LMD – 23.4
N.3.5. Wholesale Devices

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September 26, 2022

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LMD – 23.4 N.3.5. Wholesale Devices.

Item under Consideration (page S&T-178):

N.3.5. Wholesale Devices. – The **total** delivered quantity **for any required accuracy test** should be equal to**, or is recognized as being representative of, a volume equivalent to** at least the amount delivered by the device in one minute at ~~**its**~~ **the meter's** maximum discharge rate ~~**and shall in no case be less than 200 L (50 gal)**~~.

(Amended 1987,~~and~~ 1996**, and 2023**)

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Clarification that Small Volume Provers are included in N.3.5. Wholesale devices.

The 1996 NCWM agreed that small volume provers (SVP) are suitable as a test standard. The 1996 changes included modifications to paragraph N.3.5. to remove barriers for technology that could achieve the maximum flow rate of the product flowing through the meter.

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Goals of the Modification

- **Reinforce the 1996 goal to remove any test conditions that would prohibit or restrict the use of an SVP or other methodologies**
- **Establish fair test conditions** within the OEM's intended range of the meter's operating conditions
- **Specify the minimum test conditions** based on the meter's ratings and the key characteristics for the proving device to conduct a test that demonstrates the meter's performance in a commercial application
- **Encompass the concept of both the volumetric neck-type prover and small-volume prover (SVP) test** or any other methodologies that may be developed in the future
- **Provide guidance on test parameters** which meet the Fundamental Considerations without the need for a laundry list of possible test methodologies and equipment.
- **Eliminate any language that would circumvent or alter the proper use of testing devices or their results**
- **The decision of whether or not to accept a given type of test standard still rests with the Director as outlined in the Fundamental Considerations**

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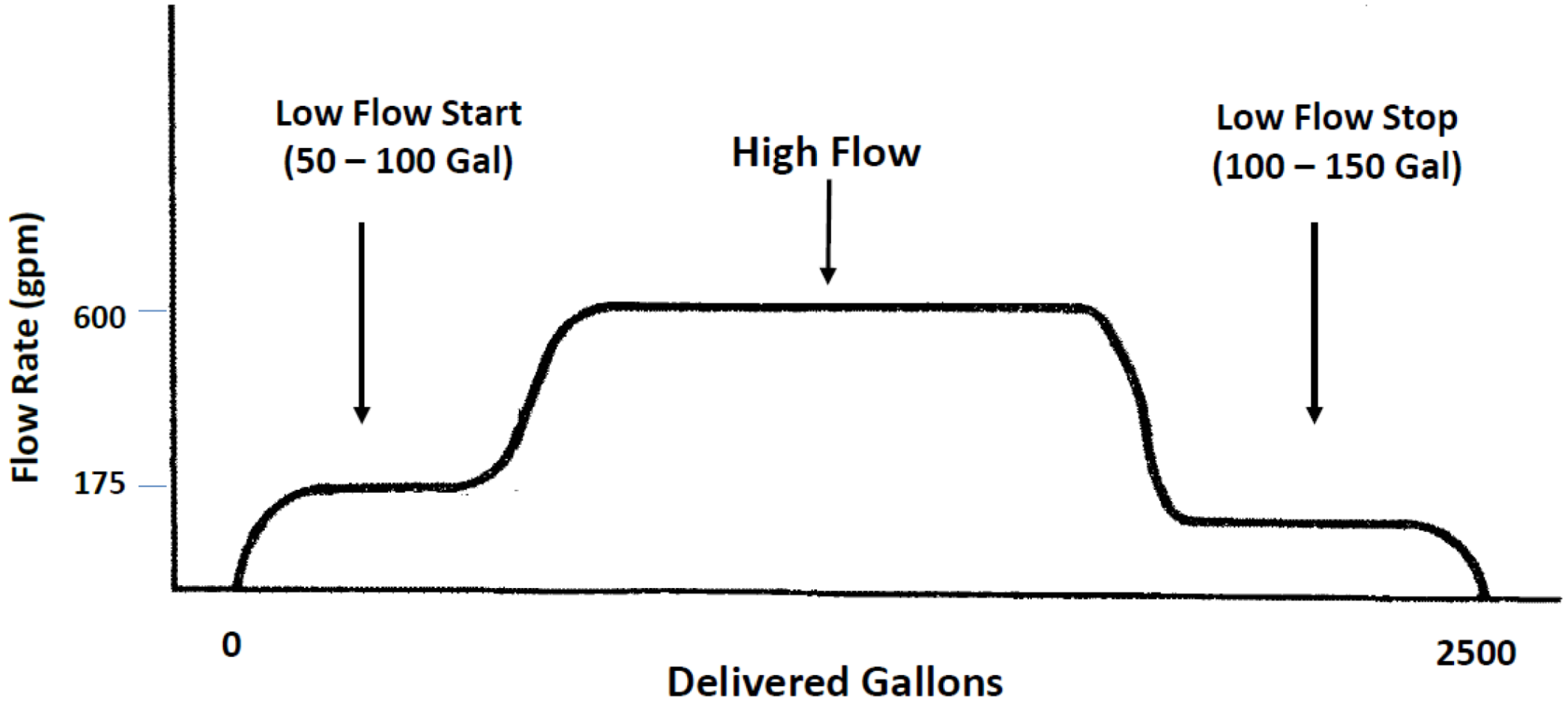
Typical Truck Filling Delivery Sequence



