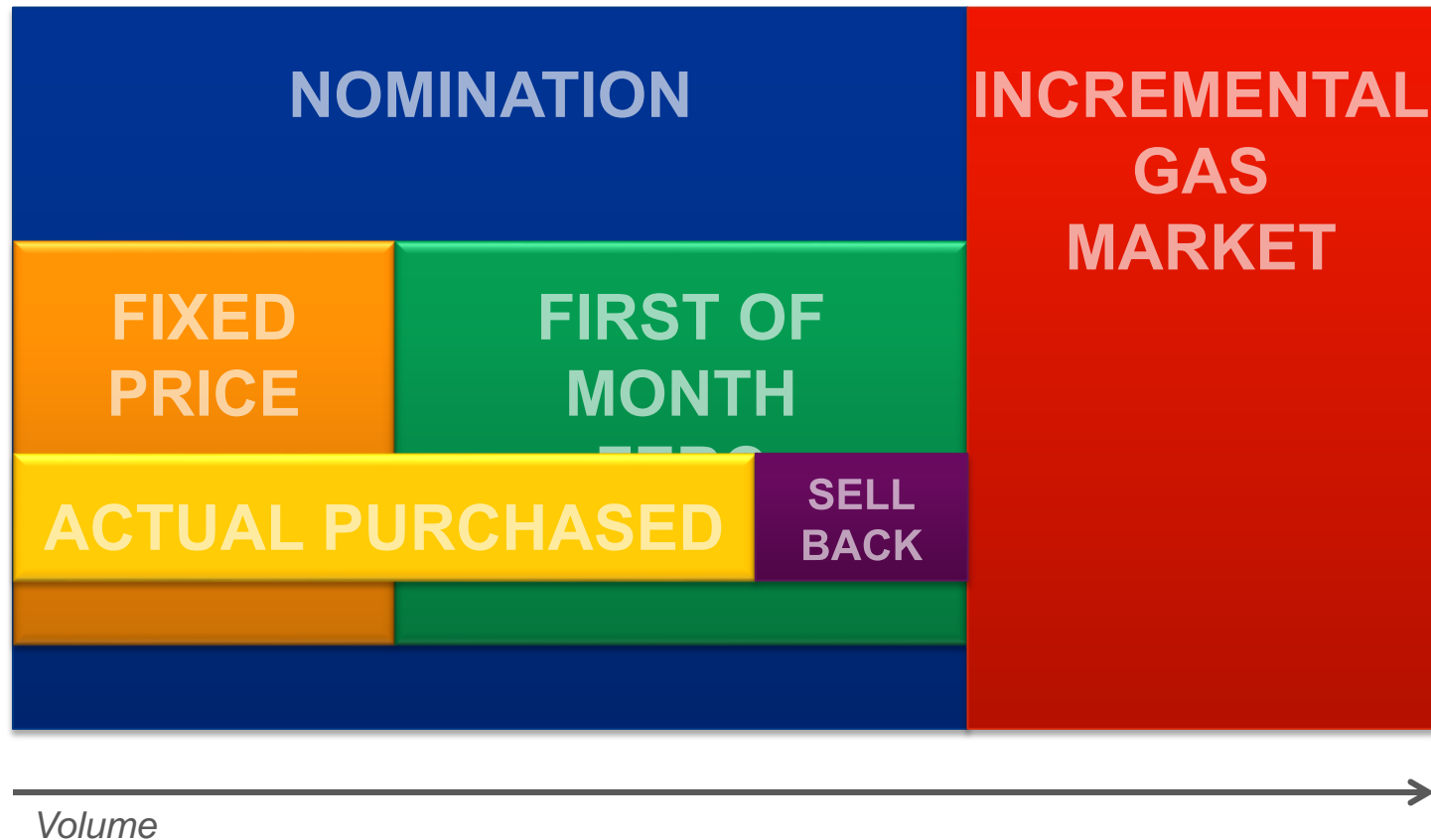
THE BALANCING ACT



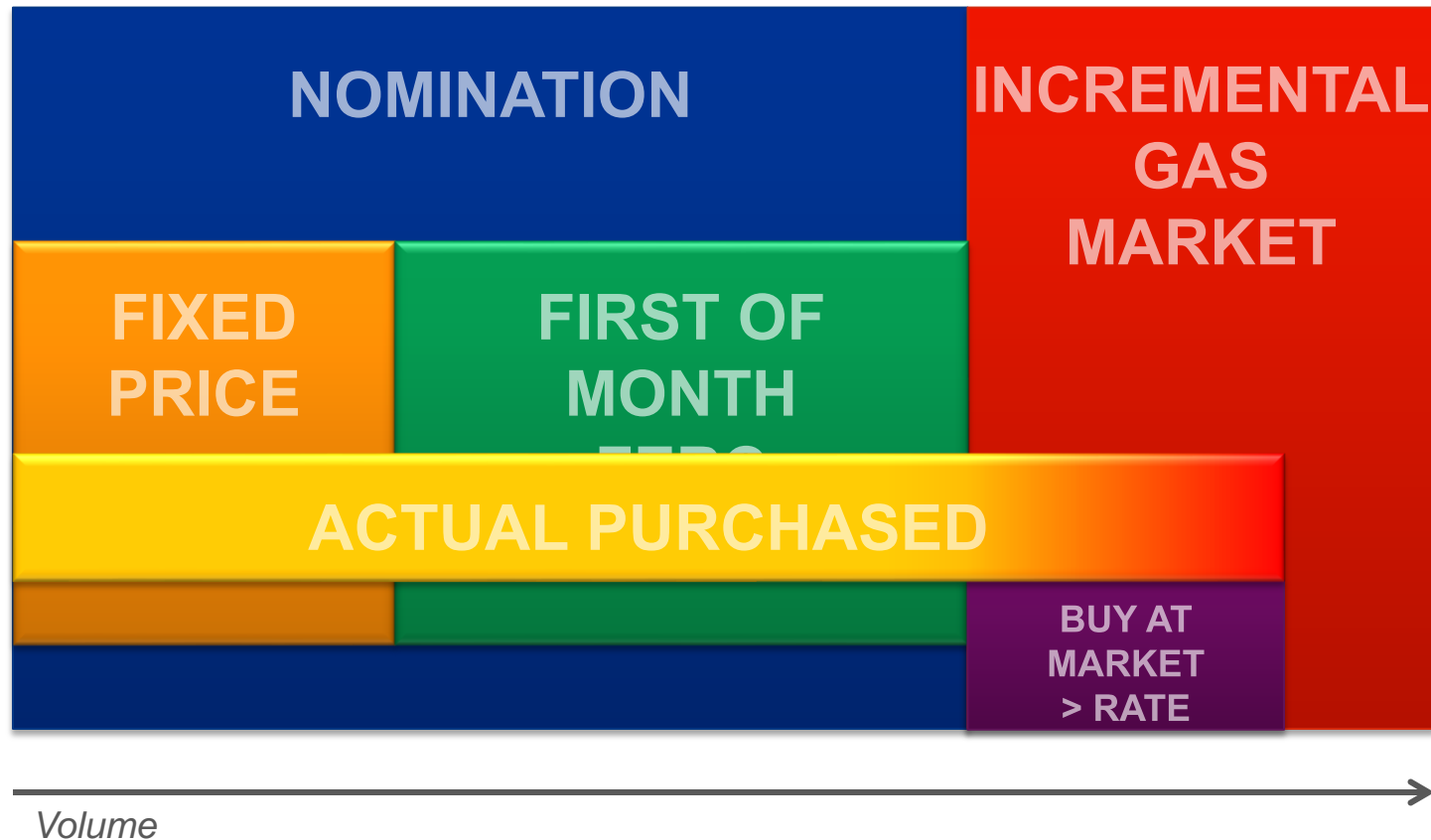
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METHOD OF PROVING CNG DISPENSER IN THE FIELD

- CNG dispensers are covered in NIST Handbook 44 as adopted by the National Conference of Weights and Measurement
- Currently in the US only the true mass weight is allowed
- Every country in the world uses master meters
- This big issue with Mass Measurement is what do you do with the gas after you fill it from the dispenser.
- Each state is making their decision on which method to use until NCWM comes out with a new EPO on Master Meters.
- The master meter method lets you fill directly to a vehicle and the prover is inline with the dispenser.

MASS METHOD USING SCALE



MASTER METER METHOD



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