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الراعي الرسمي



HUSAIN ALABDEEN

Challenges to Calibrate “on-site” a 212 Bbls
Prover by Water-Draw Method

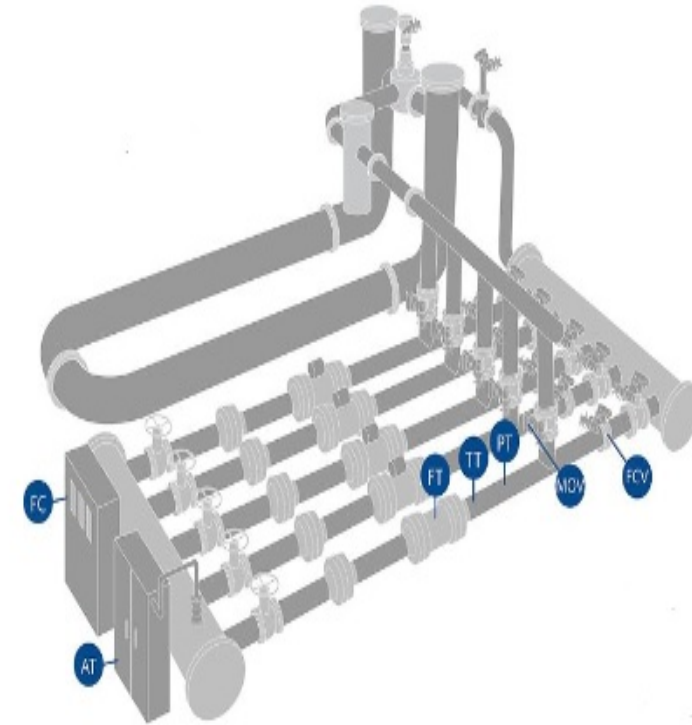
Introduction

Have you ever asked how accurate these scales?



But in Crude Oil Market

- The first question came from the customer is your Measurements System Accurate?
- Prove it?
- The Custody Transfer Metering system has Prover
- **What is a Prover?**
- A Prover is a device with a precise calibrated volume determine from international test measures.
- **What is a Prove ?**
- A prove is a procedure that validate measurement system (Meters) against a known calibrated volume (Prover)





What Proves the Prover?

Hierarchy of how users flowmeter gets certified and referenced to Original Kilogram in France.

Water-Draw Method



Why it is important?