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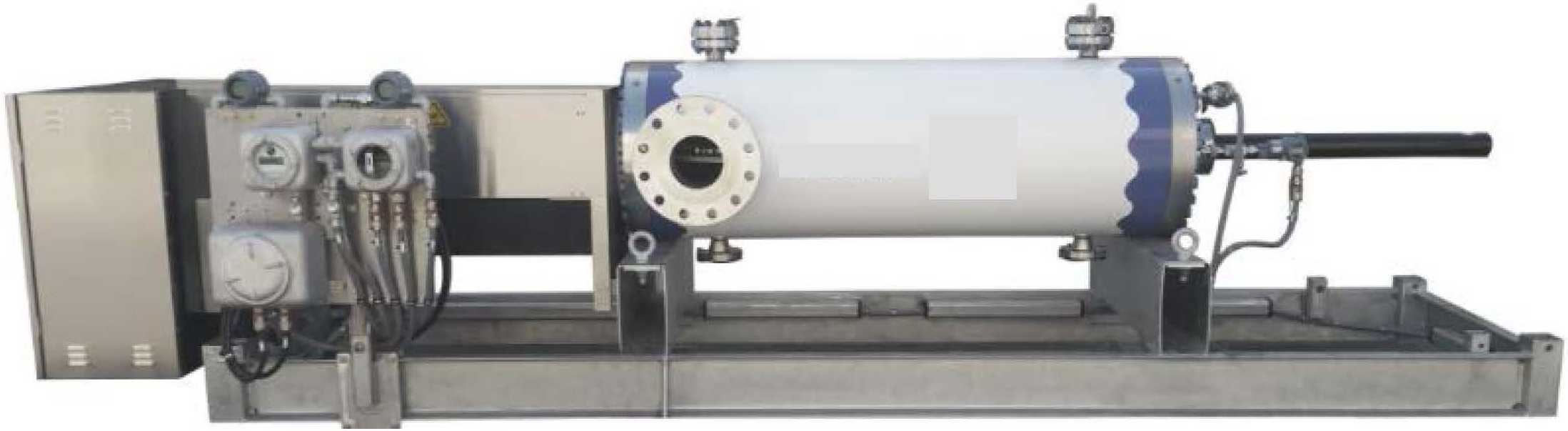
Prover: Captive Displacer



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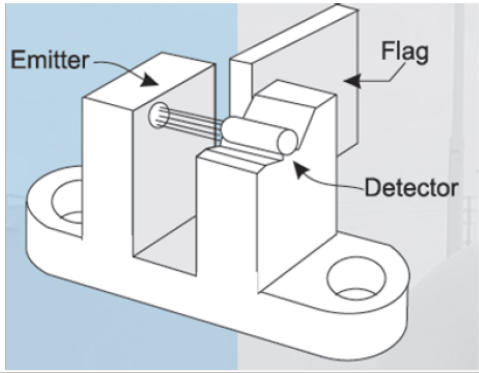
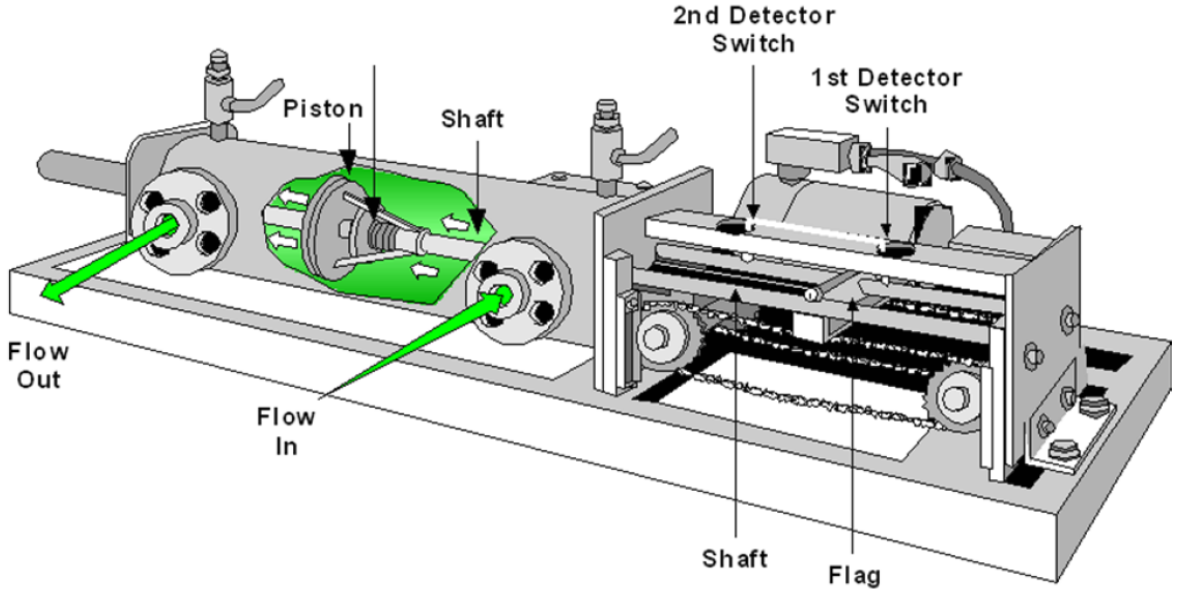
Prover: Captive Displacer

- Uses a piston attached to a rod rather than a sphere as a displacer
- Small in size
- Mechanically actuated drive
- Optical switches





Prover: Calibration

Existing provers require re-calibration:

- Every 5 years for stationary provers
- Every 3 years for portable provers

TEST NO: MI-02-22-15640 SERIAL NO: ST-0209173 (#2) TEST DATE: 2/3/2022

This report shall not be used to claim endorsement by NIST, OWM, NVLAP, or any agency of the U.S. Government or the State of Michigan.

Prover constants:

Area Thermal Expansion Coefficient (G_a)	1.77 X 10^{-5} /°F
Detector Thermal Expansion Coefficient (G_I)	6.20 X 10^{-6} /°F
Modulus of Elasticity (E)	2.80 X 10^{7} psi

The following volume was determined:

NOMINAL VOLUME	CALIBRATED VOLUME	UNCERTAINTY ± (k = 2)
20 gal	20.0188 gal	0.0043 gal

Signed:

Facts and Review

The 50-gallon minimum draft has been in Handbook 44 since 1937

- The size of wholesale meter deliveries when the 50-gal minimum was established in paragraph. N.3.5. is not reflective of the discharge rates of meters used today in commerce.

NIST suggests review and possible modifications to:

- NIST Examination Procedure Outline 25 for Loading Rack Meters
- NIST 105-7, *"Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures: Specifications and Tolerances for Dynamic Small Volume Provers,"* 1997

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(With improvements suggested at CWMA)

Item under Consideration (p. S&T – 178):

N.3.5. Wholesale Devices. – The **total** delivered quantity **for any required accuracy test** should be equal to**, or is recognized as being representative of, a volume equivalent to** at least the amount delivered by the device in one minute **of continuous flow** at its ~~**the meter's**~~ maximum discharge rate ~~**and shall in no case be less than 200 L (50 gal)**~~.

(Amended 1987,~~and~~ 1996**, and 2023**)

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700+ Standards

API standards are incorporated by reference into both U.S. federal and state oil and gas regulations, and they are the most widely-cited petroleum industry standards by international regulators.

3,800 Citations

in state regulations

650 Citations

by U.S. federal government organizations: U.S. Coast Guard, U.S. EPA, FTC, BSEE, OSHA, and PHMSA

780+ International References

by Brazil, China, Saudi Arabia, Singapore, Indonesia, Vietnam, and others.