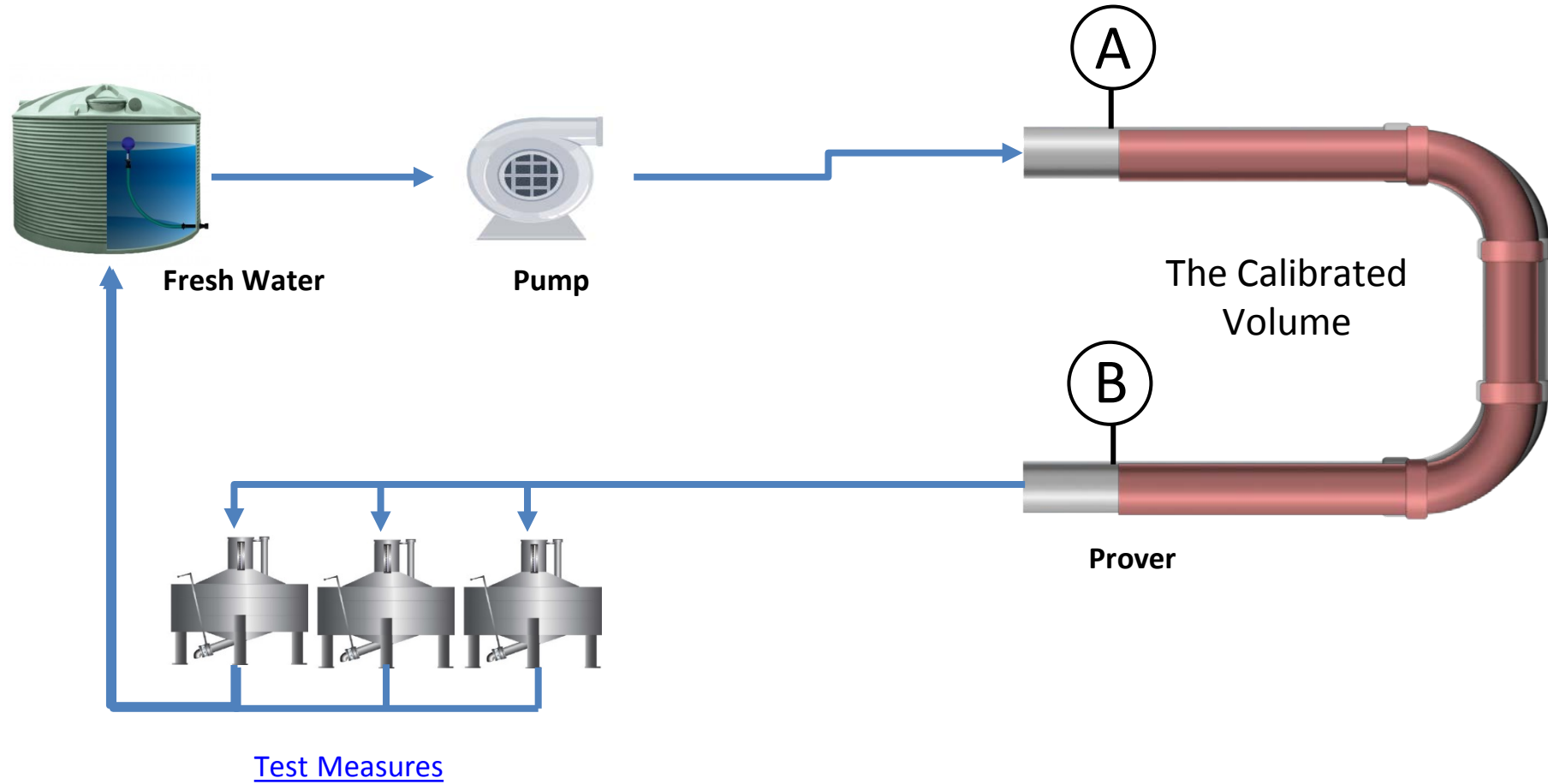
Meter Factor = (Prover Volume/Meter Volume)



Gross Standard Volume (60F) = Indicated volume(60F) * Meter Factor



How it is performed?