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API Standards Program Accreditation

API is accredited by the American National Standards Institute (ANSI)

ANSI Accreditation requires:

- ✓ Openness, Balance, Consensus and Due Process
- ✓ Approved and Published Procedures
- ✓ Public Review of Draft Standards
- ✓ Requirement for Standards Updates
- ✓ Regular Program Audits

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API Committee on Petroleum Measurement

- Responsible for approx. 200 standards
- Collectively known as API Manual of Petroleum Measurement Standards (MPMS)
- These standards provide the means by which industry and government establish **technically defensible baseline calculations for custody transfer**, loss control, and environmental measurement activities.
  - Custody Transfer Measurement is the measurements specific to change in ownership and/or a change in responsibility for commodities.

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API Manual of Petroleum Measurement Standards

- MPMS has 23 Chapters:
  - Chapter 4 Proving Systems
    - Chapter 4.3 Small Volume Provers (SVPs)
      - 1st Edition, published 1988
      - Withdrawn and SVPs moved to Chapter 4.2
    - **Chapter 4.2 Displacement Provers**
      - 3rd Edition, published 2003
      - Addendum 1 issued February 2015
  - (Sub) Committee on Liquid Measurement (COLM)
    - Develops, approves, and maintains standards dealing with the measurement of flowing hydrocarbon liquids
    - Responsible for MPMS Chapter 4.

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Standards Development Process

(Sub) Committee on Liquid Measurement (COLM)

- Currently 79 voting members
  - 38 Operators
  - 26 Manufacturers/Service Suppliers
  - 15 General Interest
- Maintains standard (periodic review)
- Approves content of standard by ballot