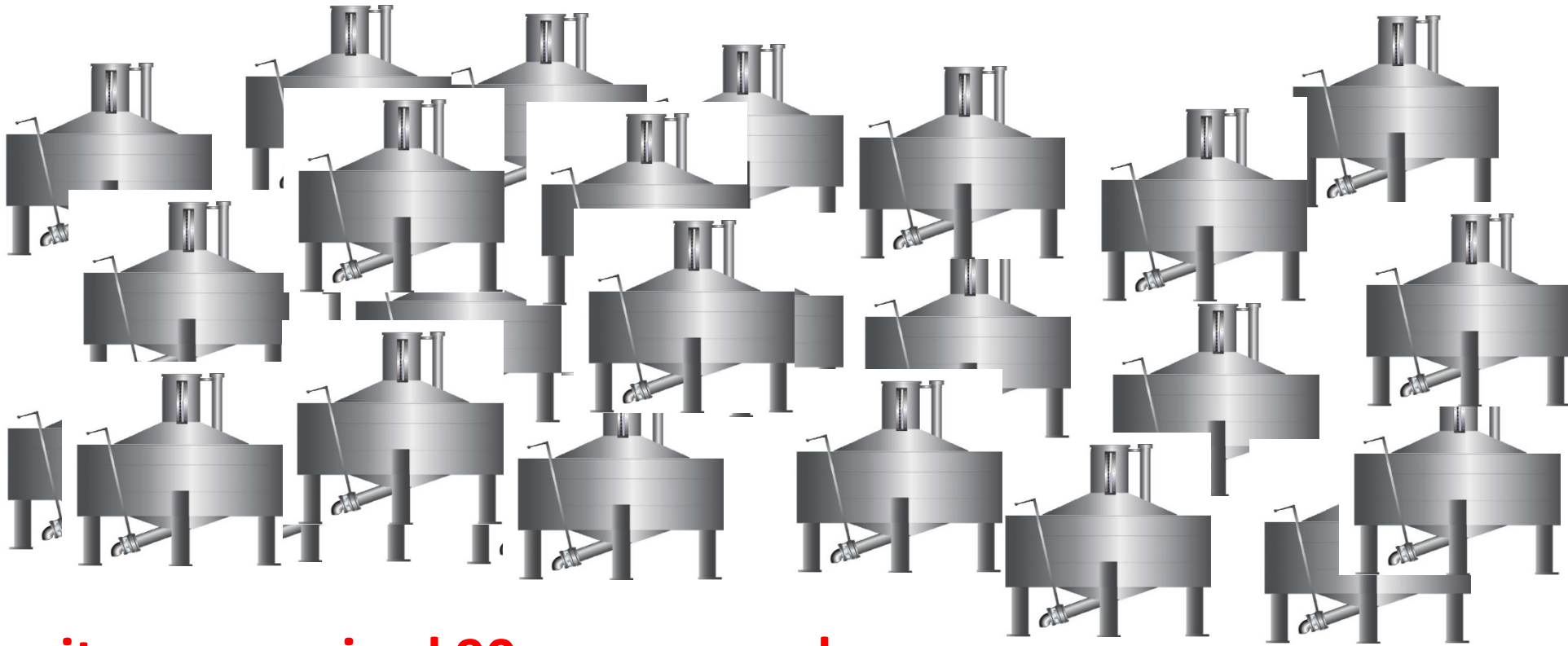


How it is performed?

- Isolate the prover and verify leaks on the 4-way valve .
- Clean the Prover and prepare it for Fresh Water.
- Validate the Detector Switches
- [Validate the Sphere size and % inflation.](#)
- Venting the System
- At least 3 consecutive calibration runs, that meet all the repeatability criteria
- Runs must be preformed on different flow rates (fast/slow/fast or slow/fast/slow)
- The corrected volumes of three or more consecutive round trip runs shall agree within a range of 0.020%

Why it is a Challenge to Calibrate 212 Bbls?

Prover Base Volume is 212 Bbls = 8904 U.S. Gallon **“Can = 100 Gallon”**



it was required 90 cans per volume

Why it is a Challenge to Calibrate 212 Bbls?

Meeting all the calibration criteria required;

- Minimum of 3 consecutive runs on different flow rates. Volumetric quantity required:



Volume 1



Volume 2



Volume 3



- with 0.020% Repeatability which is



1.8 gallon.

V-21 Calibration

- Since Factory Water Draw on 2001 this activity has not performed on-site. Only master meter method was performed frequently to validate/calibrate the Metering Skid
- On 2017, EOM&M decided to calibrate the prover on the 2 volumes (A-C & B-D) considering:
 - Each run lasted minimum of 16 hr. (per-run and run)
 - Ambient temperature challenge.
 - Location “Inside Ahmadi Refinery”
 - Preparation/set-up and Cleaning the prover.

V-21 Calibration



Calibrate the First Volume A & C

On-Site Observation;

Issue: The Sphere was not able to move due to flow rate limitations.

Solution: Have bigger Pump that required different hoses and generator.

Issue: The First 4 consecutive run were out of repeatability and we suspect Sphere.

Solution: Check the Sphere.

Issue: Repeatability was not achieved after 5 runs.

Solution: fixing back the old Detector Switches which were removed.

Repeatability achieved.

The activity took 11 runs which were performed in 24 days since start.

Calibrate the Second Volume B & D

On-Site Observation

Issue: After three runs, Repeatability was not achieved and we notice that water color has been little change.

Solution: Take Sphere out and re-fill the system with new fresh water.

Issue: Over head Crane got unavailable due to electrical motor failure

Solution: Job postponed until fixing the issue.

Issue: Repeatability was not achieved, due 4-way valve leaking. “1 littler in 5 hr.”

Solution: Inspect 4-way valve and replace the Slips.

Calibrate the Second Volume B & D

On-Site Observation

Issue: After removing the rust and clean the it, valve was still passing.

Solution: By-Pass 4-way valve by spading it and utilize the drain point to run the flow.

Issue: four runs were done and different result were obtained

Solution: *Remove the Air.*

Repeatability achieved.

This activity took 9 runs which were performed in 17 days since fixing the overhead crane.



Water-Draw Results

The Difference in historical volume compared to 2017 results.

Activiy	Year	Diff
Master Meter	2015	0.0279%
Master Meter	2014	0.0110%
Water Draw	2001	0.0036%

[Why it is important?](#)



Conclusion

Lessons Learnt:

- Sometimes one problem has a multiple reasons, so be always prepared.
- Water-Draw on site is never be easy.
- Think Out of the Box to solve the issues.

KOC Benefits:

- Improves the Measurements Systems Accuracy
- Improves KOC revenue “changing in fourth decimal will be highly appreciated if your dispatch
X,XXX,XXX bbls/day



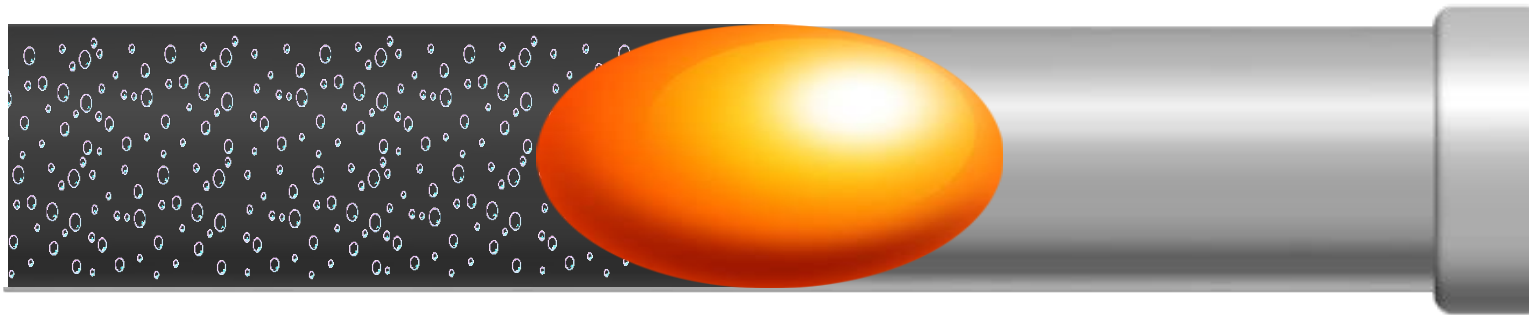




THANK YOU

Sphere Inflation

The Sphere should be inflated 2% to 5% to prevent the system from any passing and in case of Over-inflation, the sphere will stuck and stop the movements