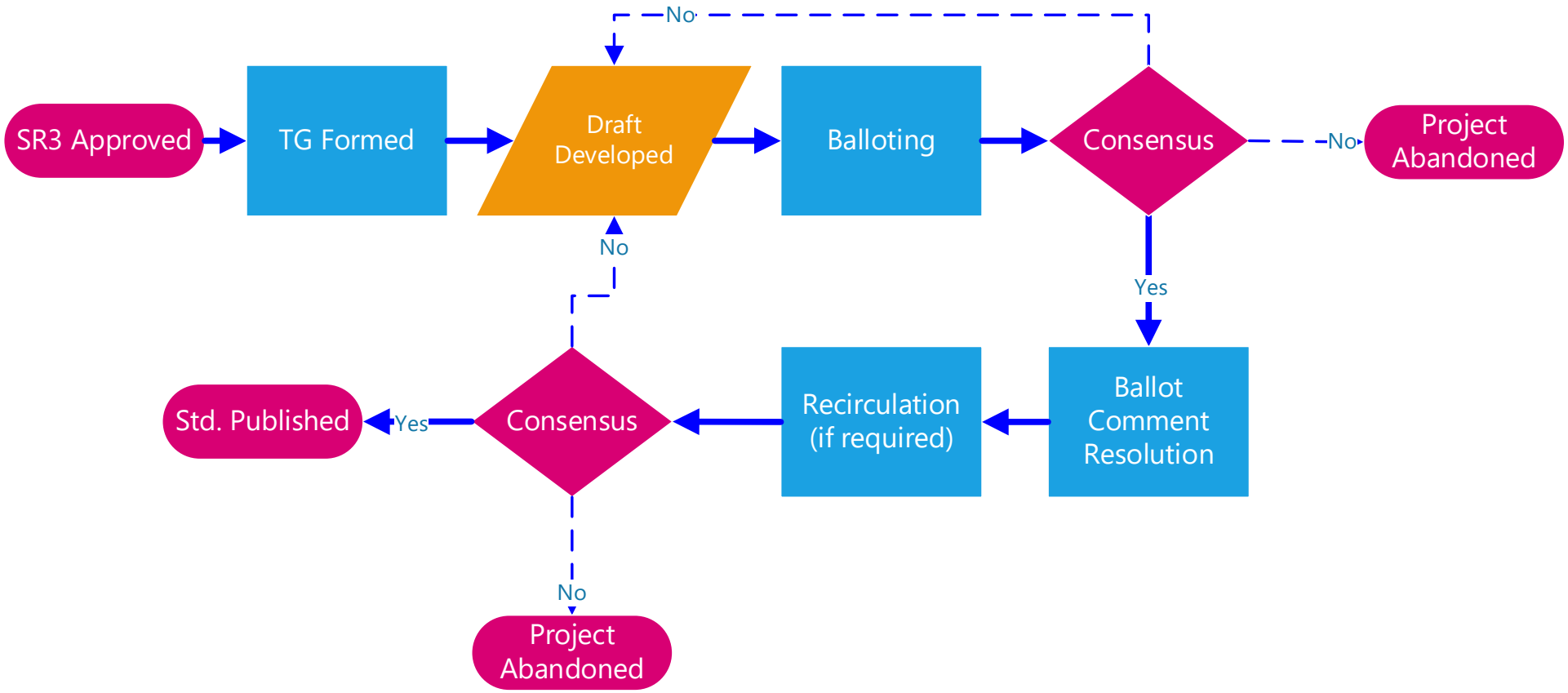
Ch. 4.2 Work Group

- Currently 56 members/SMEs
- Assess data and consider updates
- Develop revision drafts

Approval

- Once WG consensus on revision draft → COLM ballot
- Ballot pass – 2 criteria:
  - >50% response rate from voters
  - >66.66% approval

API Standards Development Process Overview



API *MPMS* Chapter 4.2 Displacement Provers - SVP

Section 3.11.1 General Description

- This section describes those provers historically referred to as “small volume provers.” These provers accumulate less than 10,000 whole, unaltered meter pulses between detectors during one pass of the piston displacer, and therefore require pulse interpolation. Optical detector switches used with these provers are externally mounted from the flow media and are able to indicate the position of the displacer with a high degree of precision. As a result of this precision it is possible to have a very short distance between detector switches. Since the small volume of these provers may not allow for the accumulation of 10,000 whole, unaltered pulses, the prover electronics must provide means for pulse interpolation. The only practice currently recognized by the API is double chronometry.

Section 3.11.3 Externally Mounted Detectors

- Detectors are high precision, highly repeatable optical type switches mounted externally to the flow media. These switches are often mounted on material having an extremely low coefficient of thermal expansion characteristic. This minimizes the change in distance between the detector switches due to temperature variation. Any linear movement must be accounted for, as this will impact the calibrated volume of the prover. Detectors must indicate the position of the displacer within 0.01% of the linear distance between the detectors. The activation of the detector switches must correspond to the position of the piston displacer, which is normally achieved with a shaft connected directly to the piston displacer.

API *MPMS* Chapter 4.2 Displacement Provers – SVP Accuracy

Section 4.2.5 Base Prover Volume Variation

- The procedural uncertainty (at the 95% confidence level) in the average of three calibration runs that agree within a range of 0.02% is ± 0.029% (see API MPMS Ch. 4.9). This means that there is a 95% probability that the true prover volume lies inside the range described by 0.029% of the calculated base volume. Conversely, there is only a 5% probability that the true prover base volume lies outside the range described by ± 0.029% of the calculated base volume.

API *MPMS* Chapter 4.8 Operation of Proving Systems – Calibration Frequency, Methods, and Assessment

Frequency

Section 10 *Prover Calibration Frequency*

A maximum of 60 months (5 years) for stationary provers and 36 months (3 years) for portable provers.

Annex B *Method for Determining the Frequency of Calibrating Provers*

The calculation utilizes the number of months since the last calibration, the agreed tolerance of the change in volume between calibrations (e.g., 0.06% or less), and percent change in volume since last calibration. The result is the number of months until the next calibration.

Methods

Section 11 *Proving Methods*

Volumetric, Direct Mass, and Inferred Mass proving are acceptable.

Assessment

Section 12 *Assessment of Proving Results*

The estimated random uncertainty of a proving (meter factors or meter pulses) is the primary criteria for an acceptable proving. A minimum of three consecutive proving runs is required. Any number of consecutive runs from 3 to 30 can be used.

Meter factor reproducibility is defined as the ability of a meter and prover system to generate results over a period of time where the range of variation of (change in) pressure, temperature, flow rate, and physical properties of the liquid is negligibly small.

API *MPMS* Ch. 4.2 Incorporation by Reference in Regs

43 CFR Parts 3160 and 3170

DOI/BLM

Onshore Oil and Gas Operations;
Federal and Indian Oil and Gas Leases;
Measurement of Oil

30 CFR Part 250

DOI/BOEMRE (now BSEE)

Oil and Gas and Sulphur Operations in the Outer Continental Shelf

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Questions?

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