Sphere Inflation



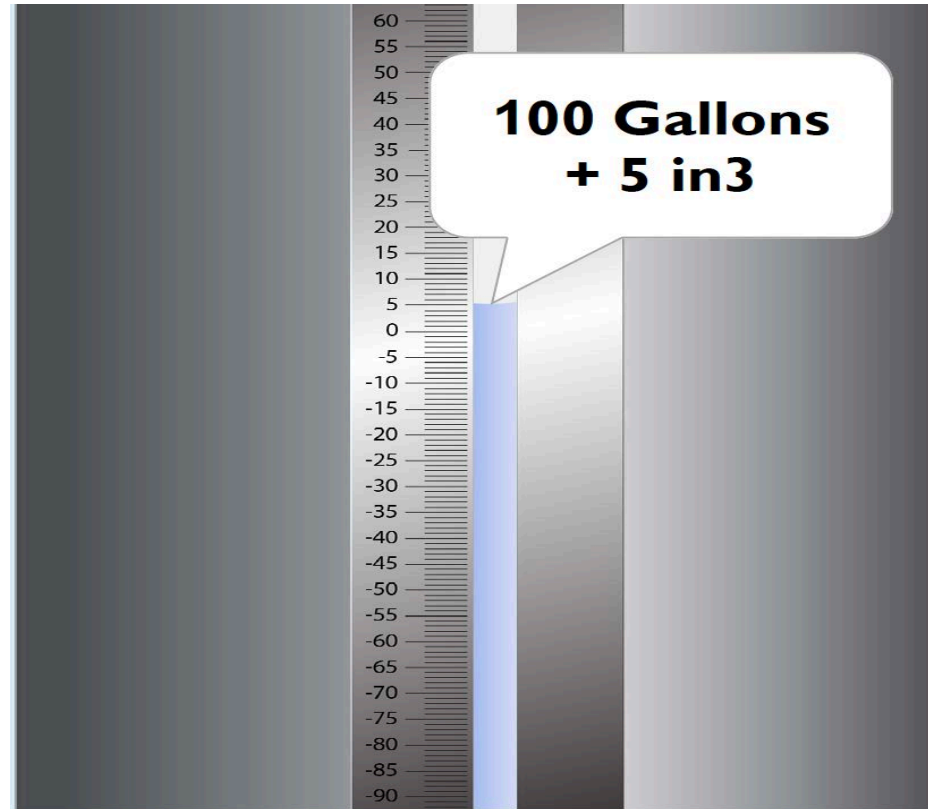
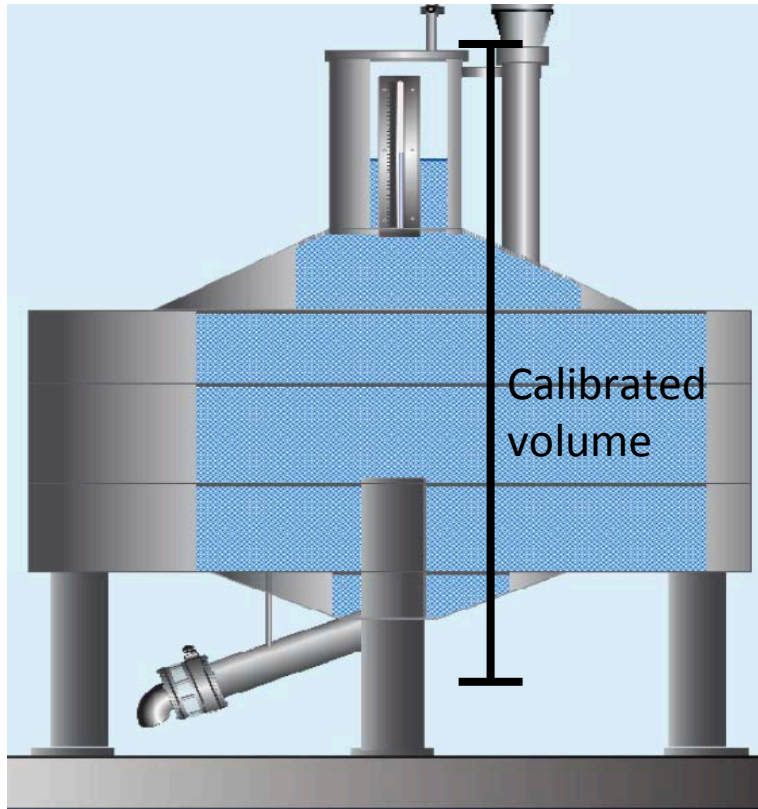
Original Kilogram



The international prototype kilogram is a cylinder of platinum and platinum-iridium alloy, which is kept at the International Bureau of Weights and Measures (BIPM) near Paris and this is the reference to all weight measurement.



Test Measure



Picture Ref: Certified Calibrations, Inc.



Why it is important?

$$\text{Meter Factor} = (\text{Prover Volume} / \text{Meter Volume})$$



$$\text{Gross Standard Volume (60F)} = \text{Indicated volume(60F)} * \text{Meter Factor}$$



Inspect 4-way valve

Rust was on the valve and due to that minor passing was happened; the valve was cleaned and observed Slips were in good conditions.



Error

We Believed that While swapping the hoses; the air was entering the system.



Avoid the Air

Swapping the hoses inside the water